Linking Mechanisms: Carbon Markets, Climate Finance and National Policies

Third Interim Report of the Project

Analysis of the Role Carbon Markets Can Play for Global Climate Finance from Today to 2020 and Beyond

On behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

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Third Interim Report

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The views expressed in this paper are strictly those of the authors and do not represent the opinion of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

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I. Executive Summary

Background and Scope of this Report

Financial support for developing countries is a core issue under the United Nations Framework Convention on Climate Change (UNFCCC). Industrialised countries strongly emphasise the potential role of carbon markets in mobilising needed finance. Carbon markets may either finance investments directly, as in the Kyoto Protocol's Clean Development Mechanism (CDM), or they may constitute innovative sources of public finance, for example from auctioning revenues in domestic emission trading systems.

The research project "Analysis of the Role Carbon Markets Can Play for Global Climate Finance from Today to 2020 and Beyond" aims at providing an analysis of and recommendations for how carbon markets can contribute to mobilising emission reduction potential in developing countries.

The first and second interim reports of the project provided an overview of the status quo of climate-related financing needs in developing countries, current climate finance and the current status of the CDM. This third interim report analyses:

- potential overlaps between carbon market instruments, national climate policies in host countries and international climate finance;
- possibilities to group countries according to criteria of economic capability and responsibility for combating climate change; and
- emission reduction potential and options for use of carbon markets in 15 country-sector combinations.

Overlap between Carbon Market Instruments, National Climate Policies and International Climate Finance

Analysing the relationship between carbon markets, international climate finance and national climate policies in host countries is an important basis for the investigation into which contributions to GHG mitigation in developing countries should be financed externally and which financing could be expected from carbon markets. A detailed analysis is furthermore required to ensure that mechanisms and instruments striving for GHG mitigation can co-exist and double counting of efforts is avoided. The study investigates how the different existing market-based instruments and those that are under development overlap and how they are linked with national climate policies in developing countries as well as international non-market based approaches such as nationally appropriate mitigation actions (NAMAs).

In order to establish a common understanding the study briefly discusses the relevant mitigation instruments. From a market perspective we describe the flexible mechanisms CDM and Joint Implementation (JI) and treat CDM Programmes of Activities (PoA) as separate mechanism approach. For New Market-based Mechanisms (NMM) we distinguish between a trading approach and a crediting approach which are based on the international UN climate regime. Emissions Trading Systems (ETS) are considered as domestic instruments potentially integrated in other national policies. Non market-based mechanisms are considered by looking at the design and setup of supported and unilateral NAMAs. In the subsequent discussion of these mechanisms, the links to national policies which are implemented independently from the UNFCCC framework are further analysed. Figure I below depicts the different instruments and illustrates the context in which they have been developed and are functioning. This graph distinguishes between instruments operated under the UNFCCC and those outside of it. The mechanisms under the UNFCCC can further be divided into existing ones that are used to achieve targets under the Kyoto Protocol (boxes in light green on the left), i.e. International Emissions Trading (IET), CDM and JI, and future mechanisms (NMM and NAMA), which are under development and will be available under a new global agreement (boxes in dark green in the middle).

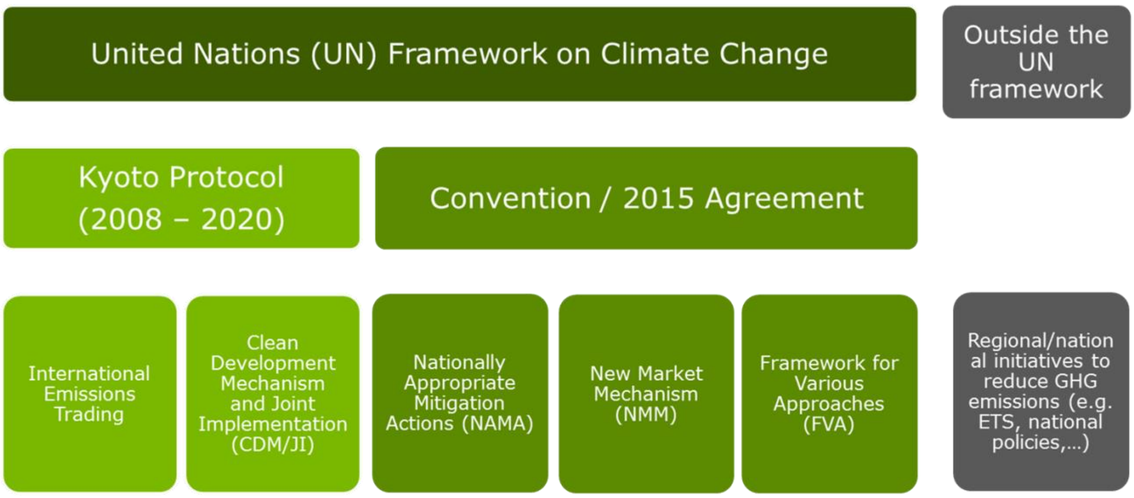

Figure I: Overview of existing and emerging mitigation mechanisms (Source: Ecofys)

Criteria-Based Mechanism Comparison

Market-based instruments (CDM/PoA/JI/ETS/NMM) and non-market based instruments (national policies, NAMAs and others) overlap in terms of their financing sources, measures and coverage. This overlap can be a challenge, in the sense that existing activities would need to be taken into account in the set-up of new instruments, but could also be seen as an opportunity to use experiences and resources from existing instruments for a future and scaled-up instrument (for example, moving from CDM/PoA to NMM). The study conducts a criteria-based mechanism comparison. The resulting overview matrix lists the mechanisms including their sub-types and compares them according to eight key policy and design elements (general objective, coverage, governance, target setting, financing, incentives, contribution to net decrease of global GHG emissions and approach to measuring, reporting and verification (MRV).

Following this, we assess how mechanisms relate to each other. Aside from the mechanisms analysed in the criteria-based comparison approach, further approaches and instruments exist that are applied in similar contexts serving similar purposes. These include, for example, “Results-based Financing Approaches”, national policies in developing countries, and voluntary carbon markets, all of which might be used in parallel with, or integrated into, the described mechanisms. These approaches and instruments are therefore additionally considered when linkages between mechanisms are assessed.

Practical Implications of Interactions between Mechanisms and Implementation Instruments

Based on the analytical comparison results, the study further investigates how parallel features, as well as overlaps, of the various mechanisms have an effect in practice. Selected mechanism connections are further analysed according to aspects such as ownership of the emission reductions, double counting of emission reductions, incentives provided and to whom, layers of implementation, national integration, source of funding and links to national policies. These findings are completed by six selected practical examples that allow a better understanding of the identified challenges and point to further areas for research.

The study in particular looks into the relation of CDM to NMM and NAMAs, which includes practical implications for CDM activity continuation in sectors that are covered by a NMM or NAMAs; CDM PoAs related to NMM and NAMAs; cross effects between the mechanisms and national policies; as well as national policies and NAMAs. We also analyse the role of NAMAs for the setup of NMMs, the role Result-based Financing could have within NAMAs and national policies in relation to an ETS and a NMM. The selected practical examples include Costa Rica’s National Climate Change Strategy, the linkage of Feed-in Tariffs with PoAs and/or NAMAs in for example Thailand or Uganda, Mexico’s

Sustainable Housing NAMA, the Chinese Certified Emission Reduction credits approach and marked-based mitigation approaches in Tunisia's cement sector.

The in-depth analysis of the relationship between carbon markets, international climate finance and national climate policies is used as basis for the analysis in further parts of the study to identify contributions to GHG mitigation in developing countries which could be financed externally and with financing from carbon markets.

Illustration of Countries or Country Groups Regarding their Use of Carbon Markets

Additionally to the analysis of different mechanisms to support mitigation, it is of relevance to evaluate which countries the mechanisms could be applied to, and which of those would serve as a host country or a donor country. On the one hand, the evaluation shall reflect the carbon market readiness of countries or country groups, on the other hand, it shall include the degree of responsibility the countries have to contribute to mitigation activities.

In the current situation, countries are grouped as "Annex I" (developed countries) and "non-Annex I" (developing countries), as defined by the UNFCCC. This grouping is based on the development situation at the point of the starting year of the Convention. Over the years, there have been changes in all countries, in terms of economic development as well as greenhouse gas emissions. The range between least developed countries and emerging economies has grown significantly, so that further differentiation is needed today.

This need for differentiation has already shown in the past years in international climate policy: First indications are for example the EU's limitation of recognising Certified Emission Redutions only from Least Developed Countries (LDCs) in the EU ETS since the start of the third trading period (January 2013), or that the agreement currently negotiated under the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP) shall also include mitigation commitments for developing countries.

This report approaches the question of differentiation by defining two dimensions – "Own contribution" and "carbon market readiness" -, lists various quantitative indicators for those and applies them to the UNFCCC parties. Thereby it is important to note that the indicators used and the way they are combined are only one illustrative example of a possible approach, and do not aim at providing a final solution.

Indicators feeding into the own contribution include the Human Development Index (or sub-indicators used for its calculation, e.g. per capita income), historic emissions and current per capita emissions. Also, the amount of mitigation potential available at negative or low costs within countries plays into the possibilities of those countries to contribute themselves to reductions: A country with abundant potential at negative costs may be able to reduce a high share of emissions itself. Other countries may have higher abatement costs on average, nevertheless these potentials need to be tapped as well under a sufficiently ambitious climate regime. These countries may thus need more support and therefore have a lower share of own contribution.

Indicators for carbon market readiness are relevant experiences with carbon markets, e.g. the number of CDM or JI projects or domestic market based instruments, and capacities for Measuring, Reporting and Verification, expressed for example through the number of submitted national communications and emission inventories to the UNFCCC. Furthermore, the statuses of current plans for emissions trading schemes or similar instruments are of relevance.

Based on different combinations for weighing the indicators for own contribution, the results provide a range of possible country groupings. Considering all combinations analysed, we nevertheless find a number of commonalities:

For all combinations of the indicators used, the Least Developed Countries remain in one group with a low carbon market readiness and a low own contribution.

There are a number of countries with high responsibilities and capabilities, but with little carbon market readiness. If those were to support mitigation activities in other countries through merely market-based tools, markets-based approaches in those countries would need to be strengthened significantly. Nevertheless, those countries could as well channel direct funds towards market-based instruments in the recipient countries.

At the same time, there are many countries which would likely need support for mitigation activities, but which at this point in time do not have successful market-based mechanisms in place to channel funding.

Another interesting aspect can be seen when comparing combinations for own contribution using HDI and alternatively per capita income. For those combinations relying on HDI, there are no countries with a low own contribution and high market readiness. However, there are countries with a relatively low per capita income with a high carbon market readiness.

The HDI considers other development factors besides the per capita income, such as education and health. Our results show that those seem correlated to the ability of countries to implement more enhanced policies, such as market-based mechanisms. Some countries with a low income per capita seem to be able to prepare for carbon markets, whereas those that additionally have low health and educational indicators are not able to do so.

Prospects for International Cooperation and Use of Carbon Markets in 15 Country/Sector Cases

The study analyses future prospects for international cooperation and in particular use of carbon markets in 15 country/sector combinations. The selection of cases aimed to cover a broad spread of sectors and countries, including all continents and a range from advanced to least developed countries. Other key criteria were data availability and whether the countries are pursuing an active climate policy that provides entry points for international cooperation.

The analysis proceeds in four steps:

1. Survey of existing studies on available mitigation potential and costs;
2. Survey of policies and measures that are currently in place;
3. Analysis of remaining barriers that impede low-emission investments;
4. On the basis of the above, discussion of the scope for international cooperation and use of carbon markets.

With these steps, we first identify where action could potentially be effective. We then check where activities already exist and where remaining barriers are, to ultimately identify potential room for carbon markets to support these areas.

The following summarises the main rationales for the selection of the country/sector combinations and the main findings.

Brazil is a key major emitter and carbon market participant and has a relatively progressive negotiation position as well as an elaborate set of national climate policies. The study analyses the electricity and waste sectors as emissions from these sectors are projected to increase strongly in the future. There is substantial potential for emission reductions in both sectors and Brazil brings to the table quite a sophisticated climate legislation architecture including substantial experience with carbon markets. However, there are also substantial barriers such as institutional complexity, a partial lack of enforcement of environmental legislation, conflicts between growth and environmental strategies and a lack of inter-municipal coordination. Furthermore, there are substantial financial barriers. The waste-management sector suffers from substantial underinvestment and the high costs of interconnecting bagasse cogeneration and wind energy projects in the back country with the main power grid so far have to be borne by the corresponding sugar mills and wind-farm developers. There is also a lack of a culture of recycling regarding broad parts of the society and materials, respectively. Besides institutional and public capacity building on the relevant issues identified, a toehold for international cooperation could include technology transfer.

China is the world's largest emitter and largest CDM host country. In addition, it is in the process of establishing regional and eventually a national carbon market. Electricity and cement are among the largest emitting sectors and emissions are projected to increase strongly in the future. Very large and achievable mitigation potentials exist in these sectors and market mechanisms have already been used extensively in both. However, national-level policy making sometimes conflicts with local-level priorities. In addition, poor awareness across the population inhibits the adoption of best practices in smaller industrial firms and the buildings sector and gives room for industrial lobbying. With its rapid growth and increasing emissions, China should be able to implement a number of mitigation measures with domestic means, but receive support to tap into the full potential.

Costa Rica has been a carbon market frontrunner since the 1990s, is currently establishing a national carbon market and has pledged to become carbon neutral by 2021. Due to the preponderance of hydropower in electricity supply agriculture is one of the key emitting sectors. Costa Rica has seen environmental politics as an important cornerstone of its government activities for a long time and has consequently put in place a clear institutional architecture as well detailed strategies, plans and programs on mitigation. Barriers include a lack of financial resources and knowledge preventing the full, effective implementation of some laws and programs on sustainable agriculture as well as the use of low-emission technologies and organic fertilizers. Furthermore, inter-sectoral coordination of sectors and institutions as well as the division of responsibilities and decision-making power could be improved. There also is a lack of awareness, information and capacity regarding various issues relating to mitigation. Due to the challenges arising for MRV in agriculture, NAMAs may be a good alternative to the sector's participation in a future global carbon market.

Ethiopia has a very progressive negotiation position and pledged to become carbon neutral by 2025. However, due to its development status as a least developed country implementing this pledge will require strong international support. Agriculture is the most important economic sector, employing about

80% of the population, and electricity demand is projected to increase sharply in line with the country's development aspirations. In 2010, only ¼ of the population had grid access. Ethiopia's renewable electricity expansion plans are economically rational but require substantial upfront investment, which is not completely covered in current budgets. Most of agricultural measures is not expected to have short term positive returns. The institutional and market environment is not conducive to participation from the private sector to close the funding gap. Ethiopia has had no interaction with market-based mechanisms historically and would require substantial preparation in order to engage with markets in the future. The agriculture sector presents further complications as it is very fragmented by small-scale activities. Market-based mechanisms may become interesting to mobilise potentials in Ethiopia in the future, however market readiness needs to be enhanced before and new approaches to mechanisms must be found to address the country-specific barriers. One promising activity to be supported could be the continued employment of renewable energy technologies for electrification.

India is a key major emitter and carbon market participant. In addition to its strong position to the CDM it is also using market-based approaches domestically. Cement and iron&steel are the largest emitters among the industrial sectors and project steep emission growth under business as usual. Prospects for the use of market-based instruments are generally good. However, there are substantial non-price barriers, including lack of access to investment capital, high ex ante investment requirements, waste legislation that impedes the use of waste as alternative fuels, low-quality waste collection, norms and standards that limit the potential of cement blending, lacking social acceptance of alternative fuels and cement blending, low quality of domestic iron ore and coal, low availability of scrap, and lacking awareness of /reluctance to invest in efficiency. Use of carbon market instruments will therefore probably only be able to fully exploit the available potential if combined with support for access to investment capital and significant regulatory changes and capacity building activities. Prospects for international cooperation could include purchase of Indian energy efficiency credits, provision of budget support, and scaling up support for investment funds.

Kenya has developed some ambitious climate policies. Due to its development status agriculture is the most important economic sector and has been identified by the government as the pivotal sector for driving the wider development of the country's economy. Substantial international funding is necessary to cover the positive costs of mitigation due to Kenya's low level of capability and responsibility. Abatement measures are also dependent on behavioural change at the individual level and therefore hindered by poor awareness and skills across the sector. With a low but more advanced carbon market readiness in comparison to other countries in the region, Kenya might be an interesting pilot for a new market mechanism, targeted to the country-specific barriers.

Morocco has submitted an elaborate and ambitious 2020 pledge to the UNFCCC. It has in particular set ambitious goals for renewable electricity as it has an inherent interest in reducing its near-total dependence on energy imports. However, it will need international support to actually achieve these objectives. Barriers include lack of access to investment capital, high ex-ante investment requirements of renewables, lack of financing mechanisms for distributed installations, a virtual monopoly of the state utility, no access to the low-voltage grid for independent producers, the existence of fossil fuel subsidies, and limited human capacity. Market readiness and scope for private sector engagement is low, most CDM projects were developed by public institutions. The most promising options for international engagement may therefore lie with working through the Moroccan government, for example on the basis of a sectoral crediting scheme including incentives for distributed installations, provision of investment support and regulatory reforms.

Peru is a member of the progressive Independent Association of Latin America and the Caribbean (AILAC). It has lately been developing initiatives to promote renewable electricity but they conflict with economic incentives for natural gas, which has become a preferred resource for the country’s development strategy. In addition, there are difficulties with reaching remote parts of the population and technical capacities. Peru might be expected to mobilise the capital for abatement costs with a positive return. Additionally, international funding should support more ambitious measures. Doing this through market mechanisms - specifically on a sectoral level - may be feasible if the mechanism adequately addresses country specific barriers.

South Africa is a key major emitter and has submitted an ambitious 2020 pledge to the UNFCCC, which it, however, now has problems to fulfil. Electricity and iron&steel are among the most important emitting sectors. Translation of policies and plans into concrete actions is slow, partly due to limited knowledge and capacities within government institutions. High investment requirements and low electricity prices act as disincentives to energy efficiency measures and stronger uptake of renewable energy deployment. South Africa's potential for the use of market-based instruments for GHG abatement seems limited. Both sectors analysed for this study show a highly concentrated structure and a small amount of market actors. Of the two, the electricity sector may develop a higher potential for market use in the future, as new companies enter the electricity market. The South African government is planning to put in place a carbon tax and has decided not to create a market instrument for various reasons, including institutional capacity constraints. The lack of a robust GHG inventory would complicate emissions monitoring necessary for a market mechanism both on the sectoral and on the national level.

Thailand has a dynamic economy and some ambitious policies domestically but has so far not submitted a 2020 pledge. Thailand's cement production is the country's largest single energy consuming sector and is among the top ten cement producers worldwide. Thailand's cement sector seems well fit for market-based approaches to reduce its carbon intensity. The country's proposal under the World Bank's Partnership for Market Readiness (PMR) defines a roadmap how such approaches could be implemented. Thailand aims at the introduction of a voluntary Energy Performance Certificate Scheme by 2017 and a mandatory emission trading scheme (ETS) in 2020. Similar to the Indian, case, these initiatives create options for international linkage of domestic systems.

II. Zusammenfassung

Hintergrund und Inhalte dieses Berichts

Finanzielle Unterstützung für die Entwicklungsländer ist eines der Kernthemen der UN-Klimarahmenkonvention (United Nations Framework Konvention on Climate Change, UNFCCC). Industrieländer betonen stark die potentielle Rolle von Kohlenstoffmärkten in der Mobilisierung benötigter Finanzmittel. Kohlenstoffmärkte können Investitionen entweder direkt finanzieren, wie etwa im Clean Development Mechanism (CDM) des Kyoto-Protokolls, oder innovative Quellen öffentlicher Finanzierung bereit stellen, z.B. aus Auktionserlösen in nationalen Emissionshandelssystemen.

Das Forschungsvorhaben „Analyse der Rolle, die Kohlenstoffmärkte für die globale Klimafinanzierung von heute bis 2020 und darüber hinaus spielen können" hat zum Ziel, zu analysieren und Empfehlungen zu entwickeln, wie Kohlenstoffmärkte zur Finanzierung von Emissionsreduktionen in Entwicklungsländern beitragen können.

Der erste und zweite Zwischenbericht über das Projekt beinhalteten einen Überblick über den Status quo der klimabezogenen Finanzierungsbedürfnisse in Entwicklungsländern, der gegenwärtigen Klimafinanzierung und den aktuellen Status des CDM. Der vorliegende dritte Zwischenbericht analysiert:

- potentielle Überschneidungen zwischen Instrumenten des Kohlenstoffmarktes, nationalen Klimaschutzprogrammen in Gastgeberländern und internationaler Klimafinanzierung;
- Möglichkeiten Länder, gemäß den Kriterien ihrer ökonomischen Entwicklungspotentiale und ihrer Verantwortung für die Bekämpfung des Klimawandels zu gruppieren; sowie
- das Emissionsreduktionspotenzial und Möglichkeiten für die Nutzung von Kohlenstoffmärkten in 15 Land-Sektor-Kombinationen.

Überschneidungen zwischen Instrumenten des Kohlenstoff-marktes, nationalen Klimaschutzprogrammen und internationaler Klimafinanzierung

Die Analyse der Beziehung zwischen Kohlenstoffmärkten, internationaler Klimafinanzierung und nationalen Klimaschutzprogrammen in Gastgeberländern ist eine wichtige Grundlage für die Ermittlung der Beiträge, die zur Verringerung von Treibhausgasen in Entwicklungsländern extern finanziert werden sollten und welche Finanzierung von Kohlenstoffmärkten erwartet werden könnte. Eine detaillierte Analyse ist außerdem erforderlich, um sicherzustellen, dass Mechanismen und Instrumente zur Treibhausgasreduktion koexistieren können und Doppelzählungen von Bemühungen vermieden werden. Die Studie untersucht, wie die unterschiedlichen existierenden marktbasierten Instrumente und die, die in der Entwicklung sind, sich überschneiden und wie sie verknüpft sind mit nationalen Klimapolitiken in Entwicklungsländern sowie mit internationalen nicht-marktbasierten Ansätzen wie nationally appropriate mitigation actions (NAMAs).

Um ein gemeinsames Verständnis zu erzielen, diskutiert die Studie kurz die relevanten Emissionsminderungsinstrumente. Wir beschreiben aus einer Marktperspektive die flexiblen Mechanismen CDM und Joint Implementation (JI) und behandeln CDM Programmes of Activities (PoA) als getrennten Mechanismen-Ansatz. Für neue marktbasierte Mechanismen (NMM) unterscheiden wir zwischen einem trading-Ansatz und einem crediting-Ansatz, die auf dem internationalen UN-Klimaregime basiert sind. Emissionshandelssysteme (EHS) betrachten wir als inländische Instrumente, die potentiell mit anderen nationalen Politiken integriert sind. Nicht-marktbasierte Mechanismen betrachten wir, indem wir das Design und den Aufbau von international unterstützten und unilateralen NAMAs analysieren. Die nachfolgende Diskussion dieser Mechanismen analysiert ihre Verknüpfung mit nationalen Politiken, die unabhängig vom UNFCCC-Rahmen umgesetzt werden. Abbildung I unten stellt die verschiedenen Instrumente dar und illustriert den Kontext, in dem sie entwickelt wurden und funktionieren. Die Graphik unterscheidet zwischen Instrumenten, die unter der UNFCCC beheimatet sind, und solchen außerhalb. Die Mechanismen unter der UNFCCC können des Weiteren unterschieden werden in einerseits bestehende, die verwendet werden, um Ziele unter dem Kyoto-Protokoll zu erfüllen (hellgrüne Kästen auf der linken Seite), z.B. Internationaler Emissionshandel (IEH), CDM und JI, sowie anderseits zukünftige Mechanismen (NMM und NAMA), die sich in der Entwicklung befinden und unter einem neuen globalen Klima-Abkommen zur Verfügung stehen werden (dunkelgrüne Kästen in der Mitte).

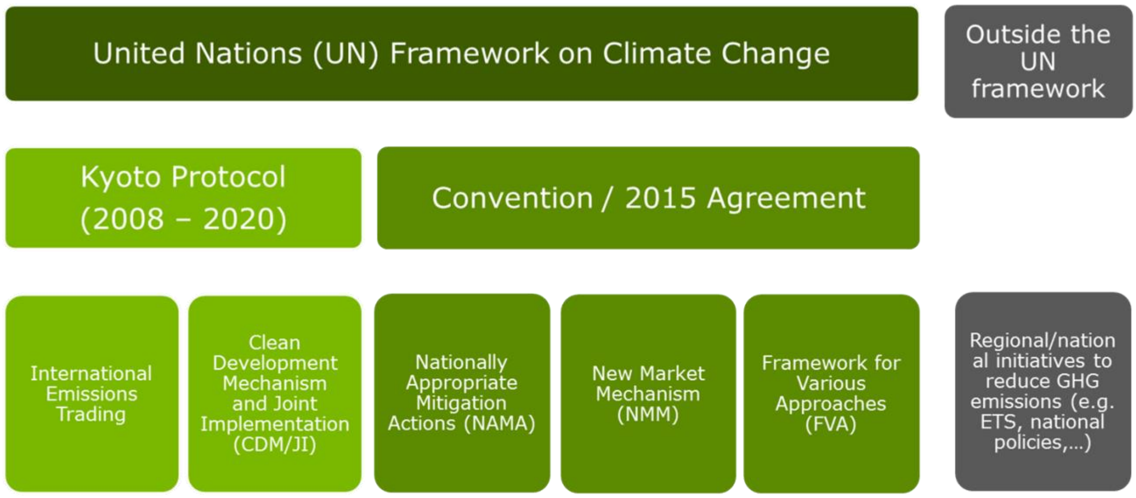

Abbildung I: Überblick existierender und entstehender Emissionsminderungsmechanismen (Quelle: Ecofys)

Kriterien-basierter Mechanismen-Vergleich

Marktbasierte Instrumente (CDM/PoA/JI/ETS/NMM) und nicht-marktbasierte Instrumente (nationale Politiken, NAMAs and andere) überschneiden sich im Hinblick auf ihre Finanzierungsquellen, Maßnahmen und Abdeckung. Diese Überschneidungen können eine Herausforderung sein in dem Sinne, dass existierende Aktivitäten bei der Einführung neuer Instrumente mit berücksichtigt werden müssten. Sie könnten aber auch als Chance gesehen werden, Erfahrungen und Ressourcen aus bestehenden Instrumenten für zukünftige und größere Instrumente zu nutzen (z.B. von CDM/PoA zu NMM). Die Studie führt einen Kriterien-basierten Vergleich der Mechanismen durch. Die resultierende Überblicks-Matrix listet die Mechanismen einschließlich ihrer Sub-Typen auf und vergleicht sie anhand von acht wesentlichen Politik- und Design-Elementen (allgemeines Ziel, Abdeckung, Governance, Zielfestlegung, Finanzierung, Anreize, Beitrag zur Netto-Minderung globaler THG-Emissionen und Ansatz für die Messung, Berichterstattung und Verifzierung (measuring, reporting and verification, MRV)).

In der Folge betrachten wir, wie sich die Mechanismen zueinander verhalten. Abgesehen von den Mechanismen, die im Kriterien-basierten Vergleich analysiert werden, existieren weitere Ansätze und Instrumente, die in ähnlichen Kontexten mit ähnlichem Ziel eingesetzt werden. Diese beinhalten bspw. Ergebnis-basierte Finanzierungsansätze, nationale Politiken in Entwicklungsländern und freiwillige Kohlenstoffmärkte, die alle parallel zu oder integriert in die beschriebenen Mechanismen verwendet werden können. Diese

Ansätze und Instrumente werden daher zusätzlich betrachtet, wenn die Verknüpfungen zwischen den Mechanismen bewertet werden.

Praktische Implikationen von Interaktionen zwischen Mechanismen und Umsetzungsinstrumenten

Auf Basis der Ergebnisse des analytischen Vergleichs untersucht die Studie zudem, wie parallele Eigenschaften und Überlappungen verschiedener Mechanismen sich in der Praxis auswirken. Wir analysieren ausgewählte Verbindungen von Mechanismen in Bezug auf die Eigentümerschaft der Emissionsreduktionen, Doppelzählung von Emissionsreduktionen, gebotene Anreize und wem sie geboten werden, Umsetzungsebenen, nationale Integration, Finanzierungsquelle und Verknüpfung mit nationalen Politiken. Diese Ergebnisse werden vervollständigt durch sechs ausgewählte Praxisbeispiele, die ein besseres Verständnis der identifizierten Herausforderungen erlauben und weitere Forschungsbedarfe aufzeigen.

Die Studie betrachtet insbesondere das Verhältnis von CDM zu NMM und NAMAs, einschließlich von praktischen Implikationen für die Fortsetzung von CDM-Aktivitäten in Sektoren, die von einem NMM oder NAMAs abgedeckt werden; CDM PoAs mit Beziehung zu NMM und NAMAs; überschneidende Effekte zwischen den Mechanismen und nationalen Politiken; sowie nationale Politiken und NAMAs. Wir analysieren zudem die Rolle von NAMAs für die Einführung von NMM und die Rolle, die Ergebnis-basierte Finanzierung haben könnte innerhalb von NAMAs und nationalen Politiken in Bezug auf ein EHS und einen NMM. Die ausgewählten Praxisbeispiele umfassen Costa Ricas nationale Klimastrategie, die Verknüpfung von Einspeisevergütungen mit PoAs und/oder NAMAs in bspw. Thailand oder Uganda, Mexikos Sustainable Housing NAMA, der chinesische Certified Emission Reduktion-Ansatz, und marktbasierte Minderungsansätze in Tunesiens Zementsektor.

Die vertiefte Analyse der Beziehung zwischen Kohlenstoffmärkten, internationaler Klimafinanzierung und nationalen Klimapolitiken dient als Basis für die Analyse in den weiteren Teilen der Studie, um Beiträge zu Emissionsminderungen in Entwicklungsländern zu identifizieren, die extern und mit Finanzierung aus dem Kohlenstoffmarkt finanziert werden könnten.

Illustration von Ländern oder Ländergruppen in Bezug auf ihre Nutzung des Kohlenstoffmarkts

Zusätzlich zu der Analyse verschiedener Minderungsmechanismen ist es auch von Relevanz, zu bewerten, auf welche Länder diese Mechanismen angewendet werden könnten, und welche davon als Gastgeber- oder Geldgeberländer dienen würden. Auf der einen Seite soll die Bewertung die Kohlenstoffmarktbereitschaft von Ländern oder Ländergruppen reflektieren, auf der anderen Seite soll sie einbeziehen, welchen Grad der Verantwortlichkeit Länder haben, zu Minderungsaktivitäten beizutragen.

In der aktuellen Situation sind die Länder in „Annex I“ (entwickelte Länder) und „nicht-Annex I“ (Entwicklungsländer) gemäß der Definition der UNFCCC gruppiert. Diese Gruppierung basiert auf der Entwicklungssituation im Startjahr der Konvention. Über die Jahre hat es in allen Ländern in Bezug auf die wirtschaftliche Entwicklung und die Treibhausgasemissionen Veränderungen gegeben. Der Unterschied zwischen den am wenigsten entwickelten Ländern und den Schwellenländern ist beträchtlich größer geworden, so dass heute eine stärkere Differenzierung nötig ist.

Diese Notwendigkeit von Differenzierung hat sich in den letzten Jahren bereits in der internationalen Klimapolitik gezeigt: Erste Anzeichen sind bspw. die Begrenzung der EU, Certified Emission Reductions mit Beginn der dritten Handelsperiode (Januar 2013) nur im EU EHS anzuerkennen, wenn sie aus den am wenigsten entwickelten Ländern kommen, oder dass das Abkommen, das derzeit unter der Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP) verhandelt wird, auch Minderungsverpflichtungen für Entwicklungsländer beinhalten soll.

Der Bericht geht die Frage der Differenzierung an, indem er zwei Dimensionen definiert – „eigener Beitrag“ und „Kohlenstoffmarktbereitschaft“ –, er listet verschiedene quantitative Indikatoren für diese Dimensionen auf, und wendet diese auf die UNFCCC-Staaten an. Dabei ist es wichtig, zu beachten, dass die verwendeten Indikatoren und ihre Kombination nur illustrative Beispiele eines möglichen Ansatzes sind, und nicht anstreben, eine endgültige Lösung zu definieren.

Indikatoren für „eigenen Beitrag“ umfassen den Human Development Index (oder Unter-Indikatoren seiner Berechnung, z.B. Pro-Kopf-Einkommen), historische Emissionen und derzeitige Pro-Kopf-Emissionen. Auch die Menge von Minderungspotenzial, das zu negativen oder geringen Kosten in den Ländern verfügbar ist, ist relevant für die Möglichkeiten dieser Länder, selber zu Reduktionen beizutragen: Ein Land mit großem Potenzial zu negativen Kosten mag in der Lage sein, einen hohen Anteil der Emissionen selbst zu mindern.

Andere Länder mögen im Durchschnitt höhere Minderungskosten haben, dennoch müssen diese Potenziale in einem ausreichend ambitionierten Klimaregime gehoben werden. Diese Länder mögen daher mehr Unterstützung benötigen und daher einen geringeren Anteil eigener Beiträge haben.

Indikatoren für die Kohlenstoffmarktbereitschaft sind relevante Erfahrungen mit Kohlenstoffmärkten, z.B. die Anzahl von CDM- oder JI-Projekten oder inländischen marktbasierten Instrumente, sowie MRV-Kapazitäten, ausgedrückt z.B. durch die Anzahl der bei der UNFCCC eingereichten Nationalberichte und Emissionsinventare. Des Weiteren sind der Status derzeitiger Pläne für Emissionshandelssysteme oder ähnlicher Instrumenten von Relevanz.

Basierend auf verschiedenen Kombinationen der Gewichtung der Indikatoren für eigene Beiträge bieten die Ergebnisse eine Spannbreite möglicher Ländergruppierungen. Unter Betrachtung aller Kombinationen finden wir dennoch eine Reihe von Gemeinsamkeiten:

Für alle Kombinationen der verwendeten Indikatoren bleiben die am wenigsten entwickelten Länder in einer Gruppe mit niedriger Kohlenstoffmarktbereitschaft und niedrigen eigenen Beiträgen.

Es gibt eine Reihe von Ländern mit hoher Verantwortlichkeit und wirtschaftlicher Fähigkeit, aber niedriger Kohlenstoffmarktbereitschaft. Wenn diese Länder Minderungsaktivitäten in anderen Ländern nur durch marktbasierte Instrumente unterstützen sollten, müssten marktbasierte Ansätze innerhalb dieser Länder erheblich gestärkt werden. Allerdings könnten diese Länder Mittel auch direkt in marktbasierte Instrumente in den Empfängerländern leiten.

Gleichzeitig gibt es viele Länder, die vermutlich Unterstützung für Minderungsaktivitäten benötigen würden, die aber derzeit keine erfolgreichen marktbasierten Mechanismen zur Verfügung haben, um die Mittel zu kanalisieren.

Ein weiterer interessanter Aspekt zeigt sich, wenn alternativ HDI und Pro-Kopf-Einkommen als Indikatoren für eigene Beiträge verwendet werden. Für die Kombinationen, die auf dem HDI basieren, existieren keine Länder mit niedrigen eigenen Beiträgen und hoher Marktbereitschaft. Es existieren jedoch Länder mit relativ niedrigem Pro-Kopf-Einkommen und hoher Kohlenstoffmarktbereitschaft.

Der HDI betrachtet auch andere Entwicklungsfaktoren neben dem Pro-Kopf-Einkommen, wie bspw. Bildung und Gesundheit. Unsere Ergebnisse zeigen, dass diese mit der Fähigkeit von Ländern zusammen zu hängen scheinen, komplexe Politiken wie marktbasierte Mechanismen umzusetzen. Einige Länder mit niedrigem Einkommen scheinen in der Lage, sich auf Kohlenstoffmärkte vorzubereiten, wohingegen jene, die zusätzlich auch niedrige Gesundheits- und Bildungsindikatoren haben, dazu nicht in der Lage sind.

Aussichten für internationale Kooperation und Nutzung von Kohlenstoffmärkten in 15 Land/Sektor-Fällen

Die Studie analysiert die Zukunftsaussichten für internationale Kooperation und insbesondere die Nutzung von Kohlenstoffmärkten in 15 Land/Sektor-Kombinationen. Die Auswahl der Fälle zielte darauf ab, eine große Spreizung von Sektoren und Ländern abzudecken, unter Einbeziehung aller Kontinente und einer Bandbreite von fortgeschrittenen bis am wenigsten entwickelten Ländern. Andere Schlüsselkriterien waren Datenverfügbarkeit und inwiefern die Länder eine aktive Klimapolitik verfolgen, die Ansatzpunkte für internationale Kooperation bietet.

Die Analyse geht in vier Schritten vor:

1. Erhebung bestehender Studien zu verfügbaren Minderungspotenzialen und –kosten;
2. Erhebung bereits existierender Politiken und Maßnahmen;
3. Analyse der verbleibenden Barrieren, die Niedrig-Emissions-Investitionen behindern;
4. Auf dieser Grundlage Diskussion der Aussichten für internationale Kooperation und die Nutzung von Kohlenstoffmärkten.

Mit diesen Schritten identifizieren wir zunächst, wo Maßnahmen potentiell effektiv sein könnten. Wir prüfen dann, wo Aktivitäten bereits vorliegen wo verbleibende Barrieren sind, um letztendlich zu identifizieren, wo Raum besteht, um Kohlenstoffmärkte zu nutzen, um diese Aktionsfelder zu unterstützen.

Im Folgenden fassen wir die Hauptgründe der Auswahl der Land/Sektor-Kombinationen sowie die Hauptergebnisse zusammen:

Brasilien ist ein wesentlicher Großemittent und Kohlenstoffmarkt-Teilnehmer und hat eine relativ progressive Verhandlungsposition sowie ein ausgefeiltes Set nationaler Klimapolitiken. Die Studie analysiert die Strom- und Abfallsektoren, da für die Emissionen aus diesen Sektoren ein starkes Wachstum projiziert wird. In beiden Sektoren besteht erhebliches Potenzial für Emissionsreduktionen und Brasilien verfügt über eine weit entwickelte Klimagesetzgebung und über beträchtliche Erfahrung mit Kohlenstoffmärkten. Jedoch bestehen auch erhebliche Barrieren, wie etwa institutionelle

Komplexität, ein teilweiser Mangel an Durchsetzung der Umweltgesetzgebung, Konflikte zwischen Wachstum und Umweltstrategien und Mangel an inter-kommunaler Koordination. Zudem bestehen erhebliche finanzielle Barrieren. Der Abfallsektor leidet an erheblichen Unter-Investitionen und die erheblichen Kosten für den Netzanschluss von Bagasse-Kraft-Wärme-Kopplung und Windenergieprojekten im Hinterland müssen bisher von den jeweiligen Zuckermühlen- und Windkraftbetreibern getragen werden. Zudem mangelt es an einer Recycling-Kultur in breiten Teilen der Bevölkerung und in Bezug auf viele Materialien. Neben institutionellem und öffentlichem Kapazitätsaufbau zu den identifizierten Fragen könnte auch Technologietransfer ein Ansatzpunkt für internationale Kooperation sein.

China ist der weltgrößte Emittent und das größte CDM-Gastgeberland. Zudem ist es dabei, regionale und letztendlich einen nationalen Kohlenstoffmarkt aufzubauen. Strom und Zement sind unter den größten emittierenden Sektoren und die Emissionen werden voraussichtlich stark ansteigen. In beiden Sektoren existieren sehr große und umsetzbare Minderungspotenziale und in beiden wurden Marktmechanismen bereits in hohem Umfang benutzt. Jedoch befindet sich die nationale Politik teilweise im Konflikt mit lokalen Prioritäten. Zudem behindert der Mangel an Bewusstsein in breiten Teilen der Bevölkerung die Anwendung von guter Praxis in kleinen Industriefirmen und im Gebäudesektor und bietet Raum für industrielles Lobbying. Mit seinem rapiden Wachstum und steigenden Emissionen sollte China in der Lage sein, eine Reihe von Minderungsmaßnahmen mit nationalen Mitteln umzusetzen, benötigt aber Unterstützung, um das gesamte Potenzial zu heben.

Costa Rica ist seit den 1990ern ein Pionier der Kohlenstoffmärkte, etabliert derzeit einen nationalen Kohlenstoffmarkt, und hat zugesagt, bis 2021 Kohlenstoff-neutral zu werden. Aufgrund des hohen Anteils von Wasserkraft in der Stromversorgung ist die Landwirtschaft einer der wesentlichen emittierenden Sektoren. Costa Rica sieht bereits seit langem Umweltpolitik als wesentlichen Eckstein seiner Regierungsführung an und hat entsprechende eine klare institutionelle Architektur sowie detaillierte Strategien, Pläne und Programme zur Emissionsminderung etabliert. Barrieren sind u.a. einen Mangel an finanziellen Ressourcen und an Wissen für die volle, effektive Umsetzung einiger Gesetze und Programme zur nachhaltigen Landwirtschaft sowie der Verwendung von Niedrig-Emissions-Technologien und ökologischem Dünger. Zudem könnte die Koordination von Sektoren und Institutionen sowie die Aufteilung von Verantwortlichkeiten und Entscheidungsbefugnissen verbessert werden. Es besteht auch ein Mangel an Bewusstsein, Informationen und Kapazitäten in Bezug auf verschiedene Themen der Emissionsminderung. Aufgrund der Herausforderungen von MRV in der Landwirtschaft mögen

NAMAs eine gute Alternative zur Teilnahme des Sektors in einem zukünftigen globalen Kohlenstoffmarkt sein.

Äthiopien hat eine sehr progressive Verhandlungsposition und zugesagt, bis 2015 Kohlenstoff-neutral zu werden. Aufgrund seines Entwicklungsstandes als eines der am wenigsten entwickelten Länder wird die Umsetzung dieser Zusage jedoch starke internationale Unterstützung erfordern. Die Landwirtschaft ist der wichtigste Wirtschaftssektor (beschäftigt 80% der Bevölkerung) und der Strombedarf wird voraussichtlich entsprechend der Entwicklungs-Aspirationen des Landes scharf ansteigen. In 2010 verfügte nur ¼ der Bevölkerung über einen Netzanschluss. Äthiopiens Pläne zum Ausbau der Erneuerbaren sind ökonomisch rational, erfordern jedoch erhebliche Vorab-Investitionen, die in den derzeitigen Budgets nicht vollständig abgedeckt sind. In der Landwirtschaft lassen die meisten Maßnahmen kurzfristig keinen positiven Ertrag erwarten. Der institutionelle und Marktrahmen ist nicht förderlich für die Beteiligung des Privatsektors, um die Finanzierungslücke zu schließen. Äthiopien hat bisher keine Erfahrung mit marktbasierten Mechanismen und würde erhebliche Vorbereitung benötigen, um sie in Zukunft zu nutzen. Die Landwirtschaft bereitet weitere Komplikationen, da sie sehr stark in kleinteilige Aktivitäten fragmentiert ist. Marktbasierte Mechanismen mögen in der Zukunft interessant werden, um Potenziale in Äthiopien zu heben, zuvor muss jedoch die Marktbereitschaft erhöht werden und neue Ansätze für Mechanismen müssen gefunden werden, um landesspezifische Barrieren anzugehen. Eine vielversprechende Aktivität, die unterstützt werden könnte, könnte die weitere Nutzung von Erneuerbaren-Energien-Technologien für die Elektrifizierung sein.

Indien ist ein wesentlicher Großemittent und Teilnehmer im Kohlenstoffmarkt. Zusätzlich zu seiner starken Position im CDM verwendet es auch national marktbasierte Ansätze. Zement und Eisen&Stahl sind die größten Emittenten unter den Industriebranchen und projizieren einen scharfen Emissionsanstieg im *business as usual*. Die Aussichten für die Nutzung marktbasierter Instrumente sind allgemein gut. Jedoch existieren erhebliche Nicht-Preis-Barrieren, u.a. Mangel an Zugang zu Investitionskapital, hohe Vorab-Investitionsbedarfe, eine Abfallgesetzgebung, die die Verwendung als alternativen Brennstoff behindert, mangelnde Qualität der Abfallsammlung, Normen und Standards, die das Potenzial der Zementbeimischung begrenzen, mangelnde soziale Akzeptanz von alternativen Brennstoffen und Zementbeimischung, niedrige Qualität des inländischen Eisenerzes und der inländischen Kohle, geringe Verfügbarkeit von Schrott, und mangelndes Bewusstsein/mangelnde Bereitschaft in Effizienz zu investieren. Die Nutzung von Kohlenstoffmärkten wird daher vermutlich nur in der Lage sein, die verfügbaren Potenziale voll zu nutzen, wenn sie kombiniert wird mit Unterstützung für den Zugang zu Investitionspotenzial und regulatorischen

Änderungen und Aktivitäten für den Kapazitätsaufbau. Aussichten für internationale Kooperation könnten den Ankauf von indischen Energieeffizienzgutschriften, die zur Verfügung Stellung von Budgethilfen und die Ausweitung der Unterstützung von Investitionsfonds beinhalten.

Kenia hat einige ambitionierte Klimapolitiken entwickelt. Aufgrund seines Entwicklungsstandes ist die Landwirtschaft der wichtigste Wirtschaftssektor und wurde von der Regierung als Ankersektor für das Vorantreiben der Entwicklung der Wirtschaft des Landes identifiziert. Aufgrund des geringen Niveaus von Kenias Fähigkeiten und Verantwortlichkeit für die Klimawandel ist erhebliche internationale Finanzierung notwendig, um die positiven Minderungskosten abzudecken. Minderungsmaßnahmen sind zudem abhängig von Verhaltensänderungen auf der individuellen Ebene und werden daher behindert von mangelndem Bewusstsein und mangelnden Kapazitäten im gesamten Sektor. Mit seiner niedrigen aber im Vergleich zu anderen Ländern der Region weiter entwickelten Kohlenstoffmarktbereitschaft könnte Kenia ein interessanter Pilot für neue Marktmechanismen sein, die auf die landesspezifischen Barrieren abzielen.

Marokko hat der UNFCCC eine detaillierte und ehrgeizige Zusage für 2020 vorgelegt. Es hat sich insbesondere Ziele für erneuerbaren Strom gesetzt, da es ein inhärentes Interesse hat, seine nahezu vollständige Abhängigkeit von Energieimporten zu senken. Es wird jedoch internationale Unterstützung benötigen, um diese Ziele tatsächlich umzusetzen. Barrieren beinhalten einen Mangel an Zugang zu Investitionskapital, hohe Vorabinvestitionserfordernisse für Erneuerbare, Mangel an Finanzierungsmechanismen für dezentrale Installationen, ein praktisches Monopol des staatlichen Energieversorgers, kein Zugang zum Niedrigspannungsnetz für unabhängige Anbieter, die Existenz von Subventionen für fossile Brennstoffe, und Mangel an menschlichen Kapazitäten. Marktbereitschaft und Möglichkeiten für das Engagement des Privatsektors sind niedrig, die meisten CDM-Projekte wurden von öffentlichen Institutionen entwickelt. Die aussichtsreichste Möglichkeit für internationales Engagement mag daher darin liegen, mit der marokkanischen Regierung zu arbeiten, bspw. auf Grundlage eines sektoralen crediting-Mechanismus unter Einbeziehung von Anreizen für dezentrale Installationen, der Unterstützung mit Investitionskapital und regulatorischen Reformen.

Peru ist Mitglied der progressiven Unabhängigen Gemeinschaft Lateinamerikas und der Karibik (AILAC). Es hat zuletzt Initiativen zur Förderung von Erneuerbarem-Strom entwickelt, diese stehen allerdings in Konflikt mit wirtschaftlichen Anreizen für Erdgas, der präferierten Ressource für die Entwicklungsstrategie des Landes. Zusätzlich bestehen Probleme in der Erreichbarkeit abgelegener Teile der Bevölkerung und bei den technischen

Kapazitäten. Man mag von Peru erwarten, das Kapital für Minderungsmaßnahmen mit positivem Ertrag zu mobilisieren. Zudem sollte internationale Finanzierung ehrgeizigere Maßnahmen unterstützen. Dies durch Marktmechanismen zu tun – insbesondere auf sektoraler Ebene –, mag möglich sein, wenn der Mechanismus adäquat die landesspezifischen Barrieren adressiert.

Südafrika ist ein wesentlicher Großemittent und hat unter der UNFCCC ein ehrgeiziges Ziel für 2020 vorgelegt, das es nun jedoch Probleme hat, zu erfüllen. Strom und Eisen&Stahl gehören zu den größten emittierenden Sektoren. Die Übersetzung von Politiken und Plänen in konkrete Maßnahmen ist langsam, u.a. aufgrund von begrenztem Wissen und Kapazitäten innerhalb der Regierungsstellen. Hohe Investitionsbedarfe und niedrige Strompreise wirken als falscher Anreiz gegen Energieeffizienzmaßnahmen und einen stärkeren Ausbau erneuerbarer Energien. Südafrikas Potenzial für die Nutzung marktbasierter Instrumente zur Treibhausgasminderung scheint begrenzt. Beide Sektoren weisen eine hochkonzentrierte Struktur und wenige Marktakteure auf. Von den beiden mag der Stromsektor in der Zukunft ein höheres Potenzial für die Nutzung des Marktes bieten, da neue Unternehmen in den Strommarkt eintreten. Die südafrikanische Regierung plant, eine Kohlenstoffsteuer einzuführen und hat aus verschiedenen Gründen entschieden, kein Marktinstrument zu schaffen, u.a. aufgrund von institutionellem Kapazitätsmangel. Das Fehlen eines robusten Treibhausgasinventars würde das Emissionsmonitoring verkomplizieren, das für einen Marktmechanismus auf sektoraler und nationaler Ebene erforderlich wäre.

Thailand hat eine dynamische Wirtschaft und einige ambitionierte nationale Politiken, hat bisher jedoch noch keine 2020-Zusage vorgelegt. Thailands Zementproduktion ist der größte einzelne energieverbrauchende Sektor des Landes und ist unter den zehn größten Zementproduzenten weltweit. Thailands Zementsektor scheint gut geeignet für marktbasierte Ansätze zur Emissionsreduktion. Der Vorschlag des Landes unter der Partnership for Market Readiness (PMR) der Weltbank definiert einen Fahrplan, wie solche Ansätze umgesetzt werden könnten: Thailand zielt auf die Einführung eines freiwilligen Energy Performance Certificate Scheme bis 2017 sowie eines verpflichtenden EHS in 2020. Ähnlich wie in Indien bieten diese Initiativen Anknüpfungspunkte für die internationale Verknüpfung nationaler Systeme.

1 Preface

Financial support for developing countries is a core issue in the international climate regime. Industrialised countries strongly emphasise the potential role of carbon markets in mobilising needed finance for developing countries. Carbon markets may either finance investments directly, as in the Kyoto Protocol's Clean Development Mechanism (CDM), or they may constitute innovative sources of public finance, for example from auctioning revenues in domestic emission trading systems. The research project "Analysis of the Role Carbon Markets Can Play for Global Climate Finance from Today to 2020 and Beyond" aims at providing an analysis of and recommendations for how carbon markets can contribute to mobilising emission reduction potential in developing countries.

This third interim report is best read in conjunction with the second interim report, which lays out the background and scope of the project and provides an overview of the status quo of climate-related financing needs in developing countries, current climate finance and the current status of the CDM. This third interim report analyses potential overlaps between carbon market instruments, national climate policies in host countries and international climate finance; possibilities to group countries according to criteria of economic capability and responsibility for combating climate change; and emission reduction potential and options for use of carbon markets in 15 country-sector combinations.

The report is structured as follows:

Chapter 2, "Analysis of overlap between carbon market instruments, national climate policies in host countries and international climate finance", elaborates on the relationship between carbon markets, international climate finance and national climate policies in host countries to serve as groundwork for the investigation into which contributions to GHG mitigation in developing countries should be financed externally and which financing could be expected from carbon markets.

Chapter 3, "Illustration of countries or country groups regarding their use of carbon markets", discusses the possibility of using a country grouping to determine which own contributions to mitigation efforts may reasonably be expected from different countries.

Chapter 4, "Country/Sector Cases", contains detailed analysis of 15 country/sector combinations regarding available mitigation potential, existing policies and measures, remaining barriers and scope for international cooperation, including use of carbon markets.

2 Analysis of Overlap between Carbon Market Instruments, National Climate Policies in Host Countries and International Climate Finance

The elaboration and presentation of the relationship between carbon markets, international climate finance and national climate policies in host countries in this section serves as the groundwork for the investigation into which contributions to GHG mitigation in developing countries should be financed externally and which financing could be expected from carbon markets. This also serves as the basis for the work conducted in the subsequent chapters, which focus in more detail on the questions of where carbon markets could make a contribution and what contributions should be financed by the host countries themselves. This section investigates how the different market-based instruments (traditional CDM/JI, CDM PoAs, ETS and New Market Mechanism) overlap and how they are linked with national climate policies in developing countries (incl. NAMAs).

2.1 Introduction to the Different Instruments

In the following section, the relevant mitigation instruments are briefly discussed to establish a common understanding. Following this, we assess how they relate to each other. From a market perspective we describe the flexible mechanisms CDM/JI and CDM PoA as well as the New Market Mechanisms, which are based on the international UN climate regime, and domestic Emissions Trading Systems (ETS). Non market-based mechanisms will be considered by looking at the design and setup of NAMAs. In the subsequent discussion of these mechanisms, the links to national policies which are implemented independently from the UNFCCC framework will also be discussed. Figure 1 below depicts the different instruments that will be analysed and illustrates the context in which they have been developed and are functioning. This graph distinguishes between instruments operated under the UNFCCC and those outside of it. Under the UNFCCC these mechanisms can also be divided into existing ones that are used to achieve targets under the Kyoto Protocol (boxes in light green on the left), i.e. International Emissions Trading (IET), CDM and JI, and future mechanisms (NMM and NAMA), which are under development and will be available under a new global agreement (boxes in dark green in the middle).

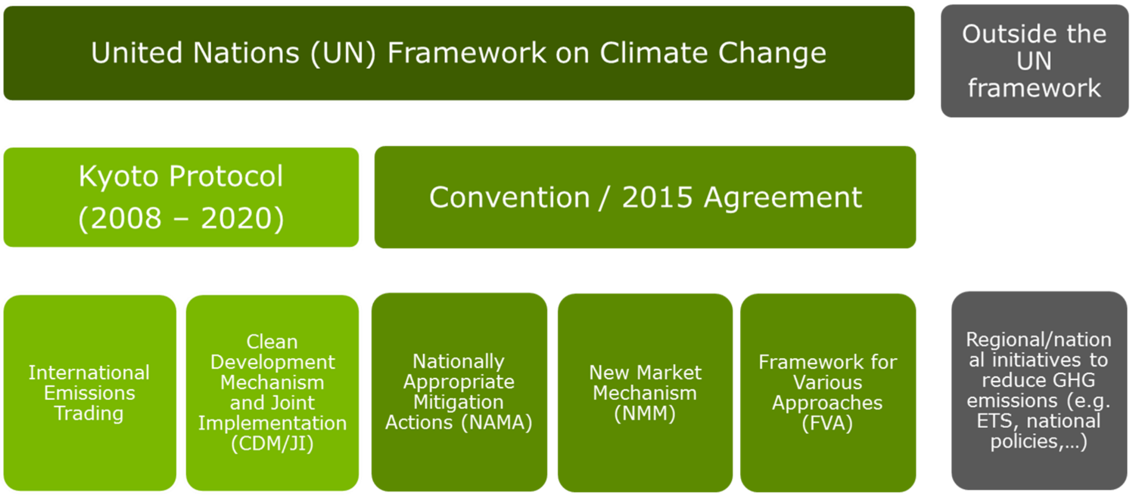

Figure 1: Overview of existing and emerging mitigation mechanisms (Source: Ecofys)

2.1.1 Clean Development Mechanism (CDM) and Joint Implementation (JI)

2.1.1.1 Regular Project Cycle

As discussed in detail under chapter 4 of the second interim report, CDM and JI are project-based mechanisms, which aim at incentivising emission reductions in developing countries and countries in transition. The mitigation activities are (co-)financed through the sale of carbon credits, the demand for which results mostly from countries' and companies' emission reduction obligations under the Kyoto Protocol and the EU ETS respectively.

The global net effect of these GHG emission reductions is at best zero, as the reduced emissions are entirely converted into carbon credits which are used to offset emissions elsewhere. Potential co-benefits of these mechanisms are technology transfer and contributions to sustainable development in developing countries. While the JI never formulated a sustainable development aim, the CDM has been widely criticised for not having met the objective to contribute to sustainable development (Boyd et al. 2009), (Ruthner et al. 2011), (Sterk et al. 2009).

JI projects, in contrast to CDM activities, take place in a capped environment as they are implemented in countries with a binding reduction target. Emission reductions achieved through JI need to be accounted for in the national inventories of the host countries. While CDM and JI are independent mechanisms administered and governed by different institutions (JI Supervisory Committee and CDM Executive Board), the JI is largely based on the rules, procedures and methodologies of the CDM. In the following assessment the focus will be on the CDM, as it can be assumed that for the relevant aspects the two mechanisms have the same characteristics.

2.1.1.2 Programme of Activities (PoA)

The CDM Programme of Activities modality emerged as an initiative for scaling up the CDM (see chapter 4.4.1 of the second interim report). This approach allows the grouping of large numbers of similar mitigation activities under one umbrella. The objective is to reduce transaction costs resulting from the different CDM processes and requirements by enabling the clustering of activities of the same type, often spread out over a large region or a whole sector. The key difference to the regular CDM setup is that the overall programme (CDM PoA), rather than the individual activities, is subject to a registration process. Also, new Component Project Activities (CPA) can be added throughout the lifetime of the programme without having to undergo a validation or registration procedure. Since such a programme can spread out over large geographical regions and can involve a large number of actors (e.g. those implementing the mitigation activity) a Coordinating/Managing Entity (CME) needs to be designated for each individual PoA.

2.1.2 The New Market Mechanism

From the discussions around the Bali Action Plan, the need for new instruments to incentivise cost-effective mitigation actions from both developing and developed countries emerged. Further aspects of these instruments were elaborated in Cancun, where it was decided that, while participation is voluntary, such mechanisms need to lead to *“a net decrease and/or avoidance of global greenhouse gas emissions”* and should be targeted at *“broad segments of the economy*” (UNFCCC 2011, §80). The work around these new mechanisms was split up into two concepts in Durban, resulting in the Framework for Various Approaches (FVA) and the New Market-based Mechanism (NMM). Under the FVA, parties are discussing ideas for both market- and non-market-based instruments, for which the design and governance might be on the national level, while the results are to be recognised under the Convention. For the NMM, it has been defined that the mechanism will be governed by the Conference of Parties (COP), whilst the Subsidiary Body for Scientific and Technological Advice (SBSTA) has been tasked with the development of the mechanism’s modalities and procedures (UNFCCC 2012, 2/CP.17, §51).

For this assessment the analysis will focus on the NMM, leaving aside the FVA, since discussions around the objectives and design of the NMM are more advanced. Hence, more information can be derived to answer the question of how market-based instruments, such as the NMM, may play a role in climate finance.

Currently there are two types of NMM being discussed (European Commission 2012): a trading approach and a crediting approach. While both types involve the use of fungible units, e.g. allowances or credits, and are envisaged to generate to some extent offset opportunities for developed countries(UNFCCC 2012b, 2/CP.17, §83), the implementation of the two options differs:

2.1.2.1 A Crediting Approach

Under a crediting approach of NMM, a crediting baseline will be defined for a specific segment of the host country's economy, which will be below - i.e. more ambitious than - the baseline of a business-as-usual (BAU) scenario[1]. Credits will then be issued to the government if the covered segment is able to reduce emissions below the crediting baseline. The revenues from the sale of those credits can be used to (co-)finance ex-post those mitigation measures that lead to the overachievement of the target. Demand for these credits is meant to stem from developed countries that use offsets to supplement their own actions to achieve their emission reduction targets under the Convention. Emission reductions achieved between the BAU scenario and the crediting baseline will be the host countries' contribution to global net emission reductions.

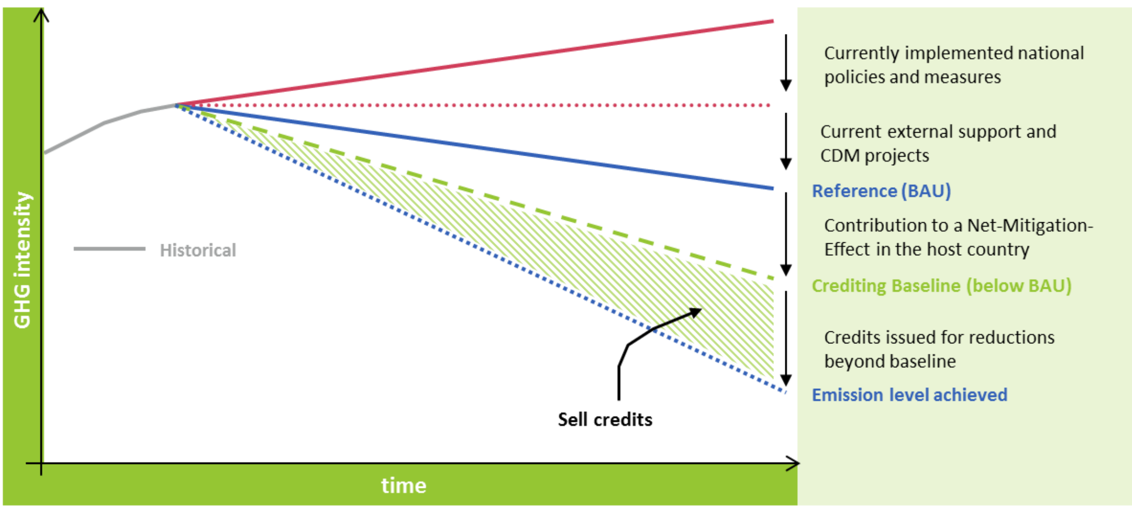

Figure 2: The crediting approach under a New Market Mechanism (Source: Ecofys)

Figure 2 above illustrates the crediting scenario under the NMM. The blue line, representing the BAU scenario, takes into account national measures

[1] To be additional the BAU scenario will have to take into account existing measures in the sector, e.g. CDM activities, national policies under implementation.

implemented (red line), as well as existing CDM activities and external support received (red dotted line). By defining a national contribution to global GHG reductions, the crediting baseline can be derived, which is depicted as the dashed green line. If the achieved emissions level, here the dotted blue line, is below the crediting baseline, credits are issued equalling the green dashed area.

2.1.2.2 A Trading Approach

A NMM based on trading requires the definition of a reference scenario, e.g. BAU, and the setting of a target for the respective sectors (or sub-sectors). This target reflects the country's national contribution to global GHG emission cuts. Tradable emission allowances equalling the projected emissions under the reference scenario minus the reductions to be achieved by the country are issued to the government. If the measures implemented in the targeted sector (or subsector) lead to reductions beyond the target, the government can sell an equivalent amount of allowances. In contrast to the crediting mechanism described above, the target would be binding and the government would hence have to buy emission units (e.g. from countries using the same mechanism) in case the target is not achieved domestically.

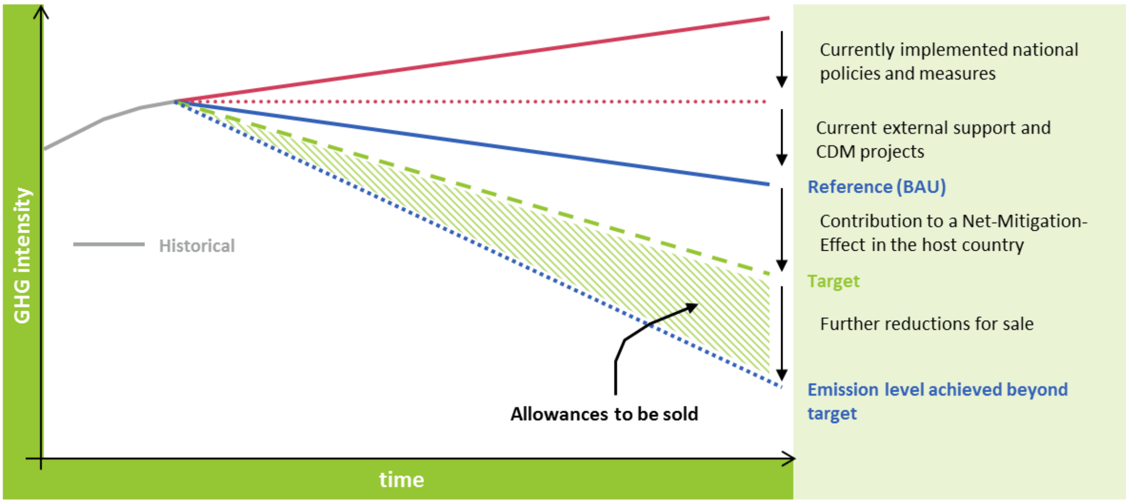

Figure 3: The trading scenario under the New Market-based Mechanism (Source: Ecofys)

The preceding graph depicts the trading approach under the NMM. The BAU scenario is again illustrated by the blue line, taking into account existing national measures (red line) and CDM projects, as well as external support (red dotted line). The green dashed line is the target emission level, which the host government committed to achieved. This graph depicts the case in which the government is able to reduce emissions beyond its target (i.e. achieving an emissions level illustrated by the blue dotted line) and has therefore an amount of allowances, equalling the green dashed area, available for sale.

2.1.3 Emission Trading Schemes (ETS)

Cap-and-trade emissions trading is a market-based instrument to incentivise mitigation activities that has been implemented or is expected to emerge in a number of jurisdictions and across national borders. While an International Emissions Trading (IET) mechanism was defined under the Kyoto Protocol as one of the three flexible mechanisms, Emissions Trading Schemes have mostly evolved on the national, subnational or multinational level, governed by national or supranational authorities and independent from the UN climate regime (e.g. the EU ETS). The instrument is built on the concept that emission reductions should take place where abatement is cheapest within the instrument's boundaries. Through setting a cap, i.e. making emissions allowances a scarce resource, the carbon price signal will incentivise reductions in areas where the abatement costs are below the market's carbon price. This incentive persists as long as the instrument has not reached its objective to match the actual emissions with the initially agreed cap. Companies under the scheme can then decide whether they will reduce emissions in-house to reach a certain reduction target, or buy allowances on the market to cover excess emissions. Emitting GHGs becomes a cost factor for companies and mitigation activities are incentivised by the possibility to either sell allowances or to save costs by buying allowances on the market.

An ETS could in fact be viewed as an ultimate aim, to be arrived at by going through an evolution of market-based mechanisms.

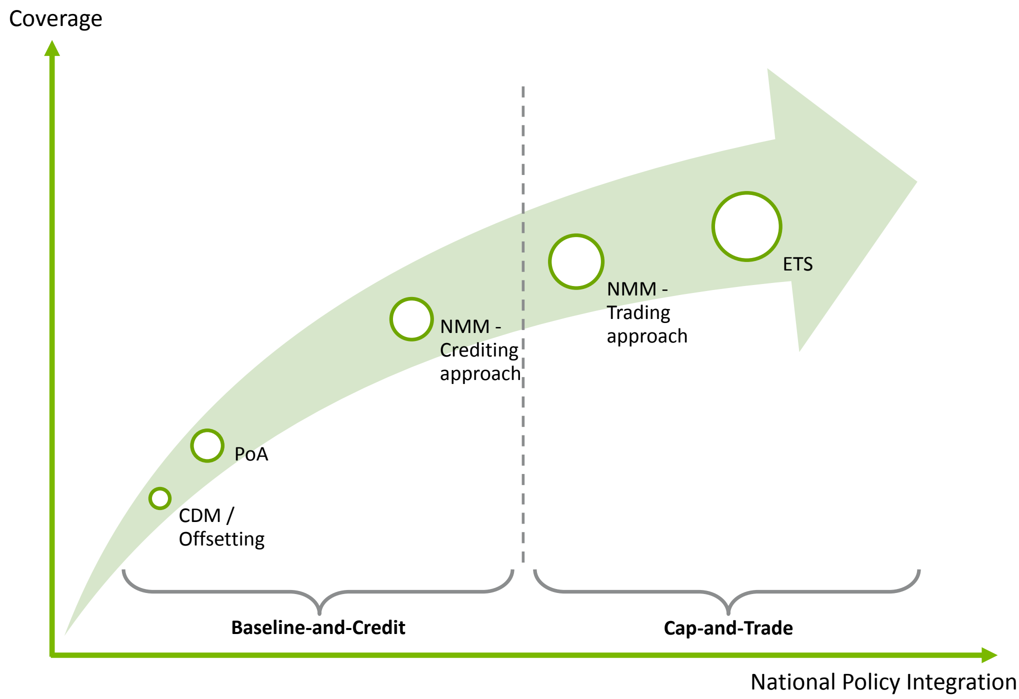

Figure 4: Evolution of market-based mechanisms (Source: Ecofys)

Figure 4 illustrates by means of two dimensions how the different market-based mechanisms can function as evolutionary steps towards extending their scope and effectiveness. The dimension of the x-axis depicts how strongly the mechanisms are integrated into national policies, while the y-axis shows the coverage in terms of sectors and emissions sources. The CDM, as a project-based crediting mechanism, can be seen as the starting point with limited coverage of sectors and emission sources, and a low degree of national integration. PoAs are then a stepping stone towards the next major mechanism as they are an extension of the CDM's coverage, and often require government involvement as CME. From there, a considerable step is required to reach the stage of sectoral crediting under a NMM, which implies an extension in terms of coverage since whole sectors would be targeted, but also requires stronger integration into national policies since the country as a whole would commit to mitigation efforts. While still operating under the umbrella of a NMM, making the switch from the crediting approach to a trading approach means to cross a clear line (illustrated by the grey dashed line in the graph), which is to accept a cap. The final stride in this evolution would be to implement an ETS on private sector level with very broad coverage (for example across sectors or even borders), which is entirely integrated into national policies.

2.1.4 Nationally Appropriate Mitigation Actions (NAMAs)

As discussed in chapter 2.2.3 of the second interim report, Nationally Appropriate Mitigation Actions (NAMAs) were introduced through the Bali Action Plan and were later recognised in the Cancún Agreements as a framework to support developing countries in undertaking mitigation actions that are appropriate given national circumstances, and that contribute to national sustainable development needs. Donor countries committed to provide financing, technology transfer and capacity building to support these measures. In general terms, NAMAs can be categorized as **unilateral,** in that they are financed entirely by the host country, and **supported**, in that they receive international support. The latter category can also contain activities which are funded by both the host country and international financing.

A number of developing countries have inscribed pledges in the Copenhagen Agreement under the umbrella of NAMAs. Some of these are quantifiable targets, which are not binding and for which no information is provided on how they will be achieved (UNFCCC 2013a). On the other hand, NAMAs that have been up until now recorded in the UNFCCC NAMA registry[2] and collected in the Ecofys NAMA database[3] provide more insight into the planned activities and illustrate the diversity of measures that can be implemented under NAMAs. They can be classified as three main types, namely “Strategy NAMAs” - long term comprehensive plans of measures and actions designed to achieve a target, “Policy & Programme NAMAs” – a governmental programme or measure that is/will be embodied in legislation, and “Project NAMAs”, such as localised capital investment in infrastructure or machinery, for example. There are numerous NAMAs that are a combination of the three types and also those that cannot be attributed to any one of them. As diverse as the measures proposed under NAMAs are their objectives. Besides mitigation of GHGs, NAMAs may aim at achieving co-benefits for the economy, society and/or the environment.

2.1.5 Implementation Instruments

Aside from the mechanisms discussed above and compared in the following table, further approaches and instruments exist that might be applied in similar contexts serving similar purposes. These include, for example, “Results-based Financing Approaches” and national policies in developing countries which might be used in parallel with, or integrated into, the described mechanisms.

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[2] See http://unfccc.int/cooperation_support/nama/items/6945.php
[3] See http://www.nama-database.org/

We will therefore first introduce these approaches and instruments before we assess in detail the linkages between mechanisms in the following chapter. The approaches are not considered as independent international market-based or non-market based mechanisms and are therefore not included in the following comparison table, but they are considered relevant for the assessments and discussions in this overall section.

2.1.5.1 Results-Based Financing

In contrast to conventional finance, results-based finance is provided upon the achievement of pre-defined goals, i.e. the financial means that are given ex-post once the implemented measures prove to be effective. In practice this type of finance can be combined with conventional finance, i.e. up-front payments in order to finance start-up and capacity building activities. Criteria for measuring the achievement of goals can be both quantitative and qualitative (Warnecke et al. 2013), which makes this financing tool applicable to various different policy instruments and mechanisms. Also, results-based finance is not limited to measures implemented on any specific level, but can be applied to nationally or locally implemented measures, as well as on government level or private sector level.

While this form of financing was first used and tested in international development cooperation, it has become a relevant concept in the context of the UNFCCC in regards to REDD+ and the creation of the Green Climate Fund (World Bank 2013). Typical indicators to measure the achievements that trigger results-based finance in the context of climate finance are emission reductions (quantitative) and sustainable development (qualitative). However, a wide range of indicators can be used, making this approach appealing in the context of NAMAs, which must meet a number of goals that are in many cases of qualitative nature.

From the funder`s perspective, results-based finance provides a useful means for justifying that funds are spent on effective measures. From the recipient`s point of view it has the clear disadvantages of requiring that self-sourced funds be made available in order to implement the measures beyond the start-up , and that in the case that these prove to be ineffective the results-based finance will not be received.

2.1.5.2 National Policies

National policies are measures governed and implemented nationally with or without the support from donor countries. Their objectives might not be directly linked to reducing GHG emissions but can lead to reduced GHG emissions as a co-benefit. On the other hand, these measures can also be targeted primarily at incentivising mitigation, such as the implementation of an ETS or a domestic offsetting scheme.

A key difference with unilateral NAMAs, which are also implemented and governed only on national level, is the fact that achievements of unilateral NAMAs will be recognised internationally and can be in the form of pledges. While not being a mechanism in itself, national policies can be means to achieve unilateral NAMAs.

2.1.6 Voluntary Carbon Market

The Voluntary Carbon Market encompasses a number of different standards for baseline setting and crediting of emission reductions through project based activities. By its nature, participation in this market is voluntary and its processes are only governed by the standard's organisation, however, no market oversight exists on national or international level. The purchase of voluntary carbon credits usually serves the offsetting of emissions elsewhere but is not recognised under any formal pledges or binding reduction targets. The Voluntary Carbon Market has been able to mobilise substantial private sector financing, for example from companies following Corporate Social Responsibility objectives, and has enabled some countries, such as Turkey for example, to participate in the carbon market outside of the UNFCCC. Since this mechanism is project based its characteristics that are of relevance to this analysis are the same as those of the CDM, and will therefore not be considered separately.

2.2 Comparison and Analysis of the Linkages and Overlaps between the Different Mechanisms

Market-based instruments (CDM/PoA/JI/ETS/NMM) and non-market based instruments (national policies, NAMAs and others) are expected to overlap in terms of their financing sources, measures and coverage. This overlap can be a challenge, in the sense that existing activities would need to be taken into account in the set-up of new instruments, but could also be seen as an opportunity to use experiences and resources from existing instruments for a future and scaled-up instrument (for example, moving from CDM/PoA to NMM).

2.2.1 Criteria-Based Mechanism Comparison

The matrix below lists the four mechanisms (CDM, NMM, ETS and NAMA) and their sub-types that are found to be relevant for the discussion, and describes them according to eight key policy and design elements:

General objective covers the explicit function of a mechanism (or its subtype) as defined by the COP or by the implementing institution. While there can be an overlap between this category and the following ones it serves to recall why the mechanism has been developed.

Coverage elaborates on the mechanism’s span over economic sectors and emission sources, and also on the level of implementation (e.g. project or sector level).

Governance highlights under which authority the mechanisms run and which institutions are involved in the implementation and supervision.

Target setting describes whether the mechanism involves a binding target or whether participation is without regret, i.e. a no-lose target.

Financing encompasses the source of finance both in terms of whether it is private or public money and whether the finance stems from donor countries or from the host country.

Incentives describes the type and recipient of incentives provided by the mechanism, for example carbon credits, allowances and penalties, for the private sector or the national government.

Contribution to net decrease of global GHG emissions emphasises whether the mechanisms lead to such a net effect and elaborates on the ownership of the emission reductions.

MRV approach describes the different requirements of the mechanisms with regards to the level that is subject to MRV (e.g. on project/installation level or national level) and by whom the MRV standards are set (e.g. nationally or internationally).

Table 1: Comparison of Mechanism Characteristics

Instrument / Characteristics	CDM		NMM[4]		ETS	NAMA	
	regular CDM	PoA	Credited	Trading		Unilateral	Supported
General Objective	Increase flexibility for compliance-based mechanisms to most cost-effectively reduce GHG emissions (offsetting); Assistance in achieving sustainable development in host countries		Provide incentives for mitigation actions in developing countries that go beyond the scale of existing market-based mechanisms (up-scaling); Stimulate emission reductions across broad segments of the economy; Ensure a net decrease and/or avoidance of global GHG emissions; Assist developed countries to meet part of their mitigation targets (through tradable and internationally recognised reduction units)		Achieve a predefined quantitative GHG emission reduction target in selected sector; Trading ensures that GHG reduction is achieved where it is most cost efficient	Encourage GHG mitigation actions (not necessarily quantifiable); Longer term transformational impacts of entire sectors or sub sectors rather than localised impacts; “[…]actions […] in the context of sustainable development”; Supporting instrument for developing countries to meet their pledges made in the Copenhagen agreement	
		Up-scaling; Reduced barriers for smallest mitigation opportunities					
Coverage	Project-based; entire unregulated emission sources in Non Annex-I countries	Programmes of projects; also activities across borders	Broad segments of economy		Selected sectors; Possibly multinational.	Country or segment of country from local to national; Can be projects, programmes or policies.	

[4] Source: UNFCCC (2012), UNFCCC (2013b)

<table>
<tr><th rowspan="2">Instrument / Characteristics</th><th colspan="2">CDM</th><th colspan="2">NMM[4]</th><th rowspan="2">ETS</th><th colspan="2">NAMA</th></tr>
<tr><th>regular CDM</th><th>PoA</th><th>Credited</th><th>Trading</th><th>Unilateral</th><th>Supported</th></tr>
<tr><td>Governance</td><td colspan="2">UNFCCC;
COP and CDM Executive Board
Designated National Authorities</td><td colspan="2">UNFCCC;
Implementation by national governments</td><td>(multi-) national government authorities</td><td>Implementation by national governments;
International recognition through (voluntary) NAMA registry;</td><td>Governance by participating parties;
Implementation by national governments;
International recognition and seeking finance through NAMA registry</td></tr>
<tr><td>Target setting</td><td colspan="2">Baseline-and-credit, no set targets;
Voluntary participation by countries and private sector</td><td>No-lose target for governments;
Voluntary participation</td><td>Binding targets for governments;
Voluntary participation</td><td>Cap-and-trade approach;
Cap results in binding targets for industry sectors</td><td colspan="2">Overall government target defined by Copenhagen pledge;
Overall target is broken down to targets for actions to achieve the pledge;
NAMAs as one specific action define their own targets for e.g. sectors or activities</td></tr>
<tr><td rowspan="2">Financing</td><td colspan="2" rowspan="2">Ex-post through carbon revenues from buyer countries (Annex I) and private sector</td><td>Host country financing and ex-post financing through potential carbon revenues (from governments to governments)</td><td>Upfront allocation (government level);
Host country financing and financing through carbon revenues where target is overachieved (intergovernmental)</td><td rowspan="2">Upfront allocation (company level);
Private sector financing and carbon revenues where target is overachieved (participating companies)</td><td colspan="2">All forms of financing possible (e.g. results-based financing, concessional loans, equity instruments, private sector investments, also upfront financing)</td></tr>
<tr><td colspan="2">Financing options on sector level depend on the instruments used by the implementing</td><td>Host government financing</td><td>Mixed funding from both sources, international donors and domestic</td></tr>
</table>

<table>
<tr><th rowspan="2">Instrument / Characteristics</th><th colspan="2">CDM</th><th colspan="2">NMM[4]</th><th rowspan="2">ETS</th><th colspan="2">NAMA</th></tr>
<tr><th>regular CDM</th><th>PoA</th><th>Credited</th><th>Trading</th><th>Unilateral</th><th>Supported</th></tr>
<tr><td rowspan="3">Incentives</td><td rowspan="3">Participants: income from carbon credits
Buyer: reduced compliance costs</td><td rowspan="3">Additional to regular CDM:
attention to small scale activities;
reputational effects for buyer</td><td colspan="2">Developing countries receive support and potential financial contributions through carbon revenue;
Low carbon development;
International recognition of GHG mitigation effort</td><td rowspan="3">Mandatory participation with binding target (reduce or trade);
penalty scheme is key design element</td><td colspan="2" rowspan="3">Developing countries to meet their pledges made in the Copenhagen agreement;
Developing countries receive capacity building and direct financial support for low carbon development</td></tr>
<tr><td></td><td>Obligation to reduce or trade;</td></tr>
<tr><td colspan="2">Incentives for the private sector depend on the instruments used by the implementing party.</td></tr>
<tr><td rowspan="2">Contribution to net decrease of global GHG emissions</td><td colspan="2" rowspan="2">None, due to complete offsetting
Ownership of emission reductions lies with private sector</td><td colspan="2">Yes, key mechanism objective;
Ownership of emission reduction lies with government</td><td rowspan="2">Yes, if cap sufficiently stringent
Emission reduction fixed upfront and owned by the government</td><td colspan="2" rowspan="2">Yes, since no credits are issued and hence no offsetting can take place;
GHG reduction solely contributes to developing country pledge made in the Copenhagen agreement;
Net contribution not necessarily quantifiable;
Ownership of emission reduction lies with government</td></tr>
<tr><td>Mitigation activities implemented to reach the crediting baseline generate net ER.
Credit issuance only for ER beyond crediting baseline which is more stringent than the BAU baseline.</td><td>Mitigation activities implemented to reach the agreed cap generate net ER.
Only surplus allowances can be sold on international market.</td></tr>
</table>

Instrument / Characteristics	CDM		NMM[4]		ETS	NAMA	
	regular CDM	PoA	Credited	Trading		Unilateral	Supported
MRV approach	MRV of emission reduction on project-level; Stringent requirements due to offsetting approach		MRV approach still to be defined under COP Possibly based on inventory emission levels		Recurring MRV of emissions on installation level; Domestic requirements	On international level achievements will be compared with pledges; Reporting tools: “national communications” and “biennial update reports” from non-Annex I Parties; On national level no specific MRV approach is prescribed; Parameters to be monitored go beyond direct GHG emission reductions, e.g. direct or transformational GHG reductions, progress of actions or sustainable development; MRV support provided (fin., cap. build., techn.)	

2.3 Interaction of Mechanisms and Implementation Instruments and their Practical Implications

In the following section the parallel features, as well as overlaps, of the various mechanisms as identified in the matrix will be assessed in more detail and findings are supported by practical examples. The conclusions on parallels and overlaps should give an insight into the question of how mechanisms that are financed through carbon revenues can play a role in those that are financed though international contributions (i.e. climate finance).

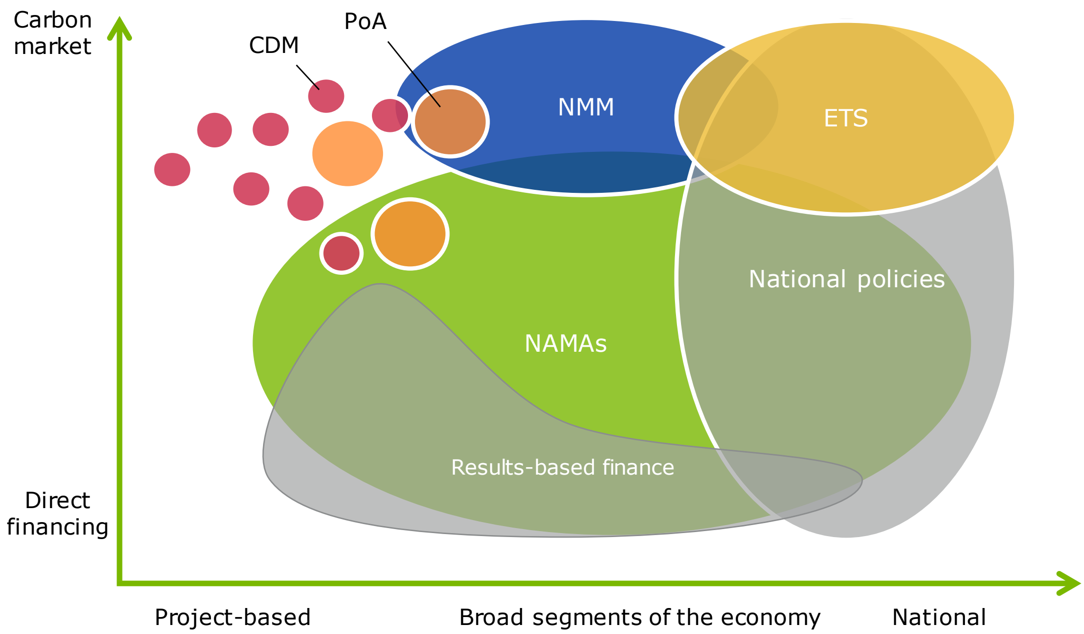

Figure 5: Schematic Overview of Mechanisms' Overlaps (Source: Ecofys)

Figure 5 above provides a simplified overview of the primary location of existing and new mechanisms in terms of their level of implementation and its financing mechanism. Possible similarities and distinct overlaps are visualized in this way.

Further aspects for the following comparison, which are relevant to identify any interplay of the mechanisms, are as follows:

- Ownership of the emission reductions
- Double counting of emission reductions
- Incentives provided and to whom
- Layers of implementation

- National Integration
- Source of funding
- Links to national policies

This comparison highlights the opportunities and challenges in regards to climate finance, which emerge from the linkage or coexistence of the various instruments.

2.3.1 Relation of CDM to NMM and NAMAs

The aim of issuing units for each emission reduction achieved under the CDM and under a crediting or trading NMM is to provide fungible units that have a financial value. In the case of the CDM the private sector receives a direct incentive to reduce emissions. In the case of NMM it is the government that is to be incentivised to implement mitigation activities, which are to lead to reductions beyond the defined target or a crediting baseline. While under the two options currently discussed for a NMM (see section 2.1.2) it is envisaged that some form of carbon unit will be issued, for example in form of allowances and credits, these will be obtained by the government. It is not necessarily envisaged, however, that these units will be passed on to the private sector. Instead, governments have a range of mitigation measures to choose from of which many are non-market measures, such as taxes, subsidies, and energy efficiency standards, as illustrated by Figure 6 below.

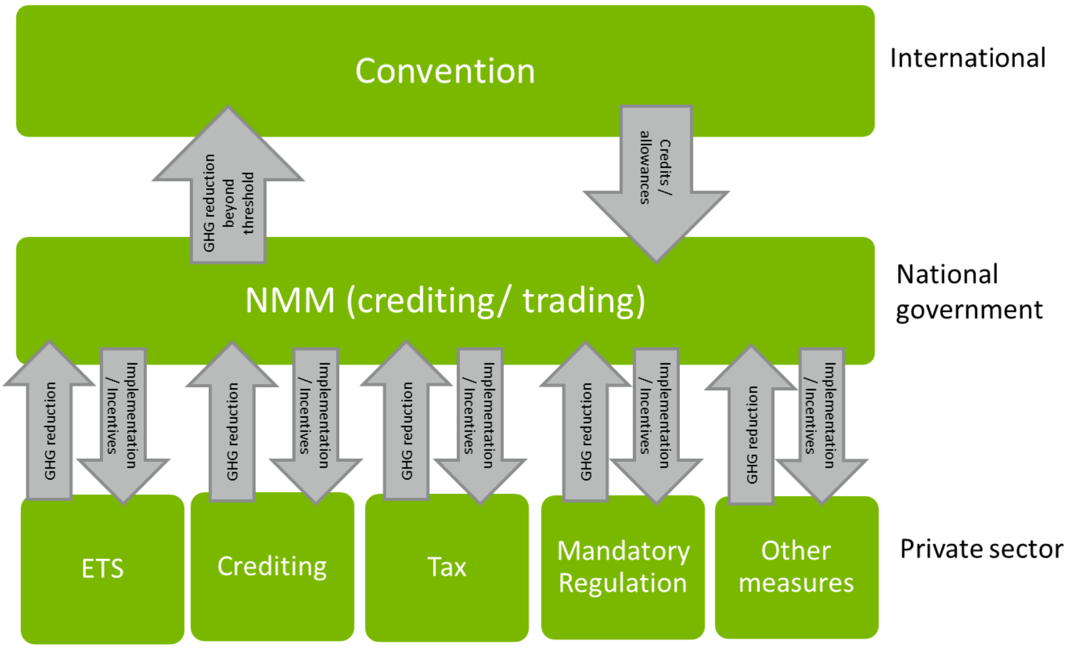

Figure 6: Context of a NMM and ETS (Source: Ecofys)

Revenues from the sale of allowances or credits could be used to co-finance the mitigation measures. Emission reductions achieved through NAMAs, on the other hand, will not be rewarded through the issuance of credits or allowances, which means that any tonne of avoided GHG emissions can be counted towards the host country's contribution to a net decrease of global GHG emissions. In contrast, the CDM has by definition no net mitigation effect as it serves to provide offsets for developed countries. The NMM is to serve both purposes, aiming at host countries contributing to global net reductions but also delivering offsets. The maximum net reduction would be defined ex-ante in the form of a target or crediting baseline and overachievement would result in the sale of carbon credits or allowances which could be used for offsetting emissions somewhere else. Therefore under a NMM and NAMAs the ownership of (net) emission reductions lies with the host country government, while under the CDM ownership is regulated by the fact that carbon credits are issued by the UNFCCC directly to the private sector.

In terms of the level of implementation the two market-based mechanisms, CDM and NMM, deviate substantially. The CDM is applied at the level of industry and households, hence directly where the mitigation activities take place, while the NMM is to be employed on the government level. This in turn primarily leads to inter-government credit trading opportunities, comparable to IET as defined by Art. 17 of the Kyoto-Protocol. However, this is conditional to consistent and complete inventories in the participating countries which might require several years to be operational. In order to enable the private sector to trade NMM reduction units internationally, an international governance is required which is not yet in sight. Hence the direct involvement of the private sector and the creation of a market for NMM units still requires to find agreements on several open questions. NAMAs on the other hand can be targeted at any level. It is at the host countries' discretion to identify which measure it wants to implement and on what level.

Section 4.5 of the second interim report already highlighted how important national integration is to the success of the CDM. Since this mechanism is governed on international level, while implementation happens on industry level some host governments have little incentive to get involved other than providing their formal approval. As a consequence, the CDM in some countries is not found to be well integrated into national policies or climate related national strategies. A second reason for this disconnect could be the fact that countries hosting the CDM had neither an obligation nor incentive to engage in mitigation activities in the past, and hence had no cause to develop national mitigation strategies in which the CDM could be incorporated.

A NMM would, by its nature, also be strongly integrated into national policies since governments would actively choose to participate in the mechanism and would, probably before defining the crediting baseline or the target, envisage which measures and policies to implement in order to achieve the self-prescribed GHG reductions. Also, the fact that it is targeted at *"broad segments of the economy"* would require integration into national circumstances to a greater degree than for CDM project activities, which can operate rather independently from national structures.

Carbon finance mobilised through the CDM has so far only played a small role in mobilising climate finance despite its leveraging effect. Sources of carbon finance from CDM include both private sector money and public funds from donor countries. In the context of a NMM, carbon finance would be generated through the possibility to generate offsets either in the form of allowances or carbon credits. However, the larger share of finance to achieve the net reduction of this mechanism would have to stem from other sources, which can be either climate finance from donor countries or domestic funds. As discussed in section 3.1 of the second interim report private finance sources require a certain degree of maturity from a mechanism. The degree to which private carbon finance, e.g. in the form of direct investment, would flow into a NMM is also likely to depend on the robustness of the host countries implementing measures since investors will have to be convinced that measures will lead to net reduction beyond the target or crediting baseline.

Practical Implications for CDM Activity Continuation in Sectors that Are Covered by a NMM or NAMAs

The CDM covers a wide range of technology types in sectors, of which some are likely to be covered by a NMM or NAMAs. Hence, CDM activities might coexist with these new mechanisms and potential double counting of emission reductions needs to be eliminated. Three options, under which the existing activities developed under the CDM can continue, could be envisaged:

a) The projects continue to operate under the existing CDM framework. Emission reductions achieved through the activities are subtracted from the amount of credits/allowances the government receives under a NMM. CDM operators continue to receive CERs through the UNFCCC.

b) The former CDM activities continue to be operated according to CDM procedures. Instead of receiving CERs from the UNFCCC the host government passes on the credits/allowances received for the implementation of an NMM to former CDM operators.

c) The former CDM activities continue to be operated according to CDM procedures. The operator is compensated directly (e.g. financially) but not in form of credits by the government for the emission reduction achieved instead of receiving CERs from the UNFCCC.

Option a) has the advantage that double counting can be addressed by subtracting the number of CERs generated in the sectors covered by a NMM or NAMAs from the overall reductions achieved under these new mechanisms. This is more straightforward under a NMM as exact measures of reduced tons of GHG emissions would exist, while for NAMAs the GHG accounting will be less detailed. However, the host country might face a situation in which it does not meet its crediting baseline/NMM target or its NAMA objective, while CDM operators are rewarded for their reductions. The government would therefore forego the opportunity to use the CDM activities as a cost-effective mitigation source. In the case of the NMM trading approach the government might in fact be faced with a penalty as the obligation to reduce emissions in line with the set target would lie with the government, while CDM operators have ownership of their achieved emission reductions.

Coexistence of CDM and a NMM or NAMAs as suggested under option a) would mean that the covered sector as a whole faces an implicit reduction target, while CDM activities do not. A mechanism on how CDM activities contribute to the reduction target/objectives would have to be introduced and be governed by the host government. It could be envisaged that the host country government levies a share of CER, with the purpose of cancelling them as part of the country's reduction efforts. A number of EU countries have implemented a comparable approach in order to achieve a net mitigation effect through domestic JI projects (Warnecke and Wartmann 2012). While applying this approach retroactively to registered projects would send adverse signals to private sector investors, such a levy would probably be viewed as the lesser evil compared to a full stop of CDM activities in sectors covered by new mechanisms.

Option b) seems to be more suitable to a NMM rather than to NAMAs as for NAMAs no creation of a carbon unit is envisaged[5]. This option would require a delisting of those activities from the CDM in order to prevent the situation that the issuance of CERs could still be requested and that double counting occurs. However, such a delisting is not envisaged under current CDM rules. This option is also only feasible if the units originating from the NMM can be traded

[5] Potentially the host country could create a national carbon unit. However, the question would arise of where the demand for it would come from.

by the private sector and governments equally. In order for those activities to contribute to a net mitigation effect the projects' baseline would have to be aligned with the NMM crediting baseline or target, i.e. be lowered.

The striking advantage of option c) would be that the entire reduction from the (former CDM) activities could be counted towards the NMM or NAMA. Also, no new MRV process would have to be developed as projects would continue to follow the existing CDM procedures and rules, while the activities themselves would, as under option b), have to officially waive their status as CDM project. The verification by a certification body such as a DOE could serve as the confirmation that the reported emission reductions have been generated and that the operator qualifies for receiving the announced compensation from the government. This would mean for the host government that it would have to source funds to finance the compensation. This could be in the form of domestic financing, which could be accounted under a unilateral NAMA, donor funding as a supported NAMA or carbon revenue from selling any excess allowances or credits. In contrast to the first two options, option c) would imply a disconnect from the carbon market. Given current low carbon prices, project operators might in fact view this as an advantage. In the case that the compensation is in the form of financial means, the approach could be described as results-based financing as funds are only provided once the results, in this case the tons of avoided GHG emissions, are verified. Such an approach could on the one hand serve the purpose of bridging the gap until demand for offset credits picks up again. On the other hand it could be a way for developing countries to make use of existing infrastructure and processes which already deliver cost-efficient GHG emission reductions in their country (Warnecke et al. 2013). Yet, emission reduction accounting is very complex under the CDM, while for NAMAs such a level of detail for GHG accounting will not be necessary.

A few developing countries have communicated that CDM activities will be a subset of measures under their NAMAs (UNFCCC 2013a). However, in these submissions no information is provided on how this is intended to work in practice, see box 1 below. In the case of supported NAMAs it is very unlikely that donor countries will accept the inclusion of CDM activities in NAMAs, as described under option a), without clear provisions of how double counting, i.e. reductions sold as offsets through the CDM and reductions achieved attributed to the NAMA, will be avoided.

Box 1: Costa Rica's National Climate Change Strategy (CO_2 neutrality inscribed in Copenhagen Accord as NAMA)

Costa Rica inscribed a goal of achieving carbon neutrality by 2021 as a NAMA in the Copenhagen Accord and Cancún Agreements. Costa Rica envisions two main instruments to achieve its neutrality target, the Carbon Neutrality Program and a domestic carbon market, both of which have already been launched. The domestic carbon market initially operates on a voluntary basis. Costa Rica expects that the potential to achieve competitive product differentiation through "Carbon Neutral" certification as well as demonstration effects will motivate companies to participate. Participants may achieve carbon neutrality through use of domestic offsets, so-called Costa Rican Compensation Units (UCC), as well as use of CERs and VERs. For the domestic offsets, Costa Rica intends to promote development of sector protocols with sector-wide baselines or benchmarks, but project-based approaches may also be used. The government also intends to explore the possibility of developing some of these sector programmes as supported NAMAs or for international crediting schemes. The trading scheme may ultimately be made mandatory if the voluntary approach does not achieve its objectives.

Target-based NAMAs raise double counting issues for the use of any carbon market instruments, either the CDM or a potential NMM:

- First, CDM (or NMM) activities contribute to reducing emissions on Costa Rica's territory and hence to its national emissions goal.
- Second, the credits from these activities will be used by industrialised countries to comply with their Kyoto commitments.

The potential for double counting is especially apparent in case both national and international offset credits are issued to the same project, but the effect is the same even if no domestic offset credits are issued since the impact on the national inventory is the same. The situation is hence essentially the same as in the case of JI. To prevent such double counting, the impact of CDM projects on the emissions of the host country would need to be accounted for. One option would be to adjust the country's emission inventory by adding one tonne to the inventory for each credit transferred out of the country for emission reductions achieved in the target year.

However, this approach would put the accounting burden on developing countries even though it is not illegitimate for them to use international mechanisms such as the CDM to co-finance their climate policies, in particular since most developing countries have made achievement of their UNFCCC pledges conditional on international support. From this perspective, double counting issues resulting from the interaction of crediting mechanisms with UNFCCC pledges should be addressed on the side of the buyer countries. Instead of using the credits for their Kyoto compliance, they could count the funding used for purchasing the credits towards compliance with their climate finance commitments and cancel the credits.

CDM PoA Related to NMM and NAMAs

The COP 8 in 2005 decided *"that a local/regional/national policy or standard cannot be considered as a clean development mechanism project activity"* (UNFCCC 2006, §20) and according to the CDM modalities CERs can only be issued for quantified emission reductions achieved by implemented project activities. Yet, another definition reads that a PoA is *"[a] voluntary coordinated action by a private or public entity which coordinates and implements any policy/measure or stated goal (i.e. incentive schemes and voluntary programmes), which leads to anthropogenic GHG emission reductions […]"* (UNFCCC). The above PoA definition, highlighting the policy relation, might therefore bear some potential for misinterpretation. However, the fact that PoAs can cover large numbers of activities under one umbrella, even across entire sectors, depict some parallels to NAMAs on the one hand and a crediting NMM on the other hand. A scaling up of existing PoAs to either a NAMA or a NMM seems appealing. However, the constraints identified in section 2.3.1 above for the inclusions (or exclusion) of project-based CDM in NAMAs or a NMM also hold for programme-based CDM activities and equal provisions to address potential double counting would need to be developed. Box 2 below provides an illustration of how a PoA could work in combination with a NAMA.

Box 2: Linking Feed-in Tariffs with PoAs and/or NAMAs

South Pole has developed a concept (Puhl 2011) to integrate renewables feed-in tariffs (FIT) with a PoA at the CME level. The concept is based on the situation in Thailand, which introduced a feed-in tariff in 2005 and consequently saw a rapid increase of the share of renewable electricity from originally about 6% to about 14% in 2012. Similar to the German model, the cost of this policy has been born by consumers and tax payers, which had led to strong political pressure to reduce these costs.

The concept envisages to develop a PoA with the eligibility criteria tied to those of the national FIT, that is, installations qualifying for the FIT would also qualify for inclusion in the PoA. The PoA's CME would be the authority operating the FIT. The FIT authority would thus receive the carbon revenue, which would allow it to moderate further FIT tariff surcharge increases for consumers. The FIT surcharge would nonetheless be likely to increase further, so South Pole also suggests to determine an "appropriate" cut-off threshold which should not be exceeded. Once the threshold was exceeded, the system would be transformed into a supported NAMA to finance further renewables expansion while keeping consumer costs stable. The supported NAMA could work for example as the Ugandan GET FiT Programme (see box 6).

The concept would thus combine a domestic policy with a PoA and a NAMA. Thai consumers have so far funded the cost of initial renewables scale-up and this contribution would increase up to a certain level to be determined. The sale of carbon credits would reduce/delay the cost impact for consumers and NAMA support would be triggered when the FIT surcharge exceeds a pre-determined "appropriate" level. The supported NAMA could thus use the MRV system of the PoA and the donor contribution could be transparently delineated on the basis of the FIT surcharge.

Instead of a PoA, an alternative design could be to use a sectoral NMM approach where the FIT itself would be the credited activity, omitting the need to constitute and register individual CPAs (Burian and Arens 2012).

A carbon-market-based approach seems appealing in the context of high carbon prices and with NAMA finance still out of reach. However, given today's low demand for offset credits and resulting low prices the development of a PoA seems less attractive and financing options through a supported NAMA more tangible. Basing a supported NAMA on an already existing FIT would be efficient and probably be politically attractive for donors as Thailand is already investing in making an own contribution.

Cross Effects between the Mechanisms and National Policies

The relation between national policies and the CDM works in two directions. First of all, national policies have direct implications on CDM activities; they would in principle need to be taken into account in the baseline. As a consequence, a perverse incentive exists to introduce policies that lead to higher baseline emissions or to refrain from new policies incentivising GHG emission cuts. Hence, the CDM may have an effect on the decision to introduce national policies. The issue has been addressed by setting cut-off dates for when policies incentivising high emissions (E+ policies) may be taken into account, i.e. only those established prior to the adoption of the Kyoto Protocol, or for when policies leading to lower emissions (E- policies) may be excluded from the baseline calculations, i.e. those policies introduced since the adoption of the Marrakesh Accords (CDM EB 2005). In a recent update of this rule the CDM Executive Board decided that national environmental policies leading to emission reductions or other benefits affecting the additionality of CDM activities will not have to be taken into account for the first seven years from the implementation of the policy (CDM EB 2013). This decision indicates a shift towards the CDM having to take account of local policies. This is in line with the envisaged design of a NMM, where national policies will need to be taken into account when defining the crediting baseline or target level (as illustrated in Figure 2 and Figure 3 by the move from the solid to the dashed red line).

National Policies and NAMAs – Overlapping Concepts or Tautologies?

NAMAs, in particular unilateral NAMAs, are measures implemented in the national context and at the host countries' discretion. Since they are not limited to any type of measure, coverage and or type of achievement, it is difficult if not impossible to distinguish them from national policies.

Figure 7 below illustrates how national policies can overlap with NAMAs, both supported and unilateral ones.

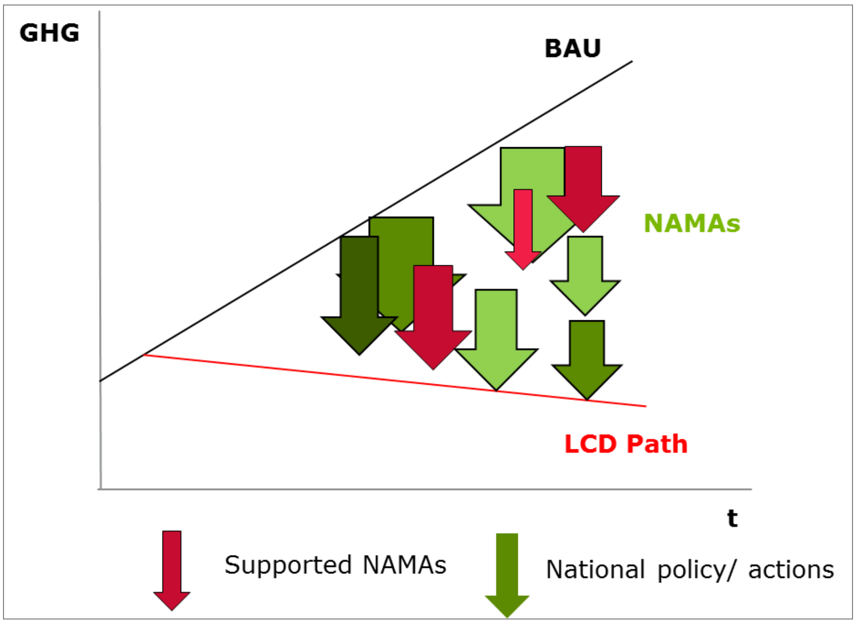

Figure 7: Overlapping GHG Impacts of NAMAs and National Policies (Source: Ecofys)

This figure shows that national policies and NAMAs could in fact be one and the same thing or have large overlaps. Technically, the only apparent difference is that NAMAs are communicated and reported on under the Convention through, for example, the NAMA registry and the biennial update reports (BURs). However, in practice, the border between the two is rather blurred. The fact that, for example, for unilateral NAMAs no international financing will be sought, and that the implementation is not internationally binding, provides little incentive to communicate national measures as unilateral NAMAs. Yet, NAMAs are considered in the context of UNFCCC commitments to reduce emissions. A country that declares an ambition to reduce emissions by x amount, and develops national policies to reach that target could then be said to be undertaking a NAMA through those policies and in determining whether an objective is met no distinctions should be made whether this is achieved through policies labelled as NAMA or national policy. However, no distinct concept exists yet that ensures the additionality of NAMAs. In supported NAMAs potential donors apply their own criteria for the assessment of proposed activities. The main focus often lies on co-benefits and less on the question to what extent do activities deviate from BAU or whether they deviate at all and thus contributing to the overall 2° target. This question might become more prominent when NAMAs leave their early development phase.

The overlap between supported NAMAs and national policies shown in Figure 7 can be further illustrated by the example in Box 3 below, in which a NAMA is built on existing policies.

Box 3: Mexico's Sustainable Housing NAMA

Mexico's population is growing rapidly, the country estimates that it will be necessary to build an additional 600,000 new homes each year over the coming decade. Mexico's Sustainable Housing NAMA has already entered the pilot phase and builds on the existing "Hipoteca Verde" ("Green Mortgage") and "Ésta es tu casa" ("This is your house") mortgage programmes, which provide supplemental loans to cover incremental costs of energy-efficient appliances in new homes (CONAVI 2012).

The NAMA concept expands the scope of these existing programmes by increasing the number of supported buildings and improving their energy performance. Mexico, together with GIZ on behalf of BMU and also supported by Canada, the UK and various development banks, has developed three performance benchmarks that building developers can achieve, and for which home-owners can receive support (Eco Casa 1, Eco Casa 2, and Eco Casa Max). While the previous programmes focused on specific technologies, the NAMA takes a "whole building" approach, setting efficiency benchmarks for total primary energy demand based on building types and local climate. Building developers and home-owners may employ any combination of interventions to achieve the targeted efficiency level.

Pilot projects consisting of around 4,600 affordable housing units in 11 cities were implemented in 2012. Mexico posits that it can support only a limited share of newly built housing, with efficiency levels approaching the Eco Casa 1 standard; additional funding would be needed to achieve the desired level of penetration and efficiency. Mexico is establishing a "NAMA Fund" as recipient of donor funds, which may be soft loans or grants. The funding is to channelled to both the supply and demand side of the market, in the form of providing or underwriting bridge loans for housing developers to support the construction phase, and offering subsidies or soft loans to home buyers to incentivize purchase of energy efficient homes. Mexico has developed illustrative support packages, which range from piloting Eco Casa Max in 890 homes to large-scale roll-out of Eco Case 1 & 2 in 27,000 homes.

Mexico also envisages that the programme could in the mid-term be transformed into a "credited NAMA", should the international negotiations in this area advance.

Existing Mechanisms as a Template for National Policies

National project-based mechanisms such as a domestic offset scheme can be built on existing mechanisms, such as the CDM. Since they are governed nationally, their achievements cannot be used to meet obligations under the UNFCCC. Their purpose is to serve national demand for offset credits in the context of other national policies that have the objective of reducing GHG emissions. Box 4 illustrates this by means of a case study.

Box 4: Chinese Certified Emission Reduction Credits

In June 2012, China's National Development and Reform Commission (NDCR) released guidelines on CCER voluntary emission reduction credits (World Bank 2013). CCERs may support the transition from the Clean Development Mechanism's dominance in China to a domestic cap-and-trade scheme, by introducing a domestic emissions reduction credit mechanism that closely matches the framework of the CDM, and which may be used for domestic offset credits in the seven ETS pilot programmes and eventually in a national ETS.

The MRV guidelines released by the NDRC in November 2012 for CCER issuance closely resemble the guidelines for CERs under the CDM (Warnecke et al. 2013), and the NDRC will approve all current CDM methodologies. Furthermore, the domestic nature of the CCER programme allows for more locally relevant methodologies to become available. As such, all existing CDM frameworks and technologies in the affected economic zones of China can be continued and merged with the new cap-and-trade mechanisms.

The issuance and use of CCERs is currently restricted to China's seven pilot ETS zones, each of which has individual restrictions for CCER eligibility and maximum offset allowances, but it is expected that CCERs will become the primary offset mechanism for a national ETS which is currently under design (World Bank 2013), and the authors of the guidelines have indicated that the use of CCERs internationally may be considered at a later stage, if an international consensus is agreed (NDRC 2012).

Support for the development of the CCER programme has been provided by the UNDP and Norwegian Government, in the form of finance and expertise for the development of a registry (World Bank 2013). Climate finance provided for the establishment of the ETS pilots (see Box 6) has also supported the market for CCERs.

In the reporting on its NAMA to reduce per capita CO2 emissions by 40-45% by 2020 compared to the 2005 level (UNFCCC 2013a) would have to take into account CCERs used as offsets by the ETS sectors in order to not double count any emission reductions achieved through this domestic offset scheme.

2.3.2 Gearing NAMAs with a NMM

Activities undertaken under NAMAs might include building mitigation capacity, which can range from developing technical expertise to process related skills, and developing MRV approaches and institutional set-ups, to get ready for market-based activities. NAMAs can therefore be used as one step in a tiered approach towards market based mechanisms, either in the form of a NMM or an ETS. The advantage of going first through the process of implementing NAMAs is that it allows for a prior acquaintance with the processes and setups required for engaging in market-based activities without facing a binding quantitative target. This way, host countries can prepare for and test market approaches without regrets (World Bank 2013). An illustrative case study of such a transitional path is provided in Box 5 below.

Box 5: Mitigation in Tunisia's Cement Sector

Tunisia's cement sector accounts for 12% of national greenhouse gas emissions. Nine production units in the country produced 8.4 million tons of cement in 2010, and the sector is experiencing an annual growth rate of 3.9% (GIZ 2012). In addition to high demand within the country, Tunisia has become a very competitive cement producer and it exports approximately 12% of its cement output. GIZ (2012) estimate a mitigation potential within the country's cement sector of 9.6 $MtCO_2$ between 2014 and 2020, through increasing energy efficiency, using alternative fuels, clinker replacement and use of renewable energy in the sector.

In cooperation with the German Ministry of Environment and the United Kingdom Department for Environment and Climate Change, Tunisia has proposed a NAMA to unlock this mitigation potential. The major processes within this NAMA include support for regulatory changes for renewable energy, energy efficiency and blended cement, the embedding of MRV processes in the industry and the enhancement of management and capacity for waste management. A key feature of the proposal is the implementation of a performance based financial mechanism, which will provide investment incentives, subsidised loans and other financial rewards to various stakeholders according to a multi-tier MRV system operating across the whole sector. It is anticipated that these incentives will be replaced by a credit based system under a New Market Mechanism (NMM) in 2020.

The case of Tunisia might be a good example of a transitional policy for sectoral mitigation under a NAMA in anticipation of the introduction of a NMM. However, the complexity of the implementation in this example is lower due to the lack of carbon market based mitigation within the sector to date; up to now only one project in the Tunisian cement sector has been able to obtain the CDM registration status (http://cdm.unfccc.int/). Countries with better-established CDM portfolios in the sector might have to develop a number of provisions, particularly when these projects include different types of activities (for example changes to the cement blend, energy efficiency measures or fuel switch), in order to address double counting issues.

Besides a gradual shift from NAMAs to a NMM, i.e. a move over time from the large green area to the blue area in above, a co-existence of the two mechanisms in the same sector could also be envisaged. NAMA measures could reach into sectors that are covered by a NMM, hence, a part of the NMM's net mitigation effect could potentially result from a unilateral and/or supported NAMAs. In order to address double counting concerns the overlap would have to be reported in communications on the NAMA to the COP.

Result-Based Financing within NAMAs

Current mismatching between financial needs for the implementation of NAMAs and the provision of financial support is sometimes attributed to the donor's desire to have a degree of certainty over whether funds are spent in line with the NAMAs' objectives. Results-based financing is being discussed as a possible approach to tackle this issue (Warnecke et al. 2013) (Jung et al. 2012):

A staged financing approach

With a staged approach the payment of financial support for each phase is conditional to the successful implementation of the previous phase. In practice this approach often requires the MRVing of various indicators, including social, economic and environmental aspects, typically going beyond emission reductions. Yet, similar MRV approaches are likely to be required for the implementation of NAMAs because the objectives of NAMAs are quite diverse and generally go well beyond generating quantifiable emission reductions. NAMAs also often consist of a number of measures that build on each other in order to achieve an overarching goal. Hence, a results-based financing approach appears to be in line with NAMA specific implementation requirements in terms of MRV and also the fact that the implementation may very well take a staged approach. In principle the MRV aspects of a results-based finance approach can be adapted to the donor's requirements.

Ex-Post Financing

Under this option financing is provided only after an objective is met and MRV'ed (e.g. emission reductions). The key difference to the use of the carbon market is that the financing is not provided in return for the receipt of carbon credits. The requirement for a rather complex MRV approach holds for the same reasons as for the staged financing approach. Ex-post result based financing appears to be most useful if the measures under a NAMA are not built upon each other but are rather implemented in parallel, and in the case that the objective will be met over a short time horizon (shorter compared to NAMAs with a staged financing approach).

Box 6: GET FiT Programme in Uganda

A concept to design an international support scheme around a national FIT has in fact already been developed and put into practice. Deutsche Bank Climate Change Advisors in 2010 proposed the concept of “Global Energy Transfer Feed-In Tariffs for Developing Countries (GET FiT)” (DB Climate Change Advisors 2010). A first application, the GET FiT Uganda Programme, has been developed by the Government of Uganda, the Ugandan Electricity Regulatory Agency (ERA), KfW and Deutsche Bank and is supported by the Government of Norway, the United Kingdom and the Government of Germany as well as the World Bank through their Partial Risk Guarantee (PRG) instrument (Deutsche Bank AG and Kreibiehl 2013). It was launched in Kampala on 31 May 2013.

The main objective is to implement a portfolio of up to 15 small-scale renewable energy projects (of 1MW-20MW) under Uganda’s Renewable Energy Feed-In Tariff (REFiT). This would add an additional 20% of installed capacity to the Ugandan grid within the next 3-5 years. GET FiT Uganda consists of three components with the aim to leverage more than EUR 300 million of private capital by addressing three key hurdles: low feed-in tariffs, high perceived offtaker risks and lack of availability of long-term commercial financing at acceptable terms and conditions. The three components are:

A Premium Payment Mechanism, which is a results-based top-up per kWh on the existing Ugandan REFiT, funded by the programme donors through

- KfW;
- A Guarantee Facility to secure projects benefiting from REFiT against offtaker and political risks managed by the World Bank;
- A Private Financing Mechanism set up by Deutsche Bank that will offer debt and equity to GET FiT projects at competitive rates.

Projects will be chosen based on selection criteria under a Request for Proposal process on a first-come-first-serve basis until funds are exhausted. The number of applications in the first funding round launched in April 2013 exceeded expectations and lead the Ugandan government to increase the REFiT for small hydro in order to leverage a higher number of projects under GET FiT.

While not designed nor registered as such, the GET FiT Programme can thus be regarded as a supported NAMA. The Ugandan government provides a basic feed-in tariff, which is, however, not sufficient for renewables and thus topped up using support by international donors.

2.3.3 The NMM and ETS Juxtaposed

While a trading approach under a NMM inhabits many similar characteristics as an ETS, for example that a predefined target sets a cap on emissions and the incentive to mitigate emissions stems from the market value of allowances, the two mechanisms are also distinct for two reasons. First of all, the reduction target to be achieved by a trading NMM will be inscribed in a pledge under the Convention, while achievements (or failures) of an ETS implemented nationally and independently from the Convention, like the EU ETS, will not be directly accounted under the Convention. In fact an ETS should be viewed as a means to achieve the objectives of a NMM. Secondly, under a trading NMM the incentive for emission reductions is provided to the government rather than to the private sector. The mitigations actions implemented on private sector level can be prompted through various types of policies, including non-market based incentives and mandatory regulations, as illustrated in Figure 6 above.

National Policies in Relation to an ETS and a NMM

An ETS should be viewed as one of many forms of national policies to achieve GHG mitigation. It is not linked to the UNFCCC, hence should be viewed as a separate concept from IET under the Kyoto Protocol and also from a trading mechanism emerging under the NMM, which will be governed by the COP.

Similar to the issue of E+/E- policies having cross effects on the CDM, leading to perverse incentives for host governments, such adverse cross effects also exist in relation to ETS and are to be expected in relation to a NMM, despite the high degree of national integration. Such a cross effect, for example, existed between the EU Renewable Energy Directive and the EU ETS Directive (Tuerk and Steiner 2013) by providing incentives for renewable energy, which in turn lead to lower emissions in the EU ETS sectors. However, this effect was taken into account by adapting the cap for Phase III of the EU ETS accordingly (Hermann and Matthes 2012). Nonetheless, the example shows that cross effects can therefore be expected and need to be taken into account when new mechanisms are implemented in order to avoid distortions.

3 Illustration of Countries or Country Groups Regarding Their Use of Carbon Markets

The objective of this chapter is to evaluate the possibility of using a country grouping to determine which own contributions to mitigation efforts may reasonably be expected from different countries. Furthermore, it aims to analyse to what extent these contributions can or should be made via the carbon market or be supported through it.

In the current situation, countries are grouped as “Annex I” (developed countries) and “non-Annex I” (developing countries), as defined by the UNFCCC[6]. This grouping is based on the development situation at the point of the starting year of the Convention. Over the years, there have been changes in all countries, in terms of economic development as well as greenhouse gas emissions. Some formerly classified as developing countries have gained strong momentum and their capacities and responsibilities have increased. At the same time, some countries still remain at a lower level of economic development and climate policy readiness. The range between least developed countries and emerging economies has grown significantly, so that further differentiation is needed. Also in the Annex I group, some countries deviate substantially from the average, especially in their carbon market readiness.

This need for differentiation has already shown in the past years in international climate policy: First indications are for example the EU’s limitation of recognising CERs only from Least Developed Countries (LDCs) in the EU ETS since the start of the third trading period (January 2013), or that the agreement currently negotiated under the Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP) shall also include mitigation commitments for developing countries.

Our analysis includes all countries under the UNFCCC. It includes the member states of the European Union (EU) individually but also the EU average to illustrate both levels. Croatia, which was the last country to join the EU in July 2013, is treated separately as until now, information on this country has been collected independently of the EU in international databases.

The results of this exercise may lead to a grouping different to the classification commonly used in the international context and included in the tender

[6] For full country lists see http://unfccc.int/parties_and_observers/parties/annex_i/items/2774.php for Annex I countries and https://unfccc.int/parties_and_observers/parties/non_annex_i/items/2833.php for non-Annex I countries.

documents (emerging economies, middle income countries, low income countries, least developed countries, developed countries). We therefore compare the categories resulting from this grouping with the country categories defined in the tender documents and point out the most interesting differences.

We furthermore describe various countries with a special status under the UNFCCC, impacting the exemplary calculations, and provide additional analysis on how these are special and how this reflects in the quantitative results. The countries looked at in detail are Kazakhstan, Russia, Ukraine and Turkey.

3.1 Two Dimensions to Differentiate Countries in the Context of Climate Finance and Carbon Markets

3.1.1 Own Contribution to Domestic Emission Reductions

This dimension ranks countries according to the potential needs for support for implementing mitigation activities or requirements to support others' activities. It reflects the principle of common but differentiated responsibilities and respective capabilities, as anchored in Article 3.1. of the UNFCCC (UNFCCC 1992).

The higher the responsibilities and capabilities for mitigation, the higher the own contribution needs to be. The own contribution can go beyond 100% of a country's domestic emission reduction options, meaning that this country would need to support other countries with less responsibilities or capabilities.

Indicators feeding into the own contribution include the Human Development Index (or sub-indicators used for its calculation, e.g. per capita income), historic emissions and current per capita emissions. Also, the amount of mitigation potential available at negative or low costs within countries plays into the possibilities of those countries to contribute themselves to reductions: A country with abundant potential at negative costs may be able to reduce a high share of emissions itself. Other countries may have higher abatement costs on average, nevertheless these potentials need to be tapped as well under a sufficiently ambitious climate regime. These countries may thus need more support and therefore have a lower share of own contribution.

Table 2 lists suggested indicators, many of which have been used in the literature to develop effort sharing proposals. The following paragraphs identify those that in our view are best suited for the analysis and describe them further.

In science and politics, different "effort sharing approaches" are often used. These approaches distribute necessary global efforts to countries, based on equity principles such as potential, capability, equality and responsibility, and different ways of combining those or some of those. They often refer to similar indicators as described in this section. We do not consider these approaches further as they are often politically biased and we furthermore aim to consider specifically the own contribution in relation to carbon markets. Effort sharing approaches do not consider this aspect.

Table 2: First Suggestion of Indicators for Own Contribution

Indicator	Rationale for inclusion	Available data sources
Human Development Index (HDI)	Globally acknowledged indicator for development. Reflects the dimensions of education, economic development and health.	UN Millennium indicators[7]
Per capita income (GDP/cap)	Indicator for economic development, can be used as an alternative to HDI.	World Bank[8]
Gross Domestic Product (GDP)	We use this indicator independently of population, as large economies have more options to implement mitigation measures. Even large countries with low per capita income often have more opportunities than smaller poor countries, as their economy is likely to be more diverse.	World Bank
Accumulated historic emissions - per capita	Describes the historic responsibility of countries in terms of climate change impact relative to their size.	CAIT 2.0[9]/ UN Statistics Division[10]
Current per capita emissions	Describes the current impact of the countries relative to their size. The differences between the countries reflect the inequality of the current emission distribution.	CAIT 2.0 / UN Statistics Division
Potential for emission reductions expressed in GHG/GDP/cap	Can serve as an indicator for potential. Using a per capita value makes the indicator relative to the size of the country.	CAIT 2.0/World Bank

This choice of indicators covers the dimensions of capacity, responsibility, equality and potential.

To reflect capacity, we use the **HDI** or alternatively **per capita income** and additionally **total GDP**. The HDI covers per capita gross national income (GNI), mean and expected years of schooling and life expectancy at birth. The HDI is an internationally acknowledged indicator for development and commonly used

[7] See http://mdgs.un.org/unsd/mdg/Data.aspx
[8] See http://data.worldbank.org/indicator
[9] See http://cait2.wri.org
[10] See http://unstats.un.org/unsd/databases.htm

in the UN context. It is expressed on a scale between 0 and 1, with a higher score reflecting a higher stage of development. Using the total GDP as an additional indicator reflects that large economies generally are more diverse and thus have a larger number of opportunities to implement emission reduction measures than small economies, even if they have relatively low per capita emissions.

As an indicator for responsibility, we use **accumulated historic emissions per capita** with the starting year 1990. This reflects the impact of the country depending on their historic development and connects this to the size of the country in terms of population. As a result, a country with high historic emissions and a large population has a smaller own contribution than a country with high emissions and a small population. When determining the accumulated emissions, the choice of the starting year is essential. Using a pre-industrialised date as a start will put a larger share of responsibility on developed countries, while a more recent starting year will weigh heavily also on emerging economies. We use 1990 as the year from which on reliable data is available. It is also the year of the first IPCC report, with which the international community first officially acknowledged man-made climate change.

To include the aspect of equality, we use emissions per capita. This indicator expresses how much each individual in a country contributes to emissions. If all were assigned equal rights to natural resources, this value would be the same for all. Various effort sharing approaches assume a convergence towards equal per capita emissions in the future.

To reflect potentials, we ideally suggest to illustrate the ratio of domestic potential at negative costs and total domestic potential. This would reveal which share of the potentials could be tapped in a cost-positive way and would therefore also be interesting to countries with a low capacity. The lower the share of potential at negative costs, the lower the own contribution. However, data availability for costs and potentials limits this analysis, so we rather consider the **emission intensity of the economy** (GHG/GDP/capita). We assume that where there is a high emission intensity, there is a high reduction potential of which at least parts can be easily tapped in a cost-positive way. Ott et al. used a similar approach for grouping countries for the “SouthSouthNorth Dialogue” (Ott et al. 2004). A problem with this indicator is that, in contradiction to other indicators, countries with a high GDP per capita will be assigned a lower own contribution.

We express the results for own contribution not as an absolute value of emission reductions or a share of the domestic potential, but remain on an abstract level, simply using the indicators to rank and later group the countries.

3.1.2 Carbon Market Readiness

This dimension ranks countries according to their readiness for carbon market based mechanisms. It reflects the extent to which the countries can engage in carbon markets, knowing that certain requirements for institutional set-up and stakeholder expertise exist in order to guarantee smooth processes and high environmental integrity of the market activities.

Indicators for this dimension are relevant experiences with carbon markets, e.g. the number of CDM or JI projects or domestic market based instruments, and capacities for Measuring, Reporting and Verification, expressed for example through the number of submitted national communications and emission inventories to the UNFCCC. Furthermore, the statuses of current plans for emissions trading schemes or similar instruments are of relevance. Table 3 illustrates possible indicators of carbon market readiness.

Table 3: Possible Indicators for Carbon Market Readiness

Indicator	Rationale for inclusion	Data source
Experiences with projects generating carbon credits		
For current non-Annex I countries: Number of CDM projects (registered only)	The existence of registered projects shows that national institutions are operational and first experiences with carbon market mechanisms exist. A larger amount of registered projects allows the assumption that the host country actively provides supporting conditions for carbon market participation. For the first few projects, this does not depend on the size of the country.	UNEP Risoe CDM/JI Pipeline[11]
For current Annex I countries: Number of JI projects		UNEP Risoe CDM/JI Pipeline (UNEP Risoe 2013)
Voluntary carbon market participation (number of gold standard + VCS projects)		Voluntary standard registries and websites
Status of carbon market preparations		
Carbon market based policy instruments on national or regional level established	A functioning ETS shows that a country is already carbon market ready. ICAP ETS Map (see graph in Annex)	ICAP ETS Map[12]
Carbon market based policy instruments on national level	Shows concrete steps of countries towards market based	ICAP ETS Map

[11] See http://cdmpipeline.org/, numbers used for this report based on Update September 2013

[12] Available at http://icapcarbonaction.com/index.php?option=com_wrapper&view=wrapper&Itemid=147, accessed on 30 October 2013

planned? (Not relevant for countries with ETS established)	mechanisms, leading to preparations of institutions and processes	
Other policies involving trading (e.g. RE quota with trading/trading of energy saving certificates)	Reflects general openness of countries for market based approaches and familiarity of stakeholders to involve in trading of environment related goods.	IEA policies and measures database[13]
MRV capabilities		
Number of submissions of GHG inventories to UNFCCC	Reflects the familiarity of countries with international reporting. However, the number does not necessarily adequately indicate the quality of such reports.	UNFCCC data query [14]
Number of submissions of national communications to UNFCCC		UNFCCC submissions of national reports[15]

These indicators reflect the aspects "experience in projects generating carbon credits", "level of activities in the area of domestic trading schemes", as well as "abilities for monitoring emissions". To provide a comprehensive picture of market readiness, we suggest to include all of the indicators in the table above.

An additional indicator may be more general criteria to determine the overall availability of countries to receive investments, for example via the Good Governance Index. This does however go beyond the scope of carbon markets, which is why we do not consider it here explicitly. One could also argue that the general investment climate is reflected already in the number of CDM or JI projects.

Not all indicators are relevant for all countries: for example, carbon market preparations are not relevant to countries which already have an ETS in place. For the experience in the CDM or JI, we need to differentiate between Annex-I and non-Annex I countries, according to the definition of the mechanisms. JI is only relevant to Annex-I countries, CDM only to non-Annex I. A special case is Turkey where neither JI nor CDM applies (compare section 3.4.2). Here, we use voluntary carbon market projects as an approximation, focusing on the Verified Carbon Standard (VCS) and the Gold Standard, which are most important standards in Turkey. As they may require less activities by public stakeholders and are in a tendency less integrated in the institutional set-up, we discount the actual number of projects by factor 2.

On the MRV indicators, it is important to note that Annex I countries have requirements on reporting which oblige them to report emissions inventories

[13] Available at http://www.iea.org/textbase/pm/index.html, accessed on 17 October 2013
[14] Available at http://unfccc.int/di/DetailedByParty.do
[15] Available at http://unfccc.int/national_reports/items/1408.php

annually and also submit national communications every 4-5 years. With a few exceptions, their rating on MRV will therefore be relatively homogeneous.

3.2 Quantification of the Indicators and Ranking of Countries within the Dimensions

The objective of this step is to come up with a country ranking within both of the dimensions “own contribution” and “carbon market readiness”. To combine the indicators of each dimension, we first quantify each of them and put them on a common scale of 0 to 1, with 1 meaning a high ranking. If necessary, we then weigh the indicators according to our expert judgement. As standard, indicators are given equal weighting, but weighting may become necessary if, for example, various indicators support one specific aspect which then would be represented too strongly. Finally, we rank countries accordingly within each dimension.

As the discussion on own contribution is especially sensitive and may become highly political, we cover a number of combinations for this dimension to display a broad range of potential results. The parameters for market readiness remain static. Independently of the combination, the resulting grouping can certainly only give a rough tendency and may not be adequate for individual countries.

The quantification and the weighting of the individual indicators is described in

Table 4 and Table 5. In general, we choose from one of the two following options for the quantification of the indicators:

Option 1: Evaluation against other countries

- Step 1: Determine a reference level. The reference can be, for example, the maximum of all countries, their average or a different statistical value (e.g. quartiles). It can also be a number independent of the actual country data, for example a common average target.
- Step 2: Compare each individual country to the reference level.
- Step 3: Scale the resulting values to a scale of 0 to 1, taking into account all countries. The maximum value will equal 1, the minimum 0.

Option 2: Evaluation against predefined expectations

- Step 1: Define “grading” between 0 and 1 for different country values (e.g. number of CDM projects <= 5 → 0, <= 100 → 0.5, >100 → 1)
- Step 2: Assign “grades” to each country, depending on their data

Table 4: Quantification and Weighting of Indicators for Own Contribution

Indicator	Quantification of indicator	Rationale for quantification
Gross Domestic Product (GDP)	Option 1. Reference level: 4th quartile of all countries.	4th quartile chosen because it reflects a level which is above most but cuts off extreme values
Human Development Index (HDI)	Directly used (values between 0 and 1)	
Per capita income	Option 1. Reference level: 2th quartile of all countries (median).	Median chosen because per capita income differs strongly and the distribution is extreme (many countries with low per capita income in comparison to a few with a high one)
Accumulated historic emissions - per capita	Option 1. Reference level: 4th quartile of all countries.	4th quartile chosen because it reflects a level which is above most but cuts off extreme values
Current per capita emissions	Option 1. Reference level: 4th quartile of all countries.	4th quartile chosen because it reflects a level which is above most but cuts off extreme values
Potential for emission reductions expressed in GHG/GDP/capita	Option 1. Reference level: 4th quartile of all countries.	4th quartile chosen because it reflects a level which is above most but cuts off extreme values

Table 5: Quantification and Weighting of Indicators for Own Contribution and Carbon Market Readiness

Indicator	Quantification of indicator	Rationale for quantification
Number of registered CDM, JI or voluntary projects	Option 2: <= 10 projects → 0 > 10 but </= 50 projects -_> 0.5 > 50 registered projects → 1 Additionally if </= 50 projects: For countries with ETS established: 1 For countries with regional ETS established: 0.5	We draw the lines between the different ratings at a relatively low level in order to better capture small countries. We assume that after a certain number of projects, there is no further improvement in market readiness. Note: For voluntary projects, we use a discount factor of 2 (explanation see in text above) We assume that a national or regional ETS replaces this indicator, if it is more ambitious
Carbon market based policy instruments on national level established	Option 2: ETS… under consideration→ 0.33 in planning → 0.66 implemented → 1	The 3-step rating expresses that there are countries generally open to an ETS and actively showing interest, countries that are intensively preparing an ETS and may already have institutions and processes in place, and countries which already have one established and are thus already market ready.
Carbon market based policy instruments on national level planned?		
Other policies involving trading	Option 1. Reference level maximum of all countries	Comparison against best available practice
Submissions of GHG inventories	Option 1. Reference level maximum of all countries	Comparison against best available practice
Submissions of national communications	Option 1. Reference level maximum of all countries	Comparison against best available practice

3.3 Combination of the Dimensions and Two-Dimensional Illustration

After having researched the indicators for each of the dimensions and given an overview of the ranking of countries within those dimensions, we aim to combine those in order to group the countries looking at both their carbon market readiness and the own contribution that may be expected from them. We present two options for conducting this exercise.

For this option, we use the rankings for each dimension resulting from the indicators and then sort the countries in a two-dimensional graph. We expect the countries to be scattered around the complete area of the graph, but possibly with a concentration of countries in certain areas. For example, current Annex-I countries have a high own contribution as well as high carbon market readiness in many cases. We will identify such groups and where possible illustrate this graphically. The exact form of the results will depend on the data. We will consider if a simplified grouping as in Figure 8 is possible or if the groupings will have to be defined differently (see for example Figure 9).

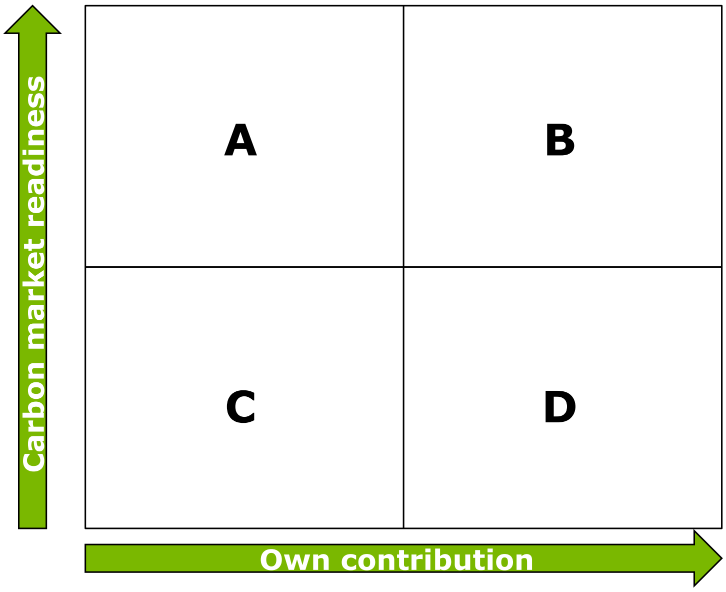

Figure 8: Example Result 1

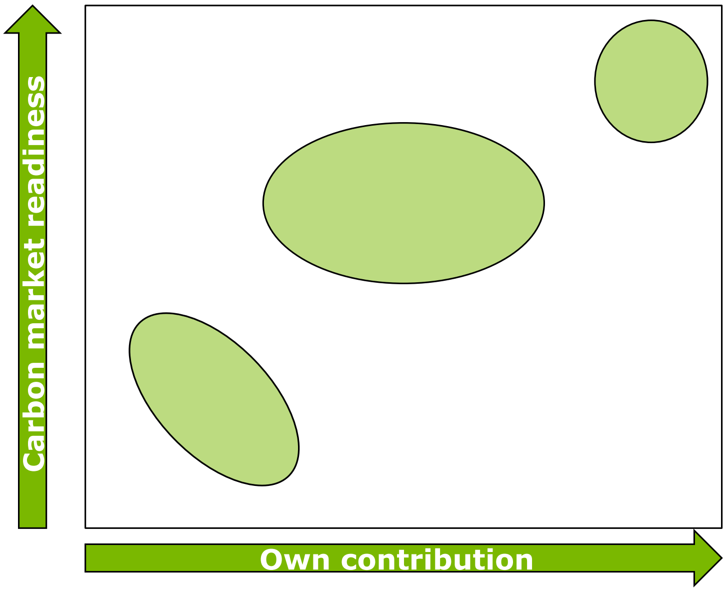

Figure 9: Example Result 2

3.4 Analysis of Exemplary Country Groupings Resulting from the Indicators

3.4.1 Overall Tendency of Country Groupings

Based on the different combinations for weighing the indicators for own contribution, the results provide a range of possible country groupings. Considering all combinations analysed, we nevertheless find a number of commonalities.

For all combinations of the indicators used, the Least Developed Countries remain in one group with a low carbon market readiness and a low own contribution. Only the indicator for emission intensity in some cases drives up the own contribution, due to very specific country circumstances (e.g. contribution of international transport to emissions for small island states or emissions from deforestation).

There are a number of countries with high responsibilities and capabilities, but with little carbon market readiness. If those were to support mitigation activities in other countries through merely market-based tools, markets-based approaches in those countries would need to be strengthened significantly. Nevertheless, those countries could as well channel direct funds towards market-based instruments in the recipient countries.

At the same time, there are many countries which would likely need support for mitigation activities, but which at this point in time do not have successful market-based mechanisms in place to channel funding.

Another interesting aspect can be found regarding carbon market readiness when comparing combinations for own contribution using HDI and alternatively per capita income. For those combinations relying on HDI, there are no countries with a low own contribution and high market readiness. However, there are countries with a relatively low per capita income with a high carbon market readiness.

The HDI considers other development factors besides the per capita income, such as education and health. Our results show that those seem correlated to the ability of countries to implement more enhanced policies, such as market-based mechanisms. Some countries with a low income per capita seem to be able to prepare for carbon markets, whereas those that additionally have low health and educational indicators are not able to do so.

3.4.2 Specific Countries' Behaviour in the Assessment

This section highlights country-specific circumstances of four countries which have special situations under the UNFCCC: Kazakhstan, Ukraine, Russia and Turkey. Table 6 illustrates some relevant indicators for the four countries considered here. The following paragraphs describe these further and put them in the context of additional background information.

Table 6: Quantitative indicators for the four chosen countries

Country	GHG/cap	Accum. GHG/ cap	HDI	No. of CDM/JI projects	National communications submitted	GHG inventory years	Status of national ETS
Kazakhstan	15 tCO2e/ (cap*a)	310 tCO2e/ cap	0.74	0	2	22	Implemented
Ukraine	8 tCO2e/ (cap*a)	226 tCO2e/ cap	0.73	97	4	22	Under consideration
Russia	16 tCO2e/ (cap*a)	337 tCO2e/ cap	0.78	273	5	22	No plans

Turkey	6 tCO2e/ (cap*a)	84 tCO2e/ cap	0.72	147 (= 73,5 CDM projects)	1	22	Under considera tion

3.4.2.1 Kazakhstan

Excluding LULUCF, Kazakhstan emissions decreased by 23.4% below 1990 levels by 2010, including LULUCF by 23.8%[16].

Kazakhstan joined the Convention as a non-Annex I Party. Kazakhstan ratified the Kyoto Protocol in 2009, becoming a Party included in Annex I to the Convention for the purposes of the Kyoto Protocol, while remaining a Party not included in Annex I to the Convention for the purposes of the Convention (FCCC/KP/CMP/2009/21). In 2010, it proposed to join Annex B with a commitment of 100% of 1992 emission levels (FCCC/SBI/2010/6). However, with Decision 9/CMP.8 the CMP concluded its consideration of this proposal without agreeing to it. Instead, the CMP welcomed Kazakhstan’s intention to participate in the second commitment period (CP2).

In the Copenhagen Accord/Cancún Agreements, Kazakhstan pledged to reduce its emissions by 7% below 1990 levels by 2020. It agreed to join CP2 with a commitment of 95% of 1990 emissions (Decision 1/CMP.8). However, since Decision 1/CMP.8 effectively capped CP2 commitments at 2008-2010 emission levels, Kazakhstan together with Belarus and the Ukraine stated that it may withdraw from the Protocol or not put into legal force the CP2 amendment

As Kazakhstan was a non-Annex I Party for various years, it was not required to submit national communications as regularly as other Annex I countries. While most Annex I countries have submitted five reports, Kazakhstan has only put forward two. Kazakhstan recently started a national ETS but has no other market-based policy instruments in place. Because of these reasons, it has a lower carbon market readiness than other Annex I countries, although it does have a national ETS in implementation.

Kazakhstan has a relatively high emission intensity and above average per capita emissions due to the low efficiency of its economy. Considering this, we can assume that Kazakhstan has broad potentials in the area of energy efficiency.

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[16] See http://unfccc.int/di/DetailedByParty.do, accessed on 30 October 2013

3.4.2.2 Ukraine

Excluding LULUCF, the Ukraine's emissions decreased 58.8% below 1990 levels by 2010, including LULUCF by 59.8% (FCCC/SBI/2012/31).

The Ukraine is an Annex I Party to the Convention and an Annex B Party to the Kyoto Protocol and committed to stabilise emissions at 1990 levels in the first commitment period.

In the Copenhagen Accord/Cancún Agreements, the Ukraine pledged to reduce its emissions by 20% below 1990 levels by 2020. It agreed to join CP2 with a commitment of 76% of 1990 emissions (Decision 1/CMP.8). However, since Decision 1/CMP.8 effectively capped CP2 commitments at 2008-2010 emission levels, the Ukraine together with Belarus and Kazakhstan stated that it may withdraw from the Protocol or not put into legal force the CP2 amendment (Allan and Kruppa 2012).

Ukraine does not yet have a national emissions trading scheme in place but is considering it. Other policy instruments involving trading of certificates do not exist. The country has gathered much experience in implementing JI projects. Also, its MRV experience is relatively advanced, although it has submitted less national communications than other Annex I countries.

Similar to the situation in Kazakhstan, Ukraine's economy is relatively inefficient, leading to high per GDP emissions. The per capita emissions on the other hand are significantly lower.

3.4.2.3 Russia

Excluding LULUCF, Russia's emissions decreased 34.1% below 1990 levels by 2010, including LULUCF by 54.7% (FCCC/SBI/2012/31).

Russia is an Annex I Party to the Convention and an Annex B Party to the Kyoto Protocol and committed to stabilise emissions at 1990 levels in the first commitment period. In the Copenhagen Accord/Cancún Agreements, Russia pledged to reduce its emissions by 15-25% below 1990 levels by 2020. The target was recently set at 25% (Davydova 2013). Russia refused to join CP2.

Russia is very similar to Ukraine and Kazakhstan regarding its activities on carbon markets. In terms of monitoring and reporting its emissions, it is the most advanced of the countries analysed in detail in this section, having submitted five national communications already. It is somewhat more carbon intensive and has a slightly higher development status, according to the HDI.

3.4.2.4 Turkey

Excluding LULUCF, Turkey's emissions increased 114.9% above 1990 levels by 2010, including LULUCF by 147.5% (FCCC/SBI/2012/31).

Turkey was initially listed in both Annex I and Annex II to the UNFCCC, but was removed from Annex II pursuant to Decision 26/CP.7, after which it proceeded to ratify the Convention. As it was not a UNFCCC Party when the Kyoto Protocol was negotiated, Turkey did not participate in the Kyoto negotiations and did not adopt a commitment. Turkey may thus not participate in the Kyoto mechanisms since only non-Annex I Parties may be CDM host countries and only Annex I Parties with a commitment inscribed in Annex B to the Kyoto Protocol may participate in JI or participate in the CDM as investor countries. Turkey did not submit a pledge under the Copenhagen Accord/Cancún Agreements.

In comparison to the other countries discussed in this chapter, Turkey is similarly developed in terms of HDI and per capita income, but is less carbon intensive. It also varies regarding its carbon market readiness. As it is neither eligible for CDM nor JI, it has no experience with those project types. Activities in the voluntary carbon market can partially make up for this, but are less anchored in the countries institutional set-up. Turkey has only submitted one national communication.

4 Country/Sector Cases

4.1 Overview of Country-Sector Combinations

This chapter analyses future prospects for international cooperation and in particular use of carbon markets in 15 country/sector combinations. The selection of cases aimed to cover a broad spread of sectors and countries, including all continents and a range from advanced to least developed countries. Other key criteria were data availability and whether the countries are pursuing an active climate policy that provides entry points for international cooperation. The following outlines the main rationales for the selection of the country/sector combinations.

Brazil is a key major emitter and carbon market participant and has a relatively progressive negotiation position as well as an elaborate set of national climate policies. The study analyses the electricity and waste sectors as emissions from these sectors are projected to increase strongly in the future.

China is the world's largest emitter and largest CDM host country. In addition, it is in the process of establishing regional and eventually a national carbon market. Electricity and cement are among the largest emitting sectors and emissions are projected to increase strongly in the future.

Costa Rica has been a carbon market frontrunner since the 1990s, is currently establishing a national carbon market and has pledged to become carbon neutral by 2021. Due to the preponderance of hydropower in electricity supply agriculture is one of the key emitting sectors.

Ethiopia was selected as one representative of the least developed and Sub-Saharan countries. It has a very progressive negotiation position and pledged to become carbon neutral by 2025. Implementing this pledge will require strong international support. Agriculture is the most important economic sector, employing about 80% of the population, and electricity demand is projected to increase sharply in line with the country's development aspirations. In 2010, only ¼ of the population had grid access.

India is a key major emitter and carbon market participant. In addition to its strong position to the CDM it is also using market-based approaches domestically. Cement and iron&steel are the largest emitters among the industrial sectors and project steep emission growth under business as usual.

Kenya is another representative of sub-Saharan African countries and has some ambitious climate policies. Due to its development status agriculture is the most important economic sector and has been identified by the government as the pivotal sector for driving the wider development of the country's economy.

Morocco is a representative of Middle East/North African countries and has submitted an elaborate and ambitious 2020 pledge to the UNFCCC. It has in particular set ambitious goals for renewable electricity.

Peru was chosen as representative of progressive Latin American countries that form the Independent Association of Latin America and the Caribbean (AILAC). It has lately been developing initiatives to promote renewable electricity.

South Africa is a key major emitter and has submitted an ambitious 2020 pledge to the UNFCCC, which it, however, now has problems to fulfil. Electricity and iron&steel are among the most important emitting sectors.

Thailand is a representative of South-East Asian countries. It has a dynamic economy and some ambitious policies domestically but has so far not submitted a 2020 pledge. Thailand's cement production is the country's largest single energy consuming sector and is among the top ten cement producers worldwide.

4.2 Methodology and Definitions

The analysis proceeds in four steps:

- Analysis of available mitigation potential and costs;
- Analysis of policies and measures that are already in place;
- Analysis of remaining barriers;
- Analysis of the scope for international cooperation and use of carbon markets.

With these steps, we first identify where action could potentially be effective. We then check where activities already exist and where remaining barriers are, to ultimately identify potential room for carbon markets to support these areas.

4.2.1 Mitigation Potential and Costs

This part of the research focuses on collecting data on mitigation potential from a range of existing literature. Alternatives such as using only one marginal abatement cost curve or creating our own mitigation potential and cost models would only reflect one view of the potential. Our own models would furthermore require significantly more resources and may produce non-transparent results.

For the chosen measures, we review existing estimates of cost and mitigation potential from various national and international studies. These studies are based on different assumptions and use different base and/or target years. Rather than trying to harmonise this data, which would necessarily involve a degree of arbitrariness, we display all data sets we found.

4.2.2 Existing Policies and Measures

For each country/sector combination we describe which policies and measures that promote or impede climate-friendly solutions are currently in place. In general, we distinguish between five groups of policies and measures.

- **A) General economic and fiscal policies and measures** have an impact on GHG emission reductions by providing for the right price signals in the markets and economic sectors by altering price ratios: energy/CO_2 taxation, emissions trading, sustainable subsidy reform.
- **B) Targeted economic and fiscal policies and measures** support the search for, or implementation of the sector- and technology-specific potential, such as subsidies for energy analyses (energy audits) or investment, feed-in tariffs for electricity from renewable energy sources or from cogeneration of heat and power, or certificate schemes for energy savings or electricity from renewable energy sources. These policy instruments aim directly at specific fields of application, sectors or technologies.
- **C) Standards and voluntary agreements** make specific technologies or measures mandatory or the default for actors and transform markets by the non-availability of certain products. Standards and voluntary agreements can also create obligations to improve or exchange existing production processes or technologies. Regulations on the use of planning procedures, e.g. in the transport sector, are also included here.
- **D) Information, know-how transfer and education** improve the knowledge basis of actors, thereby reducing transaction costs and increasing availability and uptake of climate-friendly technologies and solutions. This category also includes the necessary institutions for the know-how transfer as well as specific services that are provided for emission reduction, such as energy analyses (audits) and specialised consultancy, which can play an important role in increasing knowledge and capacity of actors and sectors.
- **E) Research and technology transfer** in order to develop new technologies for GHG mitigation and to make these technologies available. Examples are direct government investment or facilitation of investment in research and development, demonstration and deployment of new technologies. This can also be supported by demand pull through public or private targeted procurement, or through co-operative procurement. These

types of policies increase the size of the overall GHG mitigation potential, and convert part of the ambitious potential into co-benefits or even no-regret potential.

4.2.3 Barriers

In addition to mitigation costs we also analyse whether other barriers exists that impede low-emission investments. Barriers do not only exist in the sense of market barriers in a narrow understanding but have rather different dimensions. As Meyer-Stahmer has shown, the development, implementation and dissemination of new technologies is influenced by the "technological" capabilities at different levels of a society (Meyer-Stahmer 2002). In this sense, Wilkins refers to the term barrier as any "technical, economic, institutional, legal, political, social or environmental factor impeding the deployment of renewable energy technologies" (Wilkins 2002). Neglecting or ignoring one of these dimensions may seriously lower the effect of policies and measures to promote climate-friendly solutions.

In general, barriers can be differentiated at two levels: First, following e7, they can be divided into micro and macro barriers, which are distinguished by whether they can be resolved by the project participants themselves or not (e7 2003). Second, based on Painuly/Fenhann, they can be differentiated according to four main dimensions: financial & economic; institutional & political; technological; awareness & information (see Table 7). This study employs the latter approach.

Table 7: Classification of Barrier Types, Following Painuly / Fenhann 2002

Barrier type	Examples
Financial & Economic	Inadequate financing arrangements (local, national, international) for climate-friendly investments; unfavourable costs; taxes (local and import); subsidies and energy prices.
Institutional & Political	Institutional capacity limitations (R & D, demonstration and implementation); unfavourable energy sector policies and unwieldy regulatory mechanisms.
Technical	Lack of access to technology; inadequate maintenance facilities; bad quality of products; R&D requirements for improvement of technologies.
Awareness / Information / Capacity	Lack of awareness / access to information on climate-friendly solutions; lack of skilled manpower and training facilities.
Others	Lack of social acceptance and local participation (Social barriers); visual pollution, lack of valuation of social and environmental benefits (Environmental barriers).

Source: Based on (Painuly and Fenhann 2002).

4.2.4 Scope for International Cooperation and Use of Carbon Markets

Finally, we discuss possible avenues for international cooperation with a special focus on possibilities for using carbon markets. This discussion takes into account various aspects:

- Responsibility and capability. As discussed in chapter 3, countries differ strongly in their responsibility for and capability to combat climate change. Countries with high responsibility and capability can be expected to mobilise their available mitigation potential by themselves while countries with low responsibility and capability will need strong support from the international community.
- Cost structure and development co-benefits: Parts of the available mitigation potential may yield net economic benefits while for other options costs may be high. Other options may have positive costs but yield multiple benefits such as improvement of air quality. One may consider that even countries with low responsibility and capability should strive to fully mobilise their negative cost potential as well as options that has strong development benefits.
- Non-price barriers: However, even where mitigation costs are apparently low or even negative, other barriers such as lack of access to investment capital may strongly impede low-emission investments. Removal of these barriers may require targeted support from the international community.

Market readiness: In many less developed countries one particular barrier is lack of market readiness. We therefore consider indicators such as the number of already existing CDM projects and domestic market-based instruments to determine what prospects there are for using international carbon market instruments.

4.3 Overview of Main Results

Brazil's Electricity and Waste Sectors Potential and Prospects at a Glance	
Mitigation Potential	Brazil has a substantial mitigation potential in its electricity sector in the period from 2010 to 2030. Due to its natural geographical conditions, Brazil could in theory reduce its emissions from electricity to near zero. Besides a transmission line between Brazil and Venezuela options to avoid emissions in the electricity sector exist by going for an expansion of electricity production from renewable energy sources instead of coal and natural gas. Large mitigation potentials exist in wind and solar power, but also sugarcane cogeneration and wave energy may contribute to a sustainable power mix. While a large share of Brazil's hydropower potential has already been exploited, there is still room for further hydropower. The low level of waste collection and waste and wastewater treatment in Brazil leaves a lot of room for emissions mitigation in the waste sector. For the period from 2010 to 2030, a total of 1,392 Mt CO_2 can be mitigated in the waste sector. Potentials for emission reductions exist regarding solid waste, landfill gases as well as wastewater treatment. Costs for some of the existing mitigation options are expected to be very low or even negative (e.g. recycling of new solid waste, landfill methane destruction).
Policies and Measures	Brazil brings to the table quite a sophisticated climate legislation architecture, a consistent system of strategies and plans as well as a voluntary emission reduction pledge and established coordinating entities regarding climate change issues. A large number of policies and measures has been developed and implemented touching emissions in the electricity sector by, inter alia, expanding electricity generation from renewable energy sources. Also, there are a couple of policies and measures targeting emission reductions in the waste sector.
Remaining Barriers	Currently, there a number of different barriers preventing the existing mitigation potentials identified in both the electricity and the waste sector from being tapped. These barriers include political and institutional barriers such as institutional complexity, a partial lack of enforcement of environmental legislation, conflicts between growth and environmental strategies and a lack of inter-municipal coordination. Furthermore, there are substantial financial barriers. Thus, the waste-management sector suffers from substantial underinvestment and the high costs of interconnecting bagasse cogeneration and wind energy projects in the back country with the main power grid so far have to be borne by the corresponding sugar mills and wind-farm developers. There is a lack of a culture of recycling regarding broad parts of the society and materials, respectively.
Market readiness	Brazil's market readiness is considered to be medium-high. It is discussing advanced plans to develop a national as well as regional emissions registries at plant level as building blocks for future cap and trade systems. Brazil is home to 4.3% of all CDM projects and 2.6% of all PoAs in the pipeline worldwide. Most of Brazil's CDM projects and all of its PoAs are linked to the electricity or the waste sector.
Responsibility and capability	Brazil's contribution to climate change is low-medium, its capability of tackling complex problems such as climate change relatively high for an emerging economy. While there is substantial potential for emissions reductions in both the electricity and the waste sector, due to its relatively low responsibility for global climate change, international support should be provided for the

	mitigation actions with higher mitigation costs.
All in all, Brazil’s chances to benefit substantially from a future worldwide carbon market can be considered to be relatively high. While there is substantial potential for emission reductions in the electricity as well as in the waste sector, money from a carbon market alone will not suffice to tap this potential. In order to be able to exploit the mitigation potentials identified both in the electricity and the waste sector, the institutional, political, technical and capacity/awareness barriers identified will have to be tackled first. Besides institutional and public capacity building on the relevant issues identified, a toehold for international cooperation could include technology transfer.	

China's Electricity and Cement Sectors Potential and Prospects at a Glance	
Mitigation Potential	Up to 1 $GtCO_2e/a$ may be abated through renewable energy, nuclear power, and efficiency improvements in existing facilities in 2020, with uncertain cost estimates. Improvements in the cement sector could abate up to 220 $MtCO_2e/a$ through energy efficiency measures, and a further 310 $MtCO_2e/a$ abatement potential through changes to the production processes. A big share of this potential is available at negative costs.
Policies and Measures	The 12th Five Year Plan emphasises sustainable and low-carbon growth. A wide range of specific economic incentives exist for renewable energies. Standards for the cement sector are based on a top-down structure that focuses mostly on large companies. The introduction of subnational pilot ETS programmes and the proposed introduction of a national system can be a boost to the mitigation potential of both sectors.
Remaining Barriers	Policy making is centralised and sometimes conflicting local level priorities. Poor awareness across the population inhibits the adoption of best practices in smaller industrial firms and the buildings sector and gives room for industrial lobbying.
Market readiness	China has very high market-readiness. Both sectors considered here have already received great exposure to markets through the CDM and through China's pilot ETS programmes.
Responsibility and capability	With its rapid growth and increasing emissions, China's mitigation responsibility is increasing. As a middle income country with a very large resource base, China's capability is also moderate and increasing. China should be able to implement a number of mitigation measures with domestic means, but receive support to tap into the full potential.
Very large and achievable mitigation potentials exist in these sectors, in which market mechanisms have already experienced extensive implementation. Mechanisms should assume a somewhat ambitious baseline, due to China's increasing capability and responsibility.	

Costa Rica's Agriculture Sector Potential and Prospects at a Glance	
Mitigation Potential	Due to the high use of nitrogenous fertilizer and a potential for changing the diet and pasture for livestock to make this sub-sector less carbon intensive, the accumulated mitigation potential of improved pastures, agropastoral systems and reduced use of synthetic fertilizers and agrochemicals is estimated to amount to 304,890,795 t CO_2e in the period from 2010 to 2030 with an average annual emissions mitigation of 400,000 t CO_2e and costs of 25 US$/t CO_2e.
Policies and Measures	Costa Rica has seen environmental politics as an important cornerstone of its government activities for a long time. This has resulted in a clear institutional architecture as well elaborated strategies, plans and programs regarding climate policy as well as substantial efforts on mitigation. Costa Rica has set itself the target to reach Carbon Neutrality by 2021. The primary tool to achieve this target is Costa Rica's Domestic Carbon Market. Agriculture participates in the Domestic Carbon Market with its sub-sectors livestock, coffee and sugarcane. Further activities in the agricultural sector are the development of NAMAs, the most elaborate of which is the Coffee NAMA.
Remaining Barriers	Even though a lot of policies and measures regarding climate change mitigation have been implemented in Costa Rica, there are still various barriers hindering the exploitation of the country's emissions reduction potential in the agriculture sector. Thus, there is a lack of financial resources and knowledge preventing the full, effective implementation of some laws and programs on sustainable agriculture as well as the use of low-emission technologies and organic fertilizers. Furthermore, inter-sectoral coordination of sectors and institutions as well as the division of responsibilities and decision-making power could be improved. There is a lack of awareness, information and capacity regarding various issues relating to mitigation.
Market readiness	Costa Rica's carbon market readiness can be considered to be medium. Even though there are only 16 CDM projects in the country, none of which relates to the agriculture sector, Costa Rica has substantial experience in carbon market activities and has launched its own Domestic Carbon Market in 2013.
Responsibility and capability	Costa Rica has hardly contributed to global climate change, but is quite capable of targeting emissions reductions in its country. However, to fully exploit the mitigation potential identified for the agriculture sector, the non-financial barriers should be removed to enable Costa Rica to benefit to the fullest from carbon market activities. Due to the country's low responsibility for global climate change, its mitigation efforts should be supported internationally.
In total, Costa Rica is a great candidate for further participation in carbon markets. However, to fully exploit the mitigation potential identified for the agriculture sector, the non-financial barriers should be removed. While a special focus should be placed on the improvement of inter-sectoral coordination, barriers regarding awareness, information and capacity should be tackled as well as the financial constraints identified. Due to the challenges arising for MRV in agriculture, NAMAs may be a good alternative to the sector's participation in a future global carbon market.	

Ethiopia's Electricity and Agriculture Sectors Potential and Prospects at a Glance	
Mitigation Potential	The BAU emissions growth for electricity is very low, since hydro power is the most economically feasible and preferred technology for development of the sector. It is estimated that 20 $MtCO_2e$ of emissions in other counties may be abated through hydro power exports. An abatement potential of 48 $MtCO_2e/a$ exists in the pastoral agriculture sector, at abatement costs of 5.5 – 21.5 EUR / tCO_2e. 78 $MtCO_2e/a$ may be abated in the arable sector with an approximate cost of USD 30.5 billion, 42% of which may be expected to have positive economic returns by 2030.
Policies and Measures	The state-sponsored hydroelectricity expansion is underpinned by considerable political will, and the country targets near-zero emission growth by 2030. Several strategy documents prioritise efficiency in the agriculture sector, although limited instruments for specific economic incentives exist.
Remaining Barriers	Electricity expansion plans that are economically rational but require substantial upfront investment which is not completely covered in current budgets. Plans are also dependant on the cooperation of neighbouring countries due to potential environmental impacts of large scale hydro construction, despite considerable political disunity in the region. Most of agricultural measures is not expected to have short term positive returns. The institutional and market environment is not conducive to participation from the private sector to close the funding gap.
Market readiness	Ethiopia has had no interaction with market-based mechanisms historically and would require substantial preparation in order to engage with markets in the future. The agriculture sector presents further complications as it is very fragmented by small-scale activities.
Responsibility and capability	Being a least developed country, Ethiopia has a relatively low abatement capability and a low share of responsibility. Ethiopia should receive substantial international support to mobilise the domestic reduction potential.
Market based mechanisms may become interesting to mobilise potentials in Ethiopia in the future, however market readiness needs to be enhanced before and new approaches to mechanisms must be found to address the country-specific barriers. One promising activity to be supported could be the continued employment of renewable energy technologies for electrification.	

India's Cement and Iron&Steel Sectors Potential and Prospects at a Glance	
Mitigation Potential	The efficiency of the Indian cement sector is among the best in the world. There is nevertheless some scope for additional efficiency improvements. In addition, there is scope to increase the use of alternative fuels such as waste, to decrease the share of clinker, to expand the use of waste heat recovery, and to reduce emissions from captive power plants. Estimates of total potential are in the order of 100 Mt CO_2e in 2020 and 2030. Efficiency of iron&steel production ranges from state of the art to poor. Emission reduction potential lies in the areas of energy efficient technologies and processes, shift to scrap-based Electric Arc Furnaces and to gas-based direct reduced iron, use of larger blast furnaces, coke substitution, direct casting and cogeneration. Emission reduction potential is estimated at about 40 Mt CO_2e in 2020 and 140 Mt CO_2e in 2030.
Policies and Measures	India has various policies and measures in place to promote energy efficiency and emission reductions, in particular since the start of the National Action Plan on Climate Change. The National Mission for Enhanced Energy Efficiency includes the market-based Perform, Achieve, Trade (PAT) scheme for energy efficiency as well as dedicated financing vehicles.
Remaining Barriers	There are substantial non-price barriers that impede climate-friendly investments, including lack of access to investment capital, high ex ante investment requirements, waste legislation that impedes the use of waste as alternative fuels, low-quality waste collection, norms and standards that limit the potential of cement blending, lacking social acceptance of alternative fuels and cement blending, low quality of domestic iron ore and coal, low availability of scrap, and lacking awareness of /reluctance to invest in efficiency.
Market readiness	Is high among developing countries. In addition to its domestic instruments India has ¼ of all CDM projects. Out of these 38 (26 registered) are in the cement sector, 106 (58 registered) in the iron&steel sector.
Responsibility and capability	India scores low on many indicators denoting responsibility for and capability of tackling climate change. Accordingly, most effort sharing proposals allocate a rather low share of the overall global effort necessary to achieve the 2°C target to India. On this basis, one may consider that Indian responsibility for taking own efforts without support mainly relates to mobilising reduction potential with negative or low cost while strong international support should be provided to mobilise mitigation options with higher costs.
In summary, prospects for the use of market-based instruments are generally good. However, given the existence of strong non-price barriers, use of carbon market instruments will probably only be able to fully exploit the available potential if combined with support for access to investment capital and significant regulatory changes and capacity building activities. Prospects for international cooperation could include purchase of PAT credits and provision of budget support and scaling up support for investment funds.	

Kenya's Agriculture Sector Potential and Prospects at a Glance	
Mitigation Potential	Quantification of potentials is largely unavailable and unreliable, although it appears that modest mitigation potential exists, and that no measures named in literature carry negative abatement costs.
Policies and Measures	Mitigation in the agricultural sector is partially picked up by strategic planning documents, such as for example the National Climate Change Action Plan (2011). Some activities related to NAMAs refer to these mitigation opportunities, but have not yet turned into concrete policies.
Remaining Barriers	Finance is required due to the positive costs of abatement. Abatement measures are also dependent on behavioural change at the individual level and therefore hindered by poor awareness and skills across the sector.
Market readiness	Being the most active East African country in the CDM, Kenya has some experience of markets, although none of this experience was gained in the agriculture sector. Kenya is considered open to market based approaches.
Responsibility and capability	As an LDC with low emissions, Kenya has a low capability and low responsibility for mitigation. Kenya should receive substantial international support to mobilise the domestic reduction potential.
Substantial international funding is necessary to cover the positive costs of mitigation due to Kenya's low level of capability and responsibility. With a low but more advanced carbon market readiness in comparison to other countries in the region, Kenya might be an interesting pilot for a new market mechanism, targeted to the country specific barriers.	

Morocco's Electricity Sector Potential and Prospects at a Glance	
Mitigation Potential	Morocco is endowed with substantial renewable energy resources that well exceed its current and projected energy demand and can be utilised at moderate cost. Mitigation potential for 2030 has been estimated at about 40 Mt CO_2e.
Policies and Measures	Morocco has a strong interest in reducing its near-total dependence on energy imports (95% of consumption). It has established an elaborate legal and institutional framework and ambitious targets for energy efficiency and expansion of renewables, 42% of installed electricity capacity are to be renewables in 2020. Morocco has also put in place a number of programmes to promote efficiency and renewables and managed to mobilise support from the international community.
Remaining Barriers	There are substantial non-price barriers that impede climate-friendly investments, including lack of access to investment capital, high ex ante investment requirements, lack of financing mechanisms for distributed installations, a virtual monopoly of the state utility ONEE, no access to the low-voltage grid, the existence of fossil fuel subsidies, and limited human capacity.
Market readiness	Is low. Private sector engagement is impeded by the strong state dominance. The number of CDM projects (14 registered) is comparatively low given the substantial capacity building that took place. 2/3 of the 43 projects that had been examined by the DNA as of May 2011 had been developed by the public sector
Responsibility and capability	Morocco scores low on many indicators denoting responsibility for and capability of tackling climate change. Accordingly, most effort sharing proposals allocate a rather low share of the overall global effort necessary to achieve the 2°C target to Morocco. On this basis, one may consider that Morocco's responsibility for taking own efforts without support mainly relates to mobilising reduction potential with negative cost while strong international support should be provided to mobilise mitigation options with higher costs.
While Morocco has an inherent interest in reducing its energy import bill and has set ambitious targets, it will need international support to actually achieve them. However, market readiness and scope for private sector engagement is low. The most promising options for international engagement may lie with working through the Moroccan government, for example on the basis of a sectoral crediting scheme including incentives for distributed installations, provision of investment support and regulatory reforms.	

Peru's Electricity Sector Potential and Prospects at a Glance	
Mitigation Potential	Peru is estimated to have high potential for electricity emission abatement through renewable energy, although a critical lack of reliable data to quantify or cost this potential remains.
Policies and Measures	Whilst some economic incentives for renewable energy exist, they conflict with economic incentives for natural gas, which has become a preferred resource for the country's development strategy. Peru is also active in the development of NAMAs in this sector.
Remaining Barriers	An insufficient policy framework and political preference for natural gas are the primary barriers, along with difficulties to reaching remote parts of the population and technical capacities. Geographical exclusion may be a significant barrier for some renewable energy resource potential.
Market readiness	Peru has been proactive in supporting its large number of CDM activities, and has gained experience with markets. However, full-readiness is hindered by the poor availability of data across the sector.
Responsibility and capability	As a middle income country, Peru has a moderate capability to mitigate. With just 0.14% of 1990-2010 worldwide emissions its responsibility is low. Peru is still dependent on international support to implement mitigation activities.
Peru might be expected to mobilise the capital for abatement costs with a positive return. Additionally, international funding should support more ambitious measures. Doing this through market mechanisms - specifically on a sectoral level - may be feasible if the mechanism adequately addresses country specific barriers.	

South Africa's Electricity and Iron&Steel Sectors Potential and Prospects at a Glance	
Mitigation Potential	South Africa's power sector is extremely carbon intensive, with 0.8 tCO_2e/MWh. By far the highest mitigation potential lies in the use of various renewable energy technologies for electricity generation, which could yield an aggregate mitigation potential of 35-38 $MtCO_2e$/a in 2020 for wind, solar, and concentrated solar power (CSP) generators. Very sparse information exists for mitigation potentials of the South African iron&steel sector. Only one study could be found that included the sector, but could not assess mitigation potentials due to lack of data.
Policies and Measures	South Africa's approach to greenhouse gas mitigation comprises a set of high-level strategies and plans as well as a number of policies that aim at incentivising energy use reductions and energy efficiency improvements. The most important ones are the National Climate Change Response White Paper, the Integrated Resource Plan for Electricity, the Energy Efficiency Strategy, and the planned carbon tax, to be introduced in 2015.
Remaining Barriers	Translation of policies and plans into concrete actions is slow, partly due to limited knowledge and capacities within government institutions. High investment requirements and low electricity prices act as disincentives to energy efficiency measures and stronger uptake of renewable energy deployment. The strongly concentrated structure of both sectors provides only limited incentives from markets.
Market readiness	South Africa is the largest host of CDM projects in Sub-Saharan Africa, with 71 listed projects (+2 PoAs). Especially renewable energy projects have seen a strong uptake (41 listed). However, use of the CDM within the iron and steel sector has been fairly limited (7 listed). SA has opted against domestic market-based instruments in favour of an economy-wide carbon tax, *inter alia* due to limited institutional capacities.
Responsibility and capability	South Africa only ranks 121st on the 2013 Human Development Index, and faces strong developmental challenges. At the same time is the 13th largest emitter of greenhouse gases worldwide. In 2007, its emissions per capita stood at 9 Tonnes CO_2e, more than the EU. Consequently, the country's reduction pledge of 34% vs. BAU in 2020 falls in line with commonly-used effort-sharing approaches, except for those that place strong emphasis on per-capita emissions, which would call for even higher reduction efforts. In order to meet its goal, the country will have to take decisive steps, including high-cost mitigation options. South Africa currently lacks a GHG inventory system to track its progress.
South Africa's potential for the use of market-based instruments for GHG abatement seems limited. Both sectors analysed for this study show a highly concentrated structure and a small amount of market actors. Of the two, the electricity sector may develop a higher potential for market use in the future, as new companies enter the electricity market. The South African government is planning to put in place a carbon tax and has decided not to create a market instrument for various reasons, including institutional capacity constraints. The lack of a robust GHG inventory would complicate emissions monitoring necessary for a market mechanism both on the sectoral and on the national level.	

Thailand's Cement Sector Potential and Prospects at a Glance	
Mitigation Potential	The cement sector in Thailand has a reduction potential of 3.1 Mt CO_2e with relatively low negative costs. Additional carbon credit revenues could compensate for perceived abatement risks (e.g. production disruptions) and could thus trigger higher mitigation.
Policies and Measures	Thailand has a long tradition of energy efficiency policy. In 1992 the Thai government passed the Energy Conservation and Promotion Act (ENCON Act), which comprises a variety of measures and has been adapted and extended since. In 2011, a 20-year Energy Efficiency Development Plan (EEDP) was formulated with a target to reduce energy intensity by 25% in 2030, compared to 2010.
Remaining Barriers	Information needs on mitigation options (including benefits and risks) do exist. But in general no strong barriers could be identified, which would hinder the success of a market-based approach.
Market readiness	Thailand is open to explore market-based approaches to mitigation. Capacity in the country seems to exist on the level of the government (TGO) and CDM project developers. There are 142 registered CDM Projects in total. Specifically in the cement sector: there are 3 registered projects and 4 under validation MRV of GHG emissions would need to be intensified in governmental institutions responsible for energy policy (DEDE and EPPO). Within the World Bank PMR a proposal was developed which aims at the introduction of a voluntary Energy Performance Certificate Scheme by 2017 and a mandatory emission trading scheme (ETS) in 2020.
Responsibility and capability	Thailand has low-medium scores on indicators for responsibility and capability. On this basis, one may consider that Thailand's responsibility for taking own efforts without support mainly relates to mobilising reduction potential with negative or low cost while international support should be provided to mobilise mitigation options with higher costs.
Thailand's cement sector seems well fit for market-based approaches to reduce its carbon intensity. The country's PMR proposal defines a roadmap how such approaches could be implemented.	

4.4 Brazil

4.4.1 The Electricity Sector in Brazil

4.4.1.1 General Description of the Sector

Table 8: Brazil's Electricity Sector at a Glance

Number of installations	3,055 (additionally: 219 in construction and 483 approved)	**Absolute emissions**	20 Mt CO_2e (2005)
Number of companies	573 (2011)	**Percentage of national emissions**	6% (2005)
Number of CDM projects	434 (177 registered)	**Estimated emission growth**	Almost 7% per year from 2005 to 2030
Number of PoAs	20 (11 registered)	**Electricity emission factor**	0.61 tCO_2e/MWh (December 2013)
Emission reduction potential	Nearly all of the emissions from electricity production could be avoided	**Most important barriers**	Partial lack of enforcement of environmental legislation, conflicting strategies, distribution of costs in renewable energy projects, lack of materials
Policies and measures existing?	Sophisticated climate legislation architecture, system of strategies and plans	**Level of market readiness**	Medium-high

Brazil is responsible for a total of 2.25% of global emissions. When looking at GHG emissions in the Brazilian electricity sector, the first thing that catches the eye is the sector's low share of total national emission. This unusual situation for any industrialised and industrialising country is mainly owed to two factors: On the one hand, with Brazil containing the majority of the Amazon rainforest and corresponding challenges regarding deforestation, the country's emissions from agriculture, forestry and other land uses (AFOLU) are extremely high. On the other hand, renewable energy sources play a uniquely dominant role in the country's electricity supply: In February 2014, hydropower was responsible for about 68% of all electric energy production in Brazil and wind for 1,79%. The share of solar power was negligible (6 MW of the total 126,743 MW installed in Brazil). While nuclear power accounted for 1,57% of all power produced, 28,7% resulted from thermoelectric power plants (ANEEL (Agência Nacional de Energia Elétrica) 2014). This constellation lead to an extremely low electricity generation emission factor in Brazil's National Interconnected System of only 0.61 tCO_2e/MWh (operating margin) in December 2013 (Kuriyama 2014).

However, the share of renewable energy in Brazil's electricity supply, especially the one from large hydroelectric plants, has been decreasing significantly in the last couple of years (in 2005, hydropower still had a share of 90% of total electricity production). Total electricity consumption, in contrast, is expected to almost triple until 2030 (1,033 TWh; 2005: 375 TWh). Brazil's National Energy Plan 2030 (Plano Nacional de Energia 2030 (PNE 2030)) envisages the vast majority of the expansion of the electricity demand to come from nuclear energy as well as coal and natural gas while, by 2030, hydropower is projected to have a share of only little more than 70% in national electricity production (Empresa de Pesquisa Energética (EPE) 2007). The use of other renewable energy sources such as electric energy from biomass (sugarcane), wind power and municipal waste are expected to increase reaching a total of 4% of Brazil's electricity supply in 2030 (Empresa de Pesquisa Energética (EPE) 2007). In total, this development is expected to lead to a significant increase of the electricity sector's emissions. While electricity generation accounted for only 6% of Brazil's total emissions in 2005, it is expected to reach a share of 10% in 2030 and emissions are expected to grow by almost 7% per year between 2005 and 2030 (Empresa de Pesquisa Energética (EPE) 2007).

4.4.1.2 Mitigation Potential and Costs

With the decreasing level of hydropower in Brazil's electricity production and plans to satisfy the increasing electricity demand to a substantial part with coal and natural gas, Brazil has a substantial mitigation potential in its electricity sector in the future. Due to its natural geographical conditions, Brazil could in theory reduce its emissions from electricity to near zero. Emission reductions could be achieved by expanding electricity production with renewable energy sources instead of coal and natural gas. Brazil's location, large area (5^{th} largest country in the world) and coastline of 7,491 km lead to a high potential for biomass as well as solar, wind and wave power. Most of these potentials have so far hardly been tapped (see sub-chapter 4.4.1.1).

The high costs of solar energy of US$ 3,000/kW assumed in Brazil's National Energy Plan until 2030 (Plano Nacional de Energía (PNE) 2030) (Empresa de Pesquisa Energética (EPE) 2007) lead to the plan only giving a marginal role to this energy source in Brazil's electricity production in 2030 . However, over the last couple of years, the costs of solar electricity production have dropped significantly (Meisen, Peter and Hubert, Jordi 2010).

Further details on the individual options are contained in Annex 6.1. It is rather a question of choice and costs than a question of potentials how to deal with emissions in Brazil's electricity sector: They could be avoided altogether.

4.4.2 The Waste Sector in Brazil

4.4.2.1 General Description of the Sector

Table 9: Brazil's Waste Sector at a Glance

Number of installations	379 landfills, 538 controlled landfills, 68 transfer stations, 37 composting facilities, 634 dumpsites, 17 incineration units, 304 separation/ recycling stations	**Absolute emissions**	49 Mt CO_2e (2010)
Number of companies	n/a	**Percentage of national emissions**	3.9% (2010)
Number of CDM projects	186 (116 registered)	**Estimated emission growth**	26% (2005-2030)
Number of PoAs	11 (8 registered)	**Emissions intensity**	n/a
Emission reduction potential	1,392 Mt CO_2 (2010-2030)	**Most important barriers**	Lack of enforcement of environmental legislation, substantial underinvestment in waste management, lack of public awareness regarding waste related issues
Policies and measures existing?	Sophisticated climate legislation architecture, some strategies and plans	**Level of market readiness**	Medium-high

In 2010, the waste sector accounted for 3.9% of national emissions, amounting to 48.737 Gt CO_2e. Waste and wastewater treatment levels have been increasing considerably in the last couple of years (by 24% between 1995 and 2005 and by 16% between 2005 and 2010) (MCTI (Ministério da Ciência, Tecnologia e Inovação), SEPED (Secretaria de Políticas e Programas de Pesquisa e Desenvolvimento), and CGMC (Coordenação Geral de Mudanças Globais de Clima) 2013). In 2011, approximately 90% of the total waste produced in Brazil (62 million tons) was collected. While only 58% of the collected waste was disposed of in sanitary landfills, 24% ended up in controlled landfills and 17% in dumpsites (ABRELPE (Associação Brasileira de Empresas de Limpeza Pública e Resíduos Especiais) 2011) and only a small amount of all landfill gases is treated (McKinsey 2009a).

Until 2030, the daily per capita waste in Brazil is expected to rise from 0.95 kg in 2010 to more than 1.05 kg (Gouvello et al. 2010). Furthermore, the country's population is growing constantly and is expected to increase from 198 million in 2010 to 239 million people until 2030 (Empresa de Pesquisa Energética (EPE) 2007). In consequence, total waste levels will increase substantially, leading to an estimated emission growth of 26% until 2030. In Brazil, only AFOLU and the transport sector have a higher abatement potential than the waste sector

(McKinsey 2009a). Targeting emission reductions in the waste sector is therefore of key importance in the future.

4.4.2.2 Mitigation Potential and Costs

The low level of waste collection and waste and wastewater treatment in Brazil leaves a lot of room for emissions mitigation in the waste sector. For the period from 2010 to 2030, Gouvello et al. estimate that a total of 1,392 Mt CO_2 can be mitigated in the waste sector (Gouvello et al. 2010), while McKinsey provides numbers for the year 2030. McKinsey assumes the mitigation potential in the waste sector in 2030 to reach 62 MtCO_2e (McKinsey 2009a).

Potentials for emission reductions exist regarding solid waste, landfill gases as well as wastewater treatment. Details on the individual options are contained in Annex 6.1.

4.4.3 Existing Policies and Measures

Brazil has quite a sophisticated institutional setup for climate policy with the General Coordination on Global Climate Change (CGMC) and the Inter-ministerial Commission on Climate Change (CIMGC) operating as coordinating entities. The CGMC is the technical focal point of climate change issues in Brazil, assists technically during climate negotiations, prepares the National Communications, coordinates funds and builds capacities. The CIMGC, on the other hand, co-ordinates discussions and actions on climate change, integrates the government's policies in the ministries, gives input on Brazil's activities regarding the UNFCCC and functions as the Designated National Authority (DNA) for the CDM where it is responsible for the establishment of criteria and decisions on CDM projects. Brazil's Inter-ministerial Committee on Climate Change (CIM) completes the government bodies linked to climate change. It is responsible for steering the National Policy on Climate Change (PNMC) and the National Plan on Climate Change, Brazil's main framework legislation regarding climate change.

Under the umbrella of the PNMC, there are a number of policies and measures aiming at emissions mitigation. Thus, there are plans for developing a national cap and trade system, the Brazilian Emissions Reductions Market (MBRE). Also, there are plans for regional cap and trade systems in Brazil, the most developed in the State of São Paulo.

Regarding the waste sector, Brazil's most important policy is the National Policy on Solid Residues (PNRS). It promotes strategies to minimise the generation of solid residues, domestic sewerage and industrial effluents, provides incentives for selective collection, recycling and reuse of rubbish and calls on states, regions and municipalities to elaborate local strategies to implement the PNRS.

The Urban Solid Waste Program supplements the policy supporting the development of management and administration processes for urban solid wastes.

Similary to the PNRS, the National Energy Plan until 2030 (Plano Nacional de Energia (PNE) 2030) sets the scene for Brazil's energy sector. It includes targets regarding the expansion of electricity production as well as transmission and distribution (Empresa de Pesquisa Energética (EPE) 2007). Information on the expansion of hydroelectric power and other alternative energy sources until 2022 has been updated in Brazil's 10 Year National Expansion Plan (PDE 2022) (Empresa de Pesquisa Energética (EPE) 2013).

In Brazil, there are a number of funds, credit lines and other provisions of financial sources supporting mitigation and adaptation projects, studies and undertakings in place. Also, there are special programmes fostering the expansion of electricity from renewable resources such as hydropower, wind power and electricity generated from biomass.

An overview of existing policies and measures aiming at emissions mitigation in the electricity and the waste sector is provided in Table 25 in annex 6.1.

4.4.4 Remaining Barriers and Potential Ways Forward

Currently, there a number of different barriers preventing the existing mitigation potentials identified in both the electricity and the waste sector from being tapped. There are economic barriers as well as institutional and political, technical, capacity related barriers. An overview of the barriers is provided in Table 26 in Annex 6.1. Options to reduce or remove barriers for mitigation actions in the electricity and the waste sector include the following:

- The comprehensive existing environmental legislation could be enforced more rigorously by the authorities responsible (Townshend et al. 2013, 62–68).
- Aligning Brazil's growth strategies and emission reduction targets could provide better orientation for both private and public actors. Inter-municipal coordination could be increased (Gouvello et al. 2010, 35).
- Long-term planning, larger funds, and further incentives could help to overcome the current underinvestment and increase private-sector participation in the waste-management sector (Gouvello et al. 2010, 28).

- Decreasing institutional complexity and decentralization in both solid and liquid waste management could facilitate leveraging the money needed (Gouvello et al. 2010, 28, 35).
- Adverse environmental and social impacts of renewable energy projects, especially of hydropower (Meisen, Peter and Hubert, Jordi 2010, 42–43), should be prevented, mitigated and compensated from the outset of any renewable energy project. Besides being undesirable per se, they may delay power expansion plans due to civil commotion.
- The efficiency of the environmental licensing process could be improved to allow for an easier expansion of hydropower: Social and environmental factors should be considered appropriately in electricity-sector plan, programs and policies, disputes among players in the licensing process should be resolved by a mechanism, an operations guide should be prepared, and technical capacity as well as professional skills of environmental agencies should be improved (Gouvello et al. 2010, 34–35).
- Subsidies and a smart-grid development programme could be used to help bearing the cost of interconnecting bagasse cogeneration and wind energy projects in the back country with the main power grid. So far, these costs have to be borne by the corresponding sugar mills and wind-farm developers (Gouvello et al. 2010, 35, 98).
- Reducing customs duties, which favour turbine components over entire turbines, as well as the nationalization index – both of which where introduced to create a national industry and boost local manufacturing – could resolve difficulties in accessing equipment for wind power (Gouvello u. a. 2010 S. 97–98). The nationalization index for steel plates and cement for wind turbine towers was raised from 60% (Marcio Sperling 2013) to 70% in 2013 (Stephan Nielsen 2013). Furthermore, by 2015, nacelles will have to be assembled nationally and at least one of the four main components of the hub will have to be obtained locally (ibid.).
- Appropriate charges/tax collection regarding waste collection and treatment could be installed. Tax-incentive mechanisms for implementing techniques focusing on water re-use and cleaner production as well as for reverse logistics and selective waste collection could be introduced (Gouvello et al. 2010, 142–143).
- Awareness campaigns could change consumption patterns and introduce a culture of recycling (McKinsey, 2009, p. 22).

It is essential to tackle these barriers to be able to achieve substantial emission reductions in both the electricity and the waste sector.

4.4.5 Scope for International Cooperation and Use of Carbon Markets

Brazil's contribution to climate change is low-medium. While Brazil has a share of 2.25% of global emissions, its per capita emissions amount to 6 t CO_2e and its accumulated emissions in the period 1990-2010 to 98 t CO_2e per capita. These figures, however, are strongly determined by the country's huge emissions from AFOLU – the electricity sector accounted for only 6% of national emissions in 2005 (Empresa de Pesquisa Energética (EPE) 2007). This is largely owed to the huge endowment of renewable energy sources leading to an electricity emission factor of just 0.61 t CO_2e per MWh (December 2013; (Kuriyama 2014)) – an outstanding number. However, emissions in Brazil's electricity sector are expected to rise by almost 7% per year between 2005 and 2030 (Empresa de Pesquisa Energética (EPE) 2007).

While in 2010, only 3.9% of national emissions originated in the waste sector, these are expected to increase by 26% until 2030 (compared to 2005). Thus, measures to deviate from the baseline in both the electricity and the waste sector are urgently needed.

Brazil's Human Development Index of 0.73 shows its relatively high social and economic development status. Also, the country with the fifth largest population in the world (195 million inhabitants) has a relatively high per capita income of about US$ 5,600. However, the national income is distributed extremely unequally: With a Gini coefficient of 51.9, Brazil is among the countries in the world with the highest income inequality (see chapter 3 for data sources). Nevertheless, all in all, these numbers reflect Brazil's relatively high capacity to tackle complex problems such as climate change.

Thus, Brazil brings to the table quite a sophisticated climate legislation architecture, a consistent system of strategies and plans on climate change issues as well as an emission reduction pledge and established coordinating entities (CGMC and CIMGC). As depicted in sub-chapter 4.4.3 above, a large number of policies and measures has been developed and implemented aiming at emission reductions in the electricity and the waste sector. Furthermore, science and research institutions in Brazil have the know-how as well as the capacity to develop mitigation options and MRV emissions (H. Fekete, Vieweg, and Mersmann 2013). Data availability in Brazil in general is considered to be good; its quality, however, may differ from sector to sector.

Nevertheless, there are substantial barriers preventing the full exploitation of Brazil's mitigation options both in the electricity and the waste sector (see sub-chapter 4.4.4). On the one hand, Brazil is committed to combating climate change, on the other hand its mitigation plans compete with other plans, such as Brazil's growth strategy. Institutional complexity as well as a lack of enforcement of the comprehensive environmental legislation and inter-municipal coordination aggravate this problem. International cooperation could support national initiatives to alleviate these problems and also support a change of culture, raising public awareness for waste related issues such as waste avoidance and recycling.

Some of the mitigation options identified in sup-chapters 4.4.1.2 and 4.4.2.2 can be tapped at low or even negative costs. These could well be implemented by Brazil itself, once the barriers described are removed (see sub-chapter 4.4.4 and Table 26 in annex 6.1). The costs of some of implementing some of the other mitigation options, however, exceed the financial sources available - even with the funds established for climate finance in Brazil. Thus, the waste-management sector in general suffers from substantial underinvestment and project developers in the back country dread the high costs they have to bear when interconnecting their bagasse cogeneration or wind energy projects with the main power grid. Tapping the carbon market could resolve part of this problem.

Already, the carbon market plays an important role in Brazil and particularly in both its electricity and its waste sector, even though the level of activity has decreased lately due to the current lack of demand for CERs. As of January 2014, Brazil was home to 4.3% of all CDM projects worldwide with a total of 319 registered project activities and nearly 91 million issued CERs. This is the fourth highest number of CERs so far behind China, India and the Republic of Korea (UNEP Risoe Centre 2014b). Also, Programmes of Activities (PoAs) are stronlgy represented in Brazil. Thus, in February 2014, there were 19 registered PoAs and further 12 PoAs in the pipeline. This adds up to 2.6% of all PoAs in the pipeline all over the world (UNEP Risoe Centre 2014a).

Of Brazil's registered CDM projects, 92% are linked to the electricity or the waste sector. Thus, there are currently 177 registered CDM projects in the electricity sector, nearly all of which are renewable energy projects: 46% of the project activities in the electricity sector are hydropower projects, 23% biomass energy projects and nearly one in three CDM projects in the electricity sector is a wind project. Further project types in the electricity sector relate to co-generation (2 projects), energy distribution (1 project) and solar energy (1 project). The waste sector accounts for a total of 116 registered projects. Of these, 57% target the avoidance of methane (58 projects relating to manure, 7 to waste water and 1 to sawmill waste) and 43% are linked to landfill gas (27 projects focusing on landfill flaring, 18 on landfill power, 3 on the combustion of municipal solid waste and 1 on landfill composting) (UNEP Risoe Centre 2014b).

All of Brazil’s 19 registered PoAs are either in the electricity or the waste sector. The 11 PoAs related to electricity fall upon wind (6 PoAs), hydro (4 PoAs) and landfill power (1 PoA) while the 8 PoAs in the waste sector relate to power from landfill gas (1 PoA) and methane avoidance (3 PoAs relating to composting and 4 to manure) (UNEP Risoe Centre 2014a).

There are advanced plans for developing a national (Mercado Brasileiro de Redução de Emissões, MBRE) as well as regional cap and trade systems in Brazil.

In total, Brazil’s carbon market readiness can be considered to be medium to high. While there is substantial potential for emission reductions in the electricity as well as in the waste sector, money from the carbon market alone will not suffice to tap this potential. In order to be able to fully exploit the mitigation potentials identified both in the electricity and the waste sector, the institutional, political, technical and capacity/awareness barriers identified will also have to be tackled.

4.5 China

4.5.1 The Electricity Sector in China

4.5.1.1 General Description of the Sector

Table 10: China's Electricity Sector at a Glance

Number of installations	Unknown	**Absolute CO_2 emissions (2010)**	3625 $MtCO_2$/a (IEA and OECD 2012)
Number of companies	Unknown	**Percentage of national CO_2 emissions (2010)**	50% of 7214 $MtCO_2$/a
Number of CDM projects (2013)	2,975	**Estimated emission growth (2030)**	5168 $MtCO_2$/a
Emission reduction potential	280 – 1002 MtCo2/a	**Emissions intensity in 2011**	764 gCO_2/kWh
Policies and measures existing	Large number of strategy papers and range of targeted economic incentives.	**Most important barriers**	Institutional fragmentation, costs, skills and awareness.
Market readiness	High		

The largely privatised electricity sector is the largest source of GHG emissions in China, representing 44% of national emissions in 2010 (IEA 2013), and is dominated by coal and peat fired generation which accounted for approximately 77% of the energy output in 2010 (IEA 2013). Hydro facilities, including pumped storage, accounted for a further 17% of the energy output, whilst the proportion of other renewable energy sources in the energy mix is growing. Electricity output in China increased by a factor of over 700% in the period of 1990-2010 due to the increasing demand caused by high rates of economic growth and increased levels of electrification, and the growth in electricity demand is expected to continue for the foreseeable future.

4.5.1.2 Mitigation Potential and Costs

China’s greatest potential for GHG mitigation comes from the electricity sector, and within the sector renewable energy represents the most significant potential, an estimated 120 – 571 $MtCO_2e$/a (H. Fekete et al. 2013). China has gradually increased its ambition regarding renewables as the cost of technologies has decreased significantly in the past decade, and the country is host to nearly 3,000 renewable power CDM projects (UNEP Risoe 2013).

Nuclear energy also carries considerable potential – 86 to 246 MtCO2e/a – at relatively low cost (H. Fekete et al. 2013), although important concerns remain regarding the environmental hazards of nuclear technologies, and the complications of grid integration with renewables due to the inflexible base load capacities.

Most other measures identified are related to efficiency improvements in existing or new coal-fired facilities. A small amount of this potential is available at negative costs, whilst approximately 34 $MtCO_2e$/a mitigation potential is given at a low cost of €4.5/t CO_2e, due in part to the significant co-benefits that include improved local air conditions and associated improvements in health and productivity (Chen et al. 2006).

A full list of identified measures and their potentials is given in Annex 6.2, Table 27.

4.5.2 The Cement Sector in China

4.5.2.1 General Description of the Sector

Table 11: China's Cement Sector at a Glance

Number of installations in 2011	967	**Absolute emissions (2007)**	1 151 $MtCO_2e$/a
Number of companies in 2011	50	**Percentage of national emissions (2007)**	14% of 8152 $MtCO_2e$/a
Number of CDM projects	26	**Estimated sector growth (billion tonnes output)**	1,069 (2005) – 1,630 (2030)
Emission reduction potential	584 $MtCO_2$	**Emissions intensity in 2011**	652 kg CO2/t cementitious
Policies and measures existing	Policy is focused on the largest enterprises.	**Most important barriers**	Top down manner of policy implementation, finance, knowledge and awareness.
Market readiness	High		

Sources: (McKinsey & Company 2009; WBCSD 2011; Ke et al. 2013)

China experiences a very high demand for cement due to the current period of rapid growth and urbanisation; over half of the world's new buildings each year are built in China. China is also an exporter of cement, and the largest producer of cement globally, with a 627% production increase over the previous decade (WBCSD 2011). McKinsey & Company (2009) expect annual cement demand to continue to grow and peak in 2030 at 1630 billion tonnes, after which demand will experience a modest decline. The cement sector accounted for more than 10% of China's GHG emissions in 2010, and significant mitigation potentials exist at negative or very low costs (McKinsey & Company 2009). The cement sector is therefore of huge significance to China's mitigation potential during the coming decades of continued growth.

4.5.2.2 Mitigation Potential and Costs

The mitigation potential for the cement sector is vast, and listed in full Annex 6.2, Table 28. McKinsey & Company (2009) anticipate 220 $MtCO_2$ of abatement measures under BAU (from forecast emissions of 1.2 $GtCO_2$ in 2030 under current emissions behaviour), including energy saving processes and improvements in the quality and performance of cement. A further abatement potential of 310 $MtCO_2$ at negative costs is forecast through the maximisation of clinker substitution with fly ash and slag, and the use of agricultural waste as an alternative fuel for co-firing. A further abatement potential exists in the cement, chemical and steel industries combined for an estimated 210 $MtCO_2$ through the use of CCS technologies (McKinsey & Company 2009), but this measure is both ambitious due to the abatement costs, and uncertain due to the lack of clarity on the feasibility of CCS.

A wide range of co-benefits exist for mitigation in the cement sector, including improved economic productivity and competitiveness, technological and infrastructural development, enhanced energy security, and air quality improvements (Chen et al. 2006).

4.5.3 Existing Policies and Measures

China is experiencing increasing pressure on its resources due to the country's high rate of GDP growth, and is placing increasing importance on sustainability and low carbon growth across its policies. China pledged to reduce CO_2 emission intensity by 2020 by 40-45% below 2005 levels under the Copenhagen Accord, and the electricity sector carries the most potential for the achievement of this target.

Guiding China's electricity policy formation is the 12th Five Year Plan (FYP) which includes specific targets for non-fossil fuel energy production. The FYP is supported by a range of targeted economic incentives including feed-in tariffs on all technologies, tax incentives and a subsidy programme. Furthermore, the Regulation on the Administration of Power Generation from Renewable Energy requires grid operators to purchase power from renewable energy sources.

Industrial energy consumption, including the cement sector, is a key area of national concern and features prominently in national strategy documents. Most action, such as closure of inefficient plants and measures focused on the Top-

1000 and Top-10,000 energy consuming enterprises, comes from the national level. Therefore, the focus lies on large enterprises and smaller firms are somewhat overlooked.

All sources of mitigation potential in China are boosted by the implementation of emissions trading pilot schemes in 7 provinces during 2013-2016, and the continued design of a national emissions trading scheme (World Bank 2013a).

Relevant policies and measures are summarised in Annex 6.2,Table 29.

4.5.4 Remaining Barriers and Potential Ways Forward

Most of the barriers for GHG mitigation in the electricity sector relate to issues of institutional coordination that hinder the uptake of renewable energy technologies. Regulations are designed by several authorities, sometimes with competing incentives, and the focus on a centralised approach to strategy making is sometimes a hindrance to the implementation of locally appropriate action (H. Fekete, Vieweg, and Mersmann 2013). Monitoring, reporting and verification (MRV) systems are also fragmented between provincial and national levels (H. Fekete, Vieweg, and Mersmann 2013), where data is inconsistent and calculations of co-benefits are seldom performed.

In the cement sector, despite being a sector of high national relevance, policies are implemented in a top-down manner, and the implementation of best practices at smaller firms is limited by awareness and knowledge, the high upfront costs of investment, and a lack of financial incentives (Dunnett et al. 2010).

In all sectors, poor awareness of climate change issues and opportunities leads to poor consumption habits and ample room for industrial lobbying (H. Fekete, Vieweg, and Mersmann 2013).

A full list of these barriers is given in Annex 6.2, Table 30.

4.5.5 Scope for International Cooperation and Use of Carbon Markets

China as a dynamically growing country has an increasing capability to combat climate change and its share of responsibility for future climate change is rising with its current emission trends. Its share of global cumulative emissions between 1990 and 2010 was 14% and its per capita emissions in 2010 7.8 tCO_2e. With a per capita income of about US$ 2870 and an HDI of 0.69, it is in the middle of the countries considered in this study.

Based on this, one can say that China should be able to implement a number of mitigation measures with domestic means, even if those are related to costs, as for example the potential identified for the renewable energy sector. By replacing coal fired power plants with clean energy and improving the efficiency of the power plant stock, China can benefit significantly from reduced air pollution. The Chinese government already has acknowledged this as a major opportunity and made it a priority policy area.

In the cement sector, there is vast potential at negative costs, but less policy focus is on that sector. While large companies may be able to handle investment costs for restructuring their production processes, potential in smaller companies will likely lie idle under the current policy framework. Access to information is not always given either.

China is one of the leading non-Annex I countries in terms of carbon market readiness. It has established pilot emission trading platforms, which are meant to gather experiences for a potential national trading scheme. China is the biggest CDM country, with more than 3500 registered projects, of which a substantial amount is in the two sectors considered here. For these sectors, carbon trading is thus already a common instrument. While selling Certified Emission Reductions from the CDM internationally is no longer an option for Chinese companies, China has established a national framework which allows the use of those credits in the pilot regions.

Although the national Emission Trading Scheme is not yet implemented, China can be considered fully carbon market ready. China already takes many mitigation actions domestically and depending on which indicator is given more weight also has an increasing share of responsibility and capability. Thus, international support via carbon markets should be targeted carefully and the mechanisms used must assure a somewhat ambitious threshold, from which onwards credits can be issued to the international market.

4.6 Costa Rica

4.6.1 The Agriculture Sector in Costa Rica

4.6.1.1 General Description of the Sector

Table 12: Costa Rica's Agriculture Sector at a Glance

Number of installations	n/a	**Absolute emissions (2005)**	4.604 Mt CO_2e
Number of companies	n/a, high dispersion of actors	**Percentage of national emissions (2005)**	52.4% (37,5% when negative emissions from land use change are neglected)
Number of CDM projects	0	**Estimated emission growth (2010-2021)**	4%
Emission reduction potential	304,890,795 t CO_2e in the period from 2010 to 2030	**Emission intensity factor**	n/a
Policies and measures existing?	Clear institutional architecture as well elaborated strategies, plans and programs regarding climate change	**Most important barriers**	Lack of financial resources, awareness, information and capacity, lack of inter-sectoral coordination
Level of market readiness	Medium		

Sources: (MINAE 2013); (MINAET and IMN 2009)

While Costa Rica has transformed itself from an agricultural to an industrial country, agriculture still plays a major role for the labour market (11,5% of all jobs) (Agra-TEG (Agrar- und Umwelttechnik GmbH Göttingen)/ GIZ (Gesellschaft für Internationale Zusammenarbeit) / GfRS (Gesellschaft für Ressourcenschutz mbH) 2011) as well as for the economy as a whole. Thus, in 2010, coffee production alone generated 9.02% of Costa Rica's GDP and the coffee sub-sector was responsible for 2.72% of total export revenue (MINAE 2013). 16.6% of Costa Rica's territory is used for agricultural production and an additional 23.4% for livestock. Of the livestock, 15.6% is dedicated to dairy, 58.2% to beef cattle and 26.2% to both (MINAE 2013).

In 2005, agriculture was responsible for 52.4% of Costa Rica's total emissions – for 37,5% when the negative emissions from changes in land use are not included in the sum of Costa Rica's total emissions (MINAET and IMN 2009). Of the agriculture sector's emissions, 40% related to livestock, 25% to coffee, 11% to sugar cane, 8% to banana and 5% to rice. The remaining 11% originated in the production of other agricultural products (Zamora Quirós 2013b). 54% of the agriculture sector's emissions are N_20 (nitrous oxide) and 46% CH_4 (methane) emissions (MINAE 2013). In total, agriculture was responsible for 89% of Costa Rica's CH_4 emissions due to its large livestock. While 98% of these emissions resulted from enteric fermentation from farm animals, the remaining 2% are attributed to the handling of farm manure (Worldbank 2009). Furthermore, agriculture was responsible for 98% of Costa Rica's N_20 emissions (MINAET and IMN 2009), a number generated by the high use of fertilizer (Agra-TEG (Agrar- und Umwelttechnik GmbH Göttingen)/ GIZ (Gesellschaft für Internationale Zusammenarbeit) / GfRS (Gesellschaft für Ressourcenschutz mbH) 2011).

However, the use of chemical fertilizer is supposed to have decreased substantially in the last couple of years due to rising international prices for fertilizers. Conservative estimates suggest that the reduced production inputs may have caused emission reduction of 15% in relation to emissions in 2005 (MINAE 2013). However, there are no exact numbers on this development yet.

4.6.1.2 Mitigation Potential and Costs

The agriculture sector's share of methane emissions largely depends on the diet and pasture for livestock and their physical and chemical composition (Worldbank 2009), its nitrous oxide emissions on fertilizer used in agriculture. Fertilizer use per hectare agricultural land in Costa Rica is five times the average in Central America (342 kg/hectare) and chemical pesticide use in Costa Rica is among the highest worldwide. Banana plantations are responsible for a large part of this situation (Agra-TEG (Agrar- und Umwelttechnik GmbH Göttingen)/ GIZ (Gesellschaft für Internationale Zusammenarbeit) / GfRS (Gesellschaft für Ressourcenschutz mbH) 2011). Thus, the accumulated mitigation potential of improved pastures, agropastoral systems and reduced use of synthetic fertilizers and agrochemicals is estimated to amount to 304,890,795 t CO_2e in the period from 2010 to 2030 with an average annual emissions mitigation of 400,000 t CO_2e and costs of 25 US$/t CO_2e (Pratt, Rivera, and Sancho 2010, 66, 72). In its Second National Communication, Costa Rica presents emission mitigation options in the agriculture sector focusing on improved handling of pasture and better management of nitrogenous fertilizer of between 8 and 12% (0.429 to 0.683 Mt CO_2e per year) compared to the baseline scenario (MINAET and IMN 2009). See Annex 4.6.1.2 for more information on mitigation options in Costa Rica's agriculture sector.

4.6.2 Existing Policies and Measures

Costa Rica has seen environmental politics as an important cornerstone of its government activities for a long time. This has resulted in a clear institutional architecture as well elaborated strategies, plans and programs regarding climate policy as well as substantial efforts on mitigation.

Costa Rica has developed its National Climate Change Plan (PND) to establish an inter-institutional coordinating mechanism to deal with challenges and opportunities resulting from climate change (MINAET and IMN 2009). Furthermore, economic competitiveness and climate change strategies are to be aligned with the National Strategy for Climate Change (ENCC). The main objective of the ENCC is achievement of the country's Carbon Neutrality target which is to be reached until 2021 and the Region Huetar Norte is to be a test model region for the implementation of the ENCC (Worldbank 2009), (Zamora Quirós 2013b). The primary tool to achieve this target is Costa Rica's Domestic Carbon Market launched in September 2013. In addition to emissions reduction, the compensation or removal of emissions is envisaged (MINAE 2013). In developing, designing and implementing market readiness activities, Costa Rica benefits from the World Bank's Partnership for Market Readiness (PMR) (MINAE 2013).

Regarding the agriculture sector, various policies and measures are proposed in Costa Rica Carbon Neutral 2021, including knowledge and technology generation and transfer to farms, the creation of space for the diffusion of mitigation technology and incentives for the substitution of chemical fertilizer with organic fertilizer. Agriculture participates in the Domestic Carbon Market with its sub-sectors livestock, coffee and sugarcane. Furthermore, Costa Rica is currently developing Nationally Appropriate Mitigation Actions (NAMAs) in its agriculture sector, the most elaborated of which is its Coffee NAMA (Zamora Quirós).

An overview of existing policies and measures aiming at emissions mitigation in the electricity and the waste sector is provided in Annex 4.6.2.

4.6.3 Remaining Barriers and Potential Ways Forward

Even though many policies and measures regarding climate change mitigation have been implemented in Costa Rica, there are still various barriers hindering the exploitation of the country's emissions reduction potential in the agriculture sector. The existing barriers reach from financial and economic as well as institutional and political barriers to technical barriers and those barriers which are related to (public) awareness, information and capacity.

Thus, a lack of financial resources prevents the full, effective implementation of some Costa Rican laws and programmes on sustainable agriculture which are based on financial incentives for the provision of environmental services. Furthermore, inter-sectoral coordination of sectors and institutions as well as the division of responsibilities and decision-making power could be improved to streamline activities relating to climate change mitigation. Frequently, efficient policy making is hampered because costs and results of actions, plans and programmes cannot be attributed clearly as plans and budgets are not coordinated and recorded sufficiently.

The biggest technical barrier for mitigation in agriculture is the lack of an adequate emissions reporting system for the production sector. This barrier is aggravated by the lack of high-quality data available for the three sub-sectors covered by Costa Rica's Domestic Carbon Market (livestock, coffee and sugarcane). Further difficulties arise due to the resistance of producers to change behaviour and adopt new emissions mitigating production practices, e.g. regarding a switch from chemical to organic fertilizer. In general, there is a lack of awareness, information and capacity regarding various issues relating to mitigation.

An overview of the barriers is provided in Annex 4.6.3. The removal of these barriers can be fostered with:

- The allocation of more resources to advanced technologies that contribute to mitigating emissions
- The provision of grants or loans with low interest rates to enable improvements in the management and use of fertilizer
- Capacity building and awareness raising on the costs and benefits resulting from mitigation actions
- Improving inter-sectorial coordination of sectors and institutions in planning and implementing global environmental conventions based on stronger enforcement of the PND's objectives
- The creation of a new coordination platform among the sector's stakeholders (MINAE 2013)
- Clearly defining responsibilities and decision-making power in the governmental bodies relating climate change issues
- The development of an emissions reporting system for the production sector
- Gathering and processing of high quality data for the three sub-sectors covered by the Domestic Carbon Market (livestock, coffee and sugar cane)

Market readiness activities considered for Costa Rica under the World Bank's Partnership for Market Readiness (PMR) already include a number of activities that could help removing the barriers existing for mitigation in Costa Rica's agriculture sector. Thus, activities entail studies, improved emissions data generation and management as well as sector baseline/ sector benchmark methodologies and MRV. Furthermore, activities regarding Costa Rica's institutions, capacity building and social awareness are envisaged: First of all, technical, legal, administrative and financial bodies in the Ministry for Agriculture and Livestock as well as other key actors could be strengthened to improve their overall ability to act effectively on emissions reductions. To tap mitigation options, it is also important to familiarize producers and organizations of producers with the topic and consult with them for possible input and exchange. Experiences in mitigation and carbon capture and storage should be exchanged systematically. Furthermore, technical training could be provided focusing on potential leaders in the sector and producer organizations. Also, technical training on MRV could improve the ability of the agriculture sector – especially its sub-sectors livestock, coffee and sugar cane – to participate in carbon markets (MINAE 2013).

4.6.4 Scope for International Cooperation and Use of Carbon Markets

Due to the small size of the country (51,100 km^2) and its population (4.7 million inhabitants), but also its low emissions intensity (3 Mt CO_2e/ billion constant 2005 US$/cap), Costa Rica's share of global emissions in 2010 amounted to only 0.03%; its accumulated emissions in the period 1990-2010 reached 247 t CO_2e. Also, current (3.2 t CO_2e) as well as accumulated (53 t CO_2e) per capita emissions are quite low. With a share of 52.4% of total emissions in 2005 – 37,5% when the negative emissions from changes in land use are neglected in total emissions calculations – the agriculture sector plays a major role in Costa Rica's emissions inventory. In spite of Costa Rica's Carbon Neutrality target for 2021, emissions in the agriculture sector are expected to increase by 4% in the period from 2010 to 2021 (MINAET and IMN 2009). Therefore, it is important to foster mitigation activities in Costa Rica's agriculture sector.

Regarding development – economic as well as social and environmental development –, Costa Rica is Latin America's poster child. This is reflected in its relatively high Human Development Index of 0.77 as well as a per capita income of US$ 5,357. National income amounts to US$ 25 billion (see work chapter 3 for data sources) and poverty is relatively low. Also, Costa Rica has been including environmental concerns at the centre of its legislation for years and has created a sophisticated set of environmental norms (MINAE 2013, 69). This lays out a good foundation for future mitigation activities as well as the country's participation in carbon markets.

Thus, a Domestic Carbon Market has already been launched in Costa Rica in September 2013. While so far, there are no PoAs in Costa Rica (UNEP Risoe Centre 2014a), the country is home to a total of 16 registered CDM projects (UNEP Risoe 2014) and has also gained experience with the use of VERs. Building on this experience, CERs and VERs can be used in Costa Rica's Domestic Carbon Market in parallel with domestic offsets, the so-called Costa Rican Compensation Units (UCC) (MINAE 2013).

None of Cost Rica's currently registered CDM projects, however, is linked to agriculture (UNEP Risoe 2014). While the agriculture sector is destined to gain experience in carbon market activities through its participation in Costa Rica's recently launched Domestic Carbon Market with its sub-sectors livestock, coffee and sugarcane, the sector's heterogeneity and size of individual emission sources as well as the highly dispersed actors in agriculture will cause substantial challenges regarding the measuring, reporting and verification (MRV) necessary for the participation of the sector in a future global carbon market.

This poses the question of whether NAMAs, which may allow for lower requirements on MRV while holding opportunities to foster sustainable development beyond emissions mitigation, would be a better fit for Costa Rica's agriculture sector. As depicted in sub-chapter 4.6.2 above, Costa Rica is already developing NAMAs in the agriculture's sub-sectors coffee, livestock and sugar cane. Combined, these three sub-sectors cover 76% of the agriculture sector's current emissions (Zamora Quirós 2013b). Costa Rica's Coffee NAMA is envisaged to be quite comprehensive but full details are not yet available. It therefore remains to be seen whether the NAMA will be able to full tap the available potential or whether there will be a need for further instruments. The same applies for Costa Rica's livestock and sugar cane NAMAs.

The creation of Costa Rica's domestic carbon market opens new vistas for international cooperation. Costa Rican units could be converted to CERs or be made directly fungible for international uses. This would require some form of international clearing house to ensure the environmental integrity of the credits. This function could be fulfilled by the Framework for Various Approaches that is to be developed under the UNFCCC. Alternatively, donor countries could use public finance to purchase Costa Rican credits, cancel them, and count the money spent towards their climate finance commitmetns.

Whether Costa Rica will focus on options to participate in a future global carbon market or on NAMAs for its agriculture sector will, last but not least, depend on future carbon prices and, respectively, the level of support provided by the international community for NAMAs as well as corresponding timelines.

Whether via a carbon market, a NAMA or other policies and measures, to fully exploit the existing mitigation potentials in agriculture (see sub-chapter 4.6.1.2), Costa Rica will have to tackle the barriers identified in sub-chapter 4.6.3 such as the lack of financial resources and knowledge preventing the full, effective implementation of some laws and programs on sustainable agriculture as well as the use of low-emission technologies and organic fertilizers. Furthermore, inter-sectoral coordination of sectors and institutions as well as the division of responsibilities and decision-making power should be improved. Awareness raising, information and capacity building on climate change mitigation are also essential to tap Costa Rica's agriculture sector's mitigation potential. International support and cooperation – as existent with the PMR – could be extended in these fields substantially to facilitate Costa Rica to reach its Carbon Neutrality target.

With costs of 25 US$/t CO_2e, mitigation activities proposed for Costa Rica's agriculture sector require additional financial resources. As long as participation in Costa Rica's Domestic Carbon Market is voluntary, these costs will only be born by producers who value the economic benefits of their investment in mitigation activities (e.g. product differentiation via carbon neutrality) or are green by heart. As there are already a number of financial shortcomings identified regarding the government budget for climate change policies and measures, additional resources would be helpful. Since Costa Rica's has been a carbon market frontrunner since the 1990s, the carbon market could support mitigation actions in the country's agriculture sector.

In summary, Costa Rica's carbon market readiness can be considered to be medium. However, to fully exploit the mitigation potential identified for the agriculture sector, the non-financial barriers should be removed to enable Costa Rica to benefit to the fullest from carbon market activities.

4.7 Ethiopia

4.7.1 The Electricity Sector in Ethiopia

4.7.1.1 General Description of the Sector

Table 13: Ethiopia's Electricity Sector at a Glance

Number of installations	Unknown	**Absolute emissions**	3 $MtCO_2e$ (2011)
Number of companies	1 (Ethiopian Electric Power Corporation)	**Percentage of national emissions (2010)**	2%[17]
Number of CDM projects	0	**Estimated emission growth**	0% (to 2030)
Emission reduction potential	20 Mt CO_2e[18] (in 2030)	**Emissions intensity**	To remain below 5 $MtCO_2e$
Policies and measures existing	Good framework strategies for public action, but limited incentives for private investment.	**Most important barriers**	Finance and international cooperation.
Market readiness	Low		

The electricity sector in Ethiopia is managed by the state-led Ethiopian Electric Power Corporation (EEPCo) and is dominated by hydro-electric power generation, which in 2011 accounted for over 99% of the country's electricity generation (IEA 2013). As such, absolute emissions for electricity production in 2011 were just 3 $MtCO_2$ (Federal Democratic Republic of Ethiopia 2011). However, Ethiopia's electricity sector is characterised by significant supressed demand, since by 2010 only 23% of the population had access to electricity from the grid (World Bank 2013b). Significant investment in scaling up the electricity sector is required for Ethiopia to meet the targets of its *Growth and Transformation Plan* (GTP) for sustained high GDP growth (to middle income country status by 2030) and universal electrification. The 2011 *Climate Resilient Green Economy* (CRGE) strategy forecasts growth in electric power demand from 4 TWh in 2010 to approximately 77 TWh in 2030. Accordingly, EEPCo plans to expand the country's generation capacity from 7 TWh to 80 TWh, under the BAU scenario.

[17] Based on approximate GHG inventory of 150 Mt CO_2e in the year 2010 as estimated in the Climate Resilient Green Economy Strategy.
[18] Mitigation potential exceeds absolute emissions due to the potential to offset fossil-fuel combustion in neighbouring countries.

The country is endowed with an estimated potential for over 60 GW of renewable energy capacity, including 45 GW hydro, 10 GW wind and 7 GW geothermal energy (Ministry of Water and Energy 2012; Derbew 2013), and has focused its plans on the development of large scale hydroelectric facilities. The Grand Ethiopian Renaissance Dam is currently under construction and will increase Ethiopia's hydroelectric capacity from 2 GW to approximately 8 GW[19].

The electricity sector in Ethiopia is an exceptional case since the BAU scenario already represents a green growth plan. However, the country's electricity development plans face significant financial challenges, as well as potential opposition, domestically and from neighbouring countries, for example regarding the environmental impacts of large-scale hydroelectric facilities.

4.7.1.2 Mitigation Potential and Costs

It is estimated that Ethiopia can supply universal zero-emission electricity domestically by increasing its supply of renewable energy to 98 TWh by 2030 (Federal Democratic Republic of Ethiopia 2011). Additionally to the current plans of expansion to 80 TWh, this would give much room to electricity exports. The achievement of such a rapid upscale of energy supply is dependent on the availability of external investment or funding. Ethiopia is pursuing options through climate finance and development assistance. However, the CRGE and GTP documents state that any upscale of energy supply will be achieved under near-zero emission conditions as BAU, since renewable energy potential (particularly for hydroelectric power) is in abundance and is considered to be the conventional energy power source. The limited use of fossil fuels at present depends on fossil imports, and their continued usage would be costlier than the green growth strategy identified by Ethiopia (Federal Democratic Republic of Ethiopia 2011). Therefore, there is no calculated abatement of greenhouse gases from supressed demand, despite Ethiopia's huge development plans for electrification from renewable energy sources.

The single abatement potential identified in the CRGE that deviates from BAU is from the export of excess electricity to neighbouring countries, where its use would offset up to 28 TWh of fossil-fuel powered electricity, abating approximately 20 MtCO_2e. Due to the scale of co-benefits attached to the development of renewable energy capacity across a relatively poor population, where indoor air quality poses a major health concern, mitigation costs are calculated to be negative. However, an upfront investment of approximately

[19] See http://www.eepco.gov.et/abouttheproject.php?pid=1&pcatid=2 for full details on the project and its progress.

$38bn USD, or $2bn per year over the period, is required to reach this potential (Federal Democratic Republic of Ethiopia 2011).

For further details see Table 34 in the Annex.

4.7.2 The Agriculture Sector in Ethiopia

4.7.2.1 General Description of the Sector

Table 14: Ethiopia's Agriculture Sector at a Glance

Number of installations	Unknown	**Absolute emissions**	77 Mt CO_2e / an. (2010)
Number of companies	Unknown	**Percentage of national emissions (2010)**	51.3%
Number of CDM projects	0	**Estimated emission growth**	To 185 MtCO_2e in 2030
Emission reduction potential	126 Mt CO_2e	**Emissions intensity**	Unknown
% national GDP (2011)	46% (World Bank 2013a)	**Percentage of national labour force (2005)**	79.3%
Policies and measures existing	Strategy documents not supplemented by specific economic incentives.	**Most important barriers**	Finance; skills and awareness.
Market readiness	Low		

Ethiopia’s agriculture sector has been developed considerably by a period of strong economic growth over the past two decades. However, the sector remains dominated by a subsistence, low-input low-output rain-fed system, and food insecurity is still a major issue for the poorest sectors of society. Furthermore, the country’s vulnerability to periodic droughts ensures that performance gains are frequently reversed.

Despite the continued dominance of subsistence farming, agricultural produce also represents the country’s major exports. Ethiopia is the world’s tenth largest producer of livestock, and also the largest exporter of coffee in Africa (Embassy of Ethiopia 2011).

Approximately 80% of the population are employed in agriculture (Embassy of Ethiopia 2011), and the country’s GTP projects annual sectoral growth of more than 9.5% in order to keep pace with Ethiopia’s strategy to reach middle-income status by 2030 (Ministry of Finance and Economic Development 2010). Accordingly, GHG emissions from the agriculture sector, which account for over 50% of all national GHG emissions, are expected to rise from 77 MtCO_2e in 2010 to approximately 185 MtCO_2e in 2030 (Federal Democratic Republic of Ethiopia 2011).

The primary source of agricultural emissions in Ethiopia is livestock rearing, which accounted for 65 MtCO_2e in 2010 – more than 40% of the country's total emissions (Federal Democratic Republic of Ethiopia 2011). Under BAU, the cattle population is expected to increase from 50 million to 100 million, doubling the associated emissions by 2030. In arable agriculture, the primary driver for emission increases is the projected increase in cereal crop production, which is expected to increase from 19 Mt in 2010 to 71 Mt in 2030, in order to keep pace with increasing demand from the growth of the population and manufacturing industries. Therefore, GHG emissions from soil under BAU are expected to increase from 12 Mt CO2e in 2010 to 61 Mt CO2e in 2030 (Federal Democratic Republic of Ethiopia 2011) due to the more widespread use of synthetic fertilisers, manure and crop residues in soil.

4.7.2.2 Mitigation Potential and Costs

The CRGE strategy identifies mitigation potential of up to 88 Mt CO_2e/a by 2030, plus an additional 38 Mt CO_2e/a through agricultural measures that reduce the need for deforestation. The pastoral agriculture sector measures have a mitigation potential of up to 48 Mt CO_2e/a, and are expected to cost approximately USD 17.5 billion in the period from 2011 to 2030 (Federal Democratic Republic of Ethiopia 2011). These measures include intensifying of the diversification of animal herds, value chain efficiency improvements for cattle farmers, and reducing demand for oxen power through small and large scale mechanisation. The marginal mitigation costs are typically quite high (5.5 – 21.5 EUR / tCO_2e), and no positive returns up until 2030 are anticipated, meaning that grants or performance based funding are required to catalyse these measures. On the other hand, the 78 MtCO_2e/a mitigation potential of measures made in arable agriculture, which include agricultural intensification through small scale irrigation and the adoption of yield-increasing and lower-emitting techniques, carry an approximate cost of USD 30.5 billion, of which 42% is deemed to have positive returns in the short run, primarily due to the wider economic benefit of increasing agricultural yields in a country with severe food insecurity (Federal Democratic Republic of Ethiopia 2011).

See Annex 6.4, Table 35 for a full overview of potential mitigation measures.

4.7.3 Existing Policies and Measures

The 2011 Climate Resilient Green Economy Strategy (CRGE) is the first national document that comprehensively sets out options for mitigation. The strategy includes a potential package of measures (also packaged individually as NAMAs) designed to continue Ethiopia's trend of high GDP growth, whilst mitigating GHG emissions in the electricity and agriculture sectors.

Ethiopia's electrification and agriculture development plans are underpinned by the 2010 Growth and Transformation Plan (GTP). The GTP sets an ambitious target of near-zero emission electricity generation for its entire population by 2030, and focuses heavily on infrastructural development for agriculture, for which the GTP seeks to attract large scale foreign investment. On the contrary, almost all of the development of the electricity sector is envisaged under centralised public provision, although a small number of policy incentives exist for private power producers; the Rural Electrification Fund provides tax exemptions for Solar PV technologies, and modern lighting products using renewable sources. Furthermore a feed-in tariff proposal was drafted in October 2011, but as of 2013, it is still unclear if and when it will be passed as law.[20]

Government policy in agriculture has also had a long-term focus on resource efficiency improvements, and improving access to markets and finance; these were the main goals of the 1991 Agricultural Development-Led Industrialisation (ADLI), and they are reflected in the 2005-2010 Plan for Accelerated and Sustained Development to End Poverty (PASDEP) as well as the CRGE. However, there is presently a lack of targeted economic policies to directly incentivise the identified mitigation measures in the agriculture sector.

See Annex 6.4, Table 36, for a full overview of relevant policies and measures.

4.7.4 Remaining Barriers and Potential Ways Forward

The most significant barrier to the realisation of the mitigation potential is the availability of upfront finance. Implementation of the full package of measures listed is estimated to cost USD 85.5 billion between 2011 and 2030 (Federal Democratic Republic of Ethiopia 2011). Although a positive return is expected on the renewable energy expansion plans, a USD 20 billion funding gap is beyond the country's capacities. Meanwhile, for the agriculture sector, the upfront costs barrier is compounded by the fact that 73% of the required investments are considered to be economically unattractive (no positive returns by 2030) (Federal Democratic Republic of Ethiopia 2011).

Private sector investment to close the funding gap is unlikely in current conditions. Neither the institutional environment nor the market conditions are conducive to private sector participation; affordable finance is not accessible due to the small, fragmented and uncompetitive financial sector, whilst potential private initiatives are also hindered by complex and lengthy processes, as well as economic disincentives (African Development Bank 2011; Lighting Africa

[20] 2013 Investment Climate Statement – Ethiopia http://www.state.gov/e/eb/rls/othr/ics/2013/204639.htm

2012). Furthermore, significant political and technical issues exist for Ethiopia's large-scale energy expansion plans. Issues regarding the environmental impacts of proposed investment in large scale hydro facilities, along with historically tense relations with some neighbouring countries, presents potential disunity with countries upon whose cooperation Ethiopia will rely on for approval of its plans and for the potential purchase of its energy exports (African Development Bank 2011; Federal Democratic Republic of Ethiopia 2011). In addition, electricity exports, on which the CRGE plan is based, are dependent upon interconnection capacity, the infrastructure for which will not be ready until at least 2020 (African Development Bank 2011).

Lastly, there is a very poor availability of skills and awareness which are required for efficiency improvements across the supply chain in both sectors (African Development Bank 2011).

A full list of barriers is given in Annex 6.4, Table 37.

4.7.5 Scope for International Cooperation and Use of Carbon Markets

As a least developed country with very low emissions, Ethiopia has a rather low capability to mitigate climate change and holds a small share of responsibility for historic emissions. Its share of global cumulative emissions between 1990 and 2010 was only 0.2% and its per capita emissions of 1.4 tCO_2e are significantly below world average. With a per capita income of about US$ 230 and an HDI of 0.39, it is the poorest of the countries considered in this study. As a result, one can consider that Ethiopia should receive substantial international support to mobilise the domestic reduction potential.

In the electricity sector, there is little potential which goes beyond the BAU scenarios in existing studies, which assume almost 100% of renewable energy in the future. With more conservative assumptions on the BAU, there may be more relevant numbers for potentials. The methodology of this study does not render quantitative data on costs for this sector, nevertheless it shows that the current strategy of meeting the complete future demand with renewable energy is highly ambitious and faces severe financial, technical and political challenges.

Literature reveals significant emission reduction potential in the agriculture sector at medium costs. The measures considered partially may lead to important co-benefits regarding the productivity and sustainability of agricultural practices, however, the upfront investment costs are too high for stakeholders in the agricultural sector.

Using carbon markets to channel support to Ethiopia would require significant efforts to prepare the country first. Ethiopia had a very low participation in the

Clean Development Mechanism (CDM) and has no connection to other market-based instruments currently. Furthermore, data on activities and emissions is very scarce in all sectors. The agricultural sector additionally faces the challenge of fragmentation into small scale activities and a high share of subsistence agriculture, which are both difficult to monitor. The electricity sector is controlled by one state owned company, and with the government's current position to keep the sector nearly carbon-neutral, there is no market volume in this area. The ambitious target for renewable energy however should be supported internationally, and considering a less optimistic BAU, which Ethiopia could shoulder by itself, the baseline might allow a frame to generate credits for a carbon market.

The biggest barrier for implementation of mitigation measures even with positive returns in the long run are high upfront costs combined with the lack of domestic capital. Alleviation of these barriers cannot be directly targeted through existing mechanisms in carbon markets, as the payments do not flow upfront. Large-scale use of carbon markets would therefore probably have to be conceived as strategic partnership, potentially based on a sectoral approach, with provision of upfront funding instead of the currently dominating model of payment on delivery.

Market based mechanisms may become interesting to mobilise potentials in Ethiopia in the future, however market readiness needs to be enhanced before and new approaches to mechanisms must be found to address the country-specific barriers.

4.8 India

4.8.1 The Cement Sector in India

4.8.1.1 General Description of the Sector

Table 15: India's Cement Sector at a Glance

Number of installations	144 large plants	**Absolute emissions**	137 Mt CO_2 (2010)
Number of companies	42	**Percentage of national emissions**	7% of energy- and process-related CO_2 emissions
Number of CDM projects	38 (26 registered)	**Estimated emission growth**	>200% by 2020 and >500% by 2030 in BAU
Emission reduction potential	In the order of 100 Mt CO_2e in 2020 and 2030.	**Emissions intensity**	0.719 t CO2/t cement (2010)
Policies and measures existing?	Comprehensive package newly introduced	**Most important barriers**	Access to capital, high ex ante investment requirements, waste legislation, cement blending norms and standards to be adapted, low-quality waste collection, lacking social acceptance of alternative fuels and cement blending
Level of market readiness	Medium-high		

India's industrial sector accounts for 35% of total energy consumption and for 22% of total GHG emissions. Cement plus iron&steel each account for about 30% of industrial emissions (Government of India 2011). India is home to the second-largest cement industry in the world, after China (World Bank 2011). The Cement Manufacturers Association lists 144 large cement plants owned by 42 companies as well 365 mini & white cement plants, with installed capacities of 244.05 Mt and 11.1 Mt respectively (Indian Cement Manufacturer's Association 2012). By international comparison this is a high number of players. The top 4 players account for 40% of capacity (Parikh et al. 2009).

Annual production increased from about 95 Mt in 2000 to about 220 Mt in 2010, an increase of on average almost 10% per year. The sector is the third-largest user of coal in the country (Parikh et al. 2009). In 2010, it accounted for 137 Mt of CO_2 emissions, 7% of India's total energy- and process-related CO_2 emissions. The sector is projected to continue expanding rapidly as future population and economic growth and urbanisation are projected to lead to a rapid increase in demand for concrete (WBCSD and IEA 2013). Despite the strong growth of the past, per capita consumption of cement is still only 150kg per capita, 1/3 of the world average, 1/2 of the US and 1/7 of China and South Korea. Projections of future production range between 427 to 600 Mt cement in 2020, that is, nearly double or triple the 2010 volume (Government of India 2011).

4.8.1.2 Mitigation Potential and Costs

The efficiency of the Indian cement sector is among the best in the world (World Bank 2011). As about half of production capacity was built in the last ten years, many installations are very recent and use best available technology. For instance, 99% of plants use the most energy efficient dry kiln process (McKinsey 2009b; WBCSD and IEA 2013). Efficiency is also incentivised by India having some of highest industrial electricity tariffs in the world, which has driven owners of older facilities to gradually upgrade. The average emission intensity declined from 1.12 t CO2/t cement in 1996 to 0.719 t CO2/t cement in 2010 (WBCSD and IEA 2013).

There is nevertheless some scope for additional efficiency improvements. In addition, there is scope to increase the use of alternative fuels such as waste, to decrease the share of clinker, to expand the use of waste heat recovery, and to reduce emissions from captive power plants. In total, Government of India (2011) considers that bringing down the clinker/cement ratio to 0.75 by 2020, increasing fuel substitution to 10%, and adoption of BAT by smaller units could lead to a decrease of emissions intensity of 1.8% per year. This would bring overall emission intensity of the industry down to 0.59 t CO_2 /t cement, resulting in 293.5-335 Mt CO_2 of emissions in 2020. Maintaining 2007 intensities would lead to emissions of 393.5-448.5 Mt CO_2. The World Bank has projected that adoption of currently commercially available process improvement options in 80% of plants by 2020 together with exogenous efficiency improvements of 0.5% per year would result in emission reductions of about 100 Mt CO_2-eq. by 2031 (with emissions standing at 601 instead of 700 Mt CO_2-eq), compared with a scenario based on implementation of the currently adopted Five-Year-Plans (World Bank 2011).

A technology roadmap developed by the WBCSD and the IEA considers that in a 2 degree scenario (2DS) emission growth till 2050 could be contained at 100% (with low demand for cement) to 240% (high demand), instead of 255-510% in a “business as usual” six degree scenario (6DS) (see figure below). The additional investment required to achieve these emission reductions is estimated at between US$ 29 billion (low demand) and 50 billion (high demand), 15%-25% higher than in the 6DS. More than half of the additional investment would be required for CCS (WBCSD and IEA 2013).

Details on the individual mitigation options are provided in Annex 6.5.

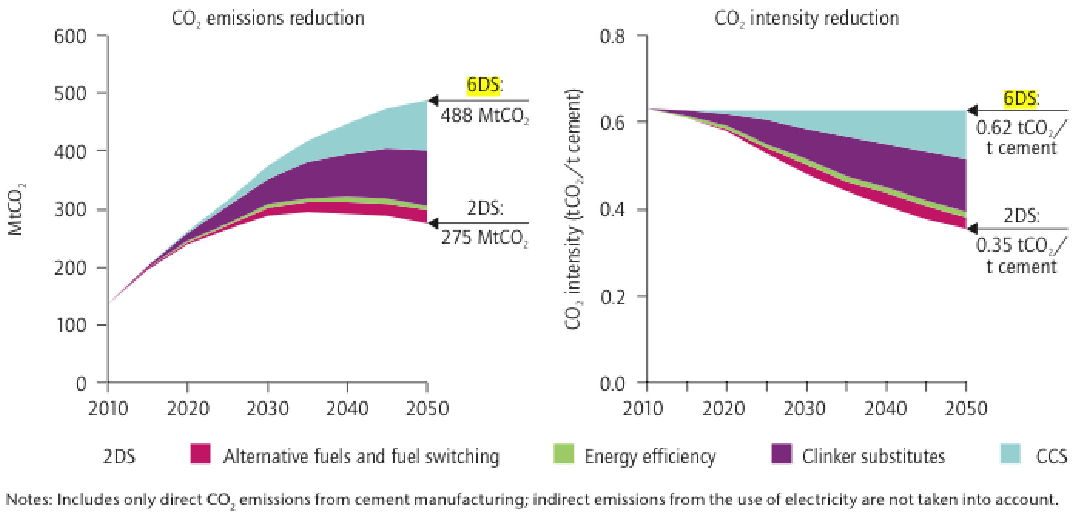

Figure 10: Direct CO2 emissions and intensity reduction by each technology in the Low-Demand Case (WBCSD and IEA 2013)

4.8.2 The Iron&Steel Sector in India

4.8.2.1 General Description of the Sector

Table 16: India's Iron&Steel Sector at a Glance

Number of installations	11 integrated steel plants plus high number of small plants	**Absolute emissions**	117.32 Mt CO_2-eq. (2007)
Number of companies	9 large companies	**Percentage of national emissions**	6.6% of energy- and process-related CO_2 emissions
Number of CDM projects	102 projects (56 registered), 4 PoAs (2 registered)	**Estimated emission growth**	About 350% by 2020 and about 800% by 2030 in BAU
Emission reduction potential	40 Mt CO_2e in 2020 and 140 Mt CO_2e in 2030	**Emissions intensity**	2.21 Mt CO_2-eq./t crude steel (2007)
Policies and measures existing?	Comprehensive package newly introduced	**Most important barriers**	Access to capital, high ex-ante investment requirements, quality of domestic iron ore and coal, low availability of scrap, lacking awareness of /reluctance to invest in efficiency
Level of market readiness	Medium-high		

India is the world's largest producer of sponge iron, with production of 20.37 Mt in 2011-12, and the fourth largest producer of steel, at 73.42 Mt of crude steel. India expects to become the largest steel producer by 2015 (Government of India, Ministry of Steel 2012). Iron&steel emitted 117.32 Mt CO_2-eq. in 2007 (Government of India 2011).

Despite the strong growth, per capita consumption of steel is still low in India at only 40 kg while the global average is 150 kg and the average in developed countries is 350 kg (Parikh et al. 2009). Production projections for 2020 range from 110 to 293 million tonnes (Government of India 2011). The sector is highly concentrated, nine companies produce 64% of total crude steel, with the remainder being produced by small-scale industries (World Bank 2011). In 2008, there were 11 integrated steel plants and there is a high number of smaller plants (Bushan 2010).

4.8.2.2 Mitigation Potential and Costs

Due to the strong production growth over the last two decades, there are many new plants that use state of the art technology and many of the large older plants have been upgraded, but upgrades have been more limited in small plants. Specific energy consumption has decreased from 42 GJ/Mt of crude steel in 1990 to 27.3 GJ/Mtcs in 2009 but is still high compared to other countries such as Japan (23.3 GJ/Mtcs), the USA (20.1 GJ/Mtcs) and China (25.6 GJ/Mtcs). Average emission intensity stood at 2.21 Mt CO_2-eq. per tonne of crude steel in 2007 (Government of India 2011). International best in class plants achieve intensities of 1.2 Mt CO_2-eq./tcs (Parikh et al. 2009). The lower efficiency is due to multiple factors, including a large share of old plants, poor coal and iron ore quality, low utilisation of scrap, and a large number of small-scale plants (Bushan 2010).

Emission reduction potential lies in the areas of energy efficient technologies and processes, shift to scrap-based Electric Arc Furnaces and to gas-based direct reduced iron, use of larger blast furnaces, coke substitution, direct casting and cogeneration. India's Expert Group on Low Carbon Strategies estimated that in the BAU scenario emission intensity would decline to 2.03 Mt CO_2-eq./tcs by 2020 and could be reduced further to 1.8 Mt CO_2-eq./tcs with an "aggressive mitigation regime". Based on production projections of 200 Mt, this would yield overall emissions of 406 and 360 Mt CO_2-eq. respectively (Government of India 2011).

McKinsey estimates that 2030 steel sector emissions could be reduced from 735 Mt CO_2-eq. in the BAU scenario to 573 Mt CO_2-eq. through energy efficiency measures and technology changes, recycled raw materials and alternative fuels (McKinsey 2009b). The World Bank similarly sees a reduction potential in iron plus steel from 934 Mt CO_2-q. to 794 Mt CO_2-eq in 2031 (World Bank 2011).

Data on the cost of individual mitigation options is scarce. The Expert Group on Low Carbon Strategies notes that “lack of extensive cost data has made impossible the cost estimation of different mitigation measures.” (Government of India 2011)

Details on the individual mitigation options are provided in Annex 6.5.

4.8.3 Existing Policies and Measures

India has various policies and measures in place to promote energy efficiency and emission reductions. The 12th Five-Year-Plan for the period from 2013-2017 for the first time dedicated a chapter to sustainable development. The major pillar of climate policy is the National Action Plan on Climate Change (NAPCC), which covers the time period up to 2022 and contains targets and strategies for eight priority areas, the “missions”.

The most relevant mission for industry is the National Mission for Enhanced Energy Efficiency, which builds on existing initiatives, in particular the Energy Conservation Act of 2001, with four new programmes:

- the Perform, Achieve, and Trade (PAT) system for tradable energy savings certificates,
- Market Transformation for Energy Efficiency, which aims to accelerate the shift towards energy efficient appliances,
- the Energy Efficiency Financing Platform, which aims to improve access to commercial lending for Energy Service Company (ESCo) projects, and
- the Framework for Energy Efficient Economic Development, which aims to stimulate commercial lending for energy efficiency.

The aim of the NMEEE is to avoid capacity addition of about 19.5GW by 2017. However, as these instruments have only recently been introduced their effectiveness cannot yet be gauged.

Further details on the existing policies and measures are provided in Annex 6.5.

4.8.4 Remaining Barriers and Potential Ways Forward

According to the WBCSD/IEA roadmap, economic incentives as provided by the PAT scheme could play a key role in mobilising the available potential. They recommend continuation of the PAT scheme and elimination of energy price subsidies. They also recommend establishing a minimum price for PAT certificates, similar to India’s renewable energy certificate trading system, in order to encourage companies to implement projects with high capital expenditure and long payback periods (WBCSD and IEA 2013).

However, provision of economic incentives will by itself probably not be sufficient to mobilise the available potential due the existence of substantial non-price barriers, which would need to be removed for all mitigation options to become fully viable, including through legislative and other government activity:

- Many companies, especially SMEs, require support with access to investment capital for the adoption of best available technologies (Government of India 2011; Parikh et al. 2009).
- Exploitation of the available energy efficiency potential is hampered by lack of information, reluctance, and lack of business models and financial products to invest in energy efficiency, both within industry and financial institutions. Awareness raising and capacity building for industrial managers and engineers and for bank managers is therefore needed (Limaye et al. 2012).
- Waste legislation must be changed to support co-processing in the cement industry as alternative to incineration and to enable effective and standardised waste collection, treatment and processing (Government of India 2011; Parikh et al. 2009; WBCSD and IEA 2013).
- Waste pricing must ensure low cost to cement manufacturers in order to encourage them to install the costly handling, storage and firing facilities (WBCSD and IEA 2013).
- Social acceptance of using wastes as alternative fuels must be improved by awareness programmes and appropriate governing mechanisms, such as pollution standards (WBCSD and IEA 2013).
- To promote clinker substitution there is a need for modifying cement blending norms and standards as well as building codes and for regulatory policies to ensure quality control of blending materials (Government of India 2011; Parikh et al. 2009; WBCSD and IEA 2013).
- Programmes are needed to raise consumer awareness and confidence in blended cement as well as to train personnel in the use of BAT (Parikh et al. 2009; WBCSD and IEA 2013).
- The low quality of Indian coal and iron ore limits exploitation of the available efficiency potential. Emerging technologies like the COREX process are better suited for Indian feedstock and coal quality but require further research and development (Government of India 2011).

- Further R&D is also required for use of the direct reduced iron process (Parikh et al. 2009).
- The utilisation of scrap is limited by low scrap availability, which could be alleviated by provision of better incentives for scrap collection (Parikh et al. 2009).

Further information on existing barriers is provided in Annex 6.5.

4.8.5 Scope for International Cooperation and Use of Carbon Markets

India scores low on many indicators denoting responsibility for and capability of tackling climate change. While its share of global cumulative emissions between 1990 and 2010 was 4%, its per capita emissions are only 1.9 t CO_2-eq., accumulated per capita emissions are 28 t CO_2-eq. Per capita income stands at about US$ 1,000. Its Human Development Index score is 0.55, the third lowest among the countries considered in this study, after Ethiopia's and Kenya's (0.39 and 0.51 respectively) (see chapter 3 for data sources).

Accordingly, most effort sharing proposals allocate a rather low share of the overall global effort necessary to achieve the 2°C target to India. On this basis, one may consider that Indian responsibility for taking own efforts without support mainly relates to mobilising reduction potential with negative or low cost, such as most efficiency improvements and clinker substitution. Some of the available mitigation options also have the potential to yield multiple dividends. As identified in the National Mission on Sustainable Habitat, effective management of solid waste emanating from the growing urban population and from industries has become a key concern. Cement kilns are well-suited to dispose of different kinds of wastes through use as alternative fuel (WBCSD and IEA 2013).

By contrast, given India's low scores on capability and responsibility, strong international support should be provided to mobilise mitigation options with higher costs, such as use of modern steel production technologies and use of renewable electricity and carbon capture and storage.

Prospects for the use of market-based instruments are generally good. India is one of the leading CDM host countries, with about ¼ of all projects. The CDM has in particular demonstrated potential to achieve emission reductions in Indian industry. UNEP Risø lists 38 cement sector CDM projects in its pipeline, of which 26 are already registered: 14 cement blending projects (13 registered), 6 projects (4 registered) to utilise alternative fuels, 9 projects (5 registered) aiming at utilisation of waste heat, and 9 projects (4 registered) to improve thermal and electric efficiency. There are also 102 iron&steel sector CDM projects in the pipeline, of which 56 are already registered: 94 (53 registered) waste heat recovery projects, 7 projects (2 registered) to improve thermal and electric efficiency, and one unregistered oil to gas fuel switch project. Steel companies are also involved in 4 biomass energy and in 8 wind energy projects, all of them registered. In addition, there are 2 registered PoAs and 2 at validation to improve energy efficiency in the steel industry (UNEP Risoe Centre 2014b).

India is also making use of market-based instruments domestically, namely the PAT scheme for energy efficiency as well as trading of renewable energy certificates. Among developing countries, India can therefore be considered to have a relatively high carbon market readiness.

Regan and Mehta (2012) suggest use of international climate finance for the purchase of PAT certificates in order to ensure a meaningful price signal for what is an innovative domestic policy instrument. Alternatively, PAT credits could be converted into internationally fungible carbon units such as CERs. Given India's carbon intensive fuel mix, they estimate that 1toe is equivalent to 3.5-4.0 t CO_2-eq. They also estimate that achieving a PAT price of about US$ 10 would require finance of about US$ 48.82 million and could lead to additional energy savings of 6.6 mtoe per year, which translates to 23.1-26.4 Mt CO_2-eq.

However, given the existence of strong non-price barriers, such as lack of acess to capital, high investment cost of some mitigation options, regulatory barriers and technical capacity problems, use of carbon market instruments will probably only be able to fully exploit the available potential if combined with support for access to investment capital and significant regulatory changes and capacity building activities. In a similar vein, Regan and Mehta suggest provision of budget support for ambitious policies like PAT, supporting investment funds by providing equity in order to leverage private investment, and providing credit lines through local banks, for example through the Market Transformation for Energy Efficiency scheme (Regan and Mehta 2012).

The NMM could theoretically provide a framing for folding all the necessary legislative and other actions into one overall programme. As it has been discussed internationally, the NMM would mainly provide an emission accounting framework for setting sectoral emission targets. The host country could undertake an unlimited number of initiatives to achieve the sectoral target. The NMM could thus theoretically provide a framework for folding the necessary regulatory changes, provision of access to investment capital, and awareness raising and capacity building activities into one programmatic approach, together with the provision of emission credits to enhance the economic viability of mitigation options.

4.9 Kenya

4.9.1 The Agriculture Sector in Kenya

4.9.1.1 General Description of the Sector

Table 17: Kenya's Agriculture Sector at a Glance

Number of installations	Unknown	**Absolute emissions (2009)**	26 $MtCO_2e$
Number of companies	Unknown	**Percentage of national emissions (2009)**	56% of 46 $MtCO_2e$
Number of CDM projects	0	**Estimated emission growth**	Up to 27 $MtCO_2e$ by 2030
Emission reduction potential	6.48 $MtCO_2e$	**Emissions intensity**	Unknown
Percentage of national GDP	26.9% (2011)	**Percentage of national labour force employed**	61% (2005)
Policies and measures existing	Strategy documents with limited measures for operationalizing.	**Most important barriers**	Finance, awareness
Market readiness	Low		

Sources: (World Bank 2013b; Republic of Kenya 2012; WRI 2013)

The agriculture sector in Kenya has been identified by the country's *Vision 2030* plan, and the *Second Medium Term Plan 2013-2017* (Republic of Kenya 2013a) as the pivotal sector for driving the wider development of the country's economy. The sector employs approximately 70% of the rural workforce (Republic of Kenya 2012), and its development is key to the achievement of national targets regarding rural human development and food security. 75% of agriculture in Kenya is small-scale (less than 3 hectares), and subsistence agriculture is very widely practiced. However, agriculture is also a major export industry, with horticulture and tea accounting for 23% and 22% of the country's total exports, respectively.

The agriculture sector has experienced a growth slump in recent decades, and in recent years following the post-election violence in 2007 and the global financial crisis, but 2011 and 2012 saw a return to modest growth (World Bank 2013b). Kenya expects growth to continue, and GHG emissions to increase from 19.92 $MtCO_2e$ in 2010 to approximately 27 $MtCO_2e$ in 2030.

The largest driver of emissions growth is from the projected increase in livestock headcounts; enteric fermentation accounts for 90% of agricultural emissions and is forecast to produce 23.9 $MtCO_2e$ in 2030. Residue burning, manure management, rice flooding and the use of nitrogen fertilisers are the other significant emission sources (Republic of Kenya 2012).

4.9.1.2 Mitigation Potential and Costs

Accurate calculation of mitigation potential in Kenya has been hindered by the unavailability of reliable GHG inventories; until the 2010 estimates were published in the Climate Change Action Plan (Republic of Kenya 2012), the most recent GHG inventory was published in 2002, but based on 1994 data[21]. Potentials and costs given in Table 42 of Annex 6.6 are, therefore, stressed as approximations in the respective sources. Nevertheless, it is clear that none of the identified mitigation options offer sufficient short term co-benefits in order to classify them as negative abatement costs (Stockholm Environment Institute 2009; Republic of Kenya 2012; FAO 2013). These measures would therefore require external investment of grant funding in order to be economically attractive. Accordingly, Kenya intends to develop the agroforestry, conservation tillage and fire-use limitation measures as NAMAs and seek climate finance (Republic of Kenya 2012).

4.9.2 Existing Policies and Measures

Aside from the National Climate Change Action Plan (Republic of Kenya 2012), which provides the most comprehensive overview of the mitigation potential of the agriculture sector and highlights some potential measures, no other recent policy documents explicitly address mitigation issues or provide direct economic incentives that may drive mitigation in the sector. A number of strategy documents exist for climate change and agriculture, but there is a lack of specific targeted measures or incentives to operationalize these strategies. Policies are based primarily on securing growth and development within the sector, but also address many barriers that apply to the mitigation potential.

Relevant policies for the development and mitigation in the sector are listed in Table 43 of Annex 6.6.

4.9.3 Remaining Barriers and Potential Ways Forward

The most significant barriers for the implementation of mitigation measures are the availability of finance, given the positive costs of investment, and the low level of awareness and acceptance of new techniques at the individual level (Republic of Kenya 2012). The behavioural shift which is required for the

[21] See http://unfccc.int/di/DetailedByParty.do

acceptance and uptake of new techniques is dependent on significant improvements in information flows and the availability of extension services.

Weak markets and market information for physical and financial inputs, as well as insecure land tenure, prevent smallholders from implementing and achieving the diverse benefits of agroforestry (Ministry of Environment and Natural Resources 2005). Furthermore, a lack of knowledge and skills on best practice for agricultural techniques remains at all levels. Further research and knowledge dissemination is required.

A full list of barriers is given in Annex 6.6, Table 44.

4.9.4 Scope for International Cooperation and Use of Carbon Markets

As a least developed country with very low emissions, Kenya, similarly to Ethiopia, has a low capability to mitigate climate change and holds a small share of responsibility for historic emissions. Its share of global cumulative emissions between 1990 and 2010 was only 0.1% and its per capita emissions of 1.1 tCO_2e. are significantly below world average. With a per capita income of about US$ 575 and an HDI of 0.51, it is among the poorest of the countries considered in this study. As a result, one can consider that Kenya should receive substantial international support to mobilise the domestic reduction potential. It is unlikely to be able to shoulder the relatively high costs identified in the section above alone.

With the participation in the CDM, Kenya was able to start building its carbon market readiness: 16 CDM projects have been registered in total, which is more than most other countries in the region. However, there are no CDM projects in the agricultural sector. This is not a specific finding for Kenya, the agricultural sector in general is underrepresented in CDM (UNEP Risoe 2014). Additionally, Kenya is discussing carbon market related activities, and includes considerations on how international carbon markets can be used to support national mitigation actions in its Climate Change Action Plan (Republic of Kenya 2013b). This demonstrates openness to market based approaches.

Emission data availability in Kenya is very limited in general, and even more restricted in the agricultural sector. Especially small and subsistence farmers are not adequately covered. If the agricultural sector was to participate in carbon trading, activities should likely be focused on larger agro-industrial companies.

At this moment in time, Kenya is only partially carbon market ready. Further preparation of stakeholders would be necessary in order to use carbon market mechanisms on a larger scale to support emission reduction activities there. A new mechanism could potentially consider the specific needs of the countries to alleviate country barriers to mitigation.

4.10 Morocco

4.10.1 The Electricity Sector in Morocco

4.10.1.1 General Description of the Sector

Table 18: Morocco's Electricity Sector at a Glance

Number of installations	No. unknown, capacity 5.3 GW in 2008	**Absolute emissions**	16.4 Mt CO_2 (2006)
Number of companies	One dominant state utility, some municipal utilities and independent producers	**Percentage of national emissions**	41% (2006)
Number of CDM projects	24 (20 registered)	**Estimated emission growth**	Ca. tripling of all energy-related emissions in 2000-2030
Emission reduction potential	About 40 Mt CO_2e in 2030	**Emissions intensity**	759 g CO_2/kWh (2006)
Policies and measures existing?	Ambitious targets but lack of financing mechanisms	**Most important barriers**	Access to capital, high ex ante investment requirements, lack of financing mechanisms, monopolistic sector structure, no access to low-voltage grid, fossil fuel subsidies, limited human capacity
Level of market readiness	Low		

Emissions from electricity generation in Morocco have risen quickly over the last two decades, mainly due to successful electrification, which increased from 18% in 1995 to 90% in 2006 (Karakosta and Psarras 2013). Looking forward, the government projects that installed capacity will increase to 12-20 GW by 2030. Total energy-related emissions are projected to roughly triple from 2000 to 2030, from 34.139 Mt to 94.557 Mt CO_2e (Government of Morocco 2010).

Morocco's electricity sector has so far been strongly fossil-based. In 2010, fossil fuels had a share of 77.3%, with coal alone accounting for 53.4%. Hydro, including pump storage plants, had a share of 6.1% and wind a share of 1%. Morocco had to import 15.8% of its electricity consumption. In addition, only 1% of the consumed fossil fuels is produced domestically, 95% of overall energy consumption is imported (Vidican et al. 2013). In 2006, power plant emissions were 16.4 Mt CO_2e, 41% of the national total. The emission intensity was 759g CO_2/kWh (Galeazzi 2009).

The national utility, the Office National de l'Électricité et de l'Eau Potable (ONEE), owns the entire transmission grid and the majority of the distribution grid. It also manages retail sales to final consumers for most of the country, while seven local municipal authorities manage distribution themselves or via commissioning private companies (Vidican et al. 2013).

4.10.1.2 Mitigation Potential and Costs

Morocco's second national communication contains a reference and a mitigation scenario up to 2030. According to these scenarios total national 2030 emissions would attain 160,8 Mt CO_2e in the reference scenarios and may be reduced by 57.6 Mt CO_2e at an investment of US$29.6 billion. 2/3 of this potential relate to electricity generation and include mainly wind, solar, hydro and nuclear power and combined cycle gas turbines (Government of Morocco 2010).

In another study Galeazzi calculates that implementation of Morocco's current energy targets for 2030 (see following section) would reduce emissions from 151.3 Mt CO_2e projected in a BAU scenario to 75.6 Mt CO_2e. According to his calculation the average abatement cost of this scenario is negative. Galeazzi also calculates an "ambitious scenario" with 30% efficiency improvement and 70% renewables. In this scenario emissions are reduced to 47 Mt CO_2e. The average abatement cost of this scenario is US$15/t CO_2, which is low compared to historic carbon prices (Galeazzi 2009).

Details on the individual mitigation options are contained in Annex 6.7.

4.10.2 Existing Policies and Measures

Driven not least by its near-total energy import dependence, Morocco has set a number of ambitious targets, which it also submitted as NAMAs under the Cancún Agreements. These include targets of 2GW of solar by 2020, 5 GW of wind by 2030, 2 GW of nuclear, 300 MW of small hydro, 870MW of combined cycles, as well as specific hydropower and combined cycle plants and electricity saving programmes.[22] In addition, Morocco's energy strategy includes targets to reduce energy consumption by 12% below BAU by 2020 and to increase the share of renewables in installed capacity to 42%, with 2GW each from solar, wind and hydro. These 6GW are expected to account for 20% of electricity consumption. By 2030, efficiency is to improve by 15% compared to BAU and renewables are to attain an electricity generation share 31%.

[22] Compilation of information on nationally appropriate mitigation actions to be implemented by developing country Parties, FCCC/SBI/2013/INF.12/Rev.2, 28 May 2013

Morocco has also established an elaborate legal and institutional framework for the promotion of renewable energy and energy efficiency. A National Committee for Climate Change was established in 2001 and a Center for Development and Renewable Energies (CDER) was established already in 1982. In 2009, it was transformed into the National Agency for the Development of Renewable Energies and Energy Efficiency (ADEREE). Morocco also has a dedicated Agency for Solar Energy (MASEN) as well as several promotion programmes.

Details on the individual policies and measures are contained in Annex 6.7.

4.10.3 Remaining Barriers and Potential Ways Forward

Despite the ambitious targets and elaborate institutional infrastructure, renewable energy deployment still faces various strong barriers that need to be overcome:

- Experts urge substantial energy market liberalisation. ONEE sill has a monopoly on electricity transmission and is the single buyer of electricity from independent power producers. There is no possibility to sell to the grid or directly to customers. There also is no separate energy regulator, all issues must be addressed to ONEE (Enzili 2010; Karakosta and Psarras 2013; Vidican et al. 2013).
- Energy subsidies are distorting the competition between fossil fuels and renewables and should therefore be re-targeted (Vidican et al. 2013).
- There is no grid access for installations of 10kW to 1MW and there are no financing mechanisms for decentralised installations such as feed-in-tariffs, net metering or renewable energy certificates. The main instrument of renewables deployment has so far been large-scale tenders. The market for small-scale applications is thus negligible (Vidican et al. 2013).
- Investment is also hampered by the high upfront costs of renewables combined with lack of access of to investment capital. Banks are reluctant to invest in renewables due to limited knowledge and the higher upfront costs and associated higher risks of renewables. The banking sector therefore needs to be assisted with building up expertise in renewables financing (Fujiwara, Alessi, and Georgiev 2012; Vidican et al. 2013).
- There is a severe lack of experts and skilled workforce to operate and maintain renewable energy plants. There is therefore a need for education and training programmes for technicians and installers

(Fujiwara, Alessi, and Georgiev 2012; Karakosta and Psarras 2013; Vidican et al. 2013).

- The investment capacity of households is also very limited. One might therefore envisage incentives such as a “solar credit” programmes to help households invest in the necessary equipment (Vidican et al. 2013).

Further information on existing barriers is contained in Annex 6.7.

4.10.4 Scope for International Cooperation and Use of Carbon Markets

Morocco scores low on indicators denoting responsibility for and capability of tackling climate change. Its share of global cumulative emissions between 1990 and 2010 was close to zero, its per capita emissions are only 1.4 t CO_2-eq., accumulated per capita emissions are 25 t CO_2-eq. Per capita income stands at about US$ 2,387. Its Human Development Index score is 0.59, the fourth lowest among the countries considered in this study (for data sources see work chapter 3). Accordingly, most effort sharing proposals allocate a rather low share of the overall global effort necessary to achieve the 2°C target to Morocco. This picture given by the aggregate indicators is reflected in the more specific sectoral assessments on the country’s lack of financial, technical and human capacity.

While Morocco has an inherent interest in reducing its energy import bill and has set ambitious targets, it will therefore need international support to actually achieve them. There is also scope to go further than Morocco’s current plans. Analysts consider that 4-7 GW of wind could feasibly be installed by 2020, while Morocco’s current target is 2GW (Perspectives and Alcor 2011).

Morocco is already taking steps to mobilise support from the international community. It received support from the World Bank to develop its 2GW Solar Plan as well its wind energy plans into concepts for credited and supported NAMAs (Perspectives and Alcor 2011). Construction of first 500MW solar plant Ourzazate is underway with support from World Bank, French and German development banks and other lenders (Hering 2012). Morocco’s Expression of Interest to the Partnership for Market Readiness PMR highlights the need for support to build and improve MRV processes, the identification, development and crediting of NAMAs and capacity building for piloting new market instruments (Government of Morocco 2011).

Morocco has been among the most active countries in the Mediterranean region in promoting CDM activities and has received substantial capacity building support (Karakosta and Psarras 2013). However, given the amount of support received, the number of projects is rather low (Perspectives and Alcor 2011). UNEP Risø lists in total 18 projects, 14 of which are registered. Among these, there are 8 wind and 2 solar electricity projects (all registered). In addition, there are 6 PoAs (all registered), four of which implement renewable energy technologies (UNEP Risoe Centre 2014b). 2/3 of the 43 projects that had been examined by the DNA as of May 2011 had been developed by the public sector (Government of Morocco 2011). This further highlights the lack of possibilities for private market actors.

Given this strong state dominance and corresponding lack of entry points for private sector engagement, the most promising options for international engagement may lie with working through the Moroccan government. Given the homogeneity of the product electricity and the relative ease of calculating the sector's emission intensity, one option is to establish a sectoral crediting programme on this basis. Morocco could set a target for the emission intensity of its electricity generation, overachievement of which could yield emission credits. Implementation could include the following measures:

- Establishment of an incentive scheme such as feed-in tariffs, net metering or tax rebates;
- Establishment of a fund providing grants, loans and/or payment guarantees to companies and households to help them shoulder the upfront investment requirement;
- Regulatory reform to increase the participation of independent power producers in the market.

Morocco could use the carbon revenue to directly co-finance such domestic financing instruments. One reason why no such scheme as so far been introduced has been the fear of its budgetary implications (Vidican et al. 2013). Providing an additional revenue stream to the Moroccan government might help alleviate such concerns. Alternatively, the government might continue with its current state-led approach and directly invest in new installations.

However, given Morocco's lack of capital, such an approach could probably not work with the CDM's traditional payment on delivery model but would require provision of upfront finance. This could be provided by the buyers of the emission reductions, but arguably only public buyers would be willing to provide such support. Alternatively, one might consider a blended approach combining a supported NAMA with sectoral crediting.

Fujiwara et al. note that there is an already established framework that could be used to establish such a cooperation: The Union for the Mediterranean, which includes energy cooperation and specifically a Mediterranean Solar Plan to promote the large-scale development of renewables and efficiency in the Mediterranean basin. In addition, several donors have established the

Mediterranean Carbon Fund, which could be used as vehicle for the purchase of emission credits (Fujiwara, Alessi, and Georgiev 2012).

4.11 Peru

4.11.1 The Electricity Sector in Peru

4.11.1.1 General Description of the Sector

Table 19: Peru's Electricity Sector at a Glance

Number of installations	Unknown	**Absolute emissions (2000)**	3.1 $MtCO_2e$ (Year 2000)[23]
Number of companies	Unknown	**Percentage of national emissions (2000)**	4% (of 76.3 $MtCO_2e$)
Number of CDM projects (2013)	54	**Estimated emission growth**	Unknown for electricity. Primary energy demand from 25.4 $MtCO_2e$ in 2000 to 70 $MtCO_2e$ in 2050.
Emission reduction potential	Unknown	**Emissions intensity**	297 gCO_2/kWh
Policies and measures existing	Limited number of incentives, overcrowded by competing incentives with natural gas.	**Most important barriers**	Lack of data and uncertainty regarding feasibility, political preference for natural gas.
Market readiness	Medium		

Sources: (IEA 2013; MINAM Peru 2010; EDGAR 2011)

In 2010, Peru's privatised electricity sector was powered primarily by hydro (55%) and natural gas (36%) (IEA 2013). The development of feasibility studies for the potential contribution of renewable energy is immature, as is the implementation of renewable technologies; only 732 GWh and 1 GWh was produced in 2010 from biofuels and wind power, respectively, from a total production of approximately 36,000 GWh (IEA 2013).

The availability of data regarding emissions in Peru remains poor. The most recent emissions inventory is for the year 2000, before the discovery of large natural gas reserves, at which point hydro accounted for over 80% of the electricity production (IEA 2013). Peru is in the process of compiling a new emissions inventory and a comprehensive climate change action plan under the name of PlanCC[24], which is due for completion in summer 2014.

In 2000, the electricity sector accounted for just 12% of the overall emissions from primary energy consumption, which was dominated by oil and natural gas

[23] The most recent emissions inventory available for Peru is for the year 2000

[24] See http://www.planccperu.org/Project-Objectives for details.

(MINAM Peru 2010). Electricity's share of primary energy demand can be expected to significantly increase in future inventories, due to improvements in the rate of electrification. Furthermore, overall emissions from primary energy are forecast to increase from 25.4 $MtCO_2e$ in 2000 to approximately 70 $MtCO_2e$ in 2050 (MINAM Peru 2010).

4.11.1.2 Mitigation Potential and Costs

The literature widely postulates that Peru has the natural resource base for significant mitigation potential through renewable energy technologies. However, until the completion of the PlanCC project, data related to mitigation potential in Peru is very limited. Table 48 in Annex 6.8 summarises the available information regarding areas of potential mitigation action, and resource potential for renewable energy technologies.

Hydro and wind power are estimated to hold the most potential, with up to 59 GW and 22 GW of technical potential, respectively. Large areas in Peru also hold great potential for solar energy with irradiance levels of 5.24 kWh/m^2. Potentials for biomass have not been quantified but are said by the national climate change communication paper to be very high (MINAM Peru 2010). Some potential areas of action have been highlighted by the national communication, including an increase in the proportion of hydro and renewables in the energy mix, increased use of combined cycle combustion in natural gas plants, and the construction of micro-scale renewable solutions in rural areas, but quantified projections of potential and cost are not currently available.

4.11.2 Existing Policies and Measures

Peru has introduced a number of policies aimed at incentivising private investments in renewable energy. Tax exemptions for renewable energy powered electricity have been introduced, and a tender process for the private development of renewable energy facilities took place in 2008, through which 511 MW of generating capacity was contracted. Furthermore, Decree 1002 sets premiums for some renewable energy powered electricity, and requires that renewable energy gets priority dispatch and priority connection in the grid.

Despite these measures, incentives for natural gas have also been institutionalised in law, and several policy documents, including the National Energy Plan (2009), still focus on natural gas as the key power source of the future. Renewable energies are therefore still unable to compete on a financial or an institutional setting with natural gas.

Table 49 of Annex 6.8 provides a summary of the relevant policies.

4.11.3 Remaining Barriers and Potential Ways Forward

Given the privatised nature of the electricity sector in Peru, strong economic incentives and risk reduction measures are required to convert the countries renewable energy potential into implemented projects. The few incentives that are available are outweighed by tax incentives for natural gas, and the focus on natural gas in strategy papers provides no reassurance to potential investors.

Despite these unconducive institutional conditions, the most immediate barrier might be the very poor availability of knowledge regarding the sector's current condition and its mitigation options. The completion of the PlanCC project should go some way to mitigate this barrier, but public awareness and the local availability of renewable energy expertise and technologies are also poor.

Some more remote areas where much of the resource potential is located are far away from the grid network and also characterised by informality of legislation. Furthermore, the feasibility of the potential itself is threatened by changing rainfall patterns, which should restrict the country's dependence on hydro power.

A list of the barriers is given in Table 50 of Annex 6.8.

4.11.4 Scope for International Cooperation and Use of Carbon Markets

Peru's economy is among the most fast-growing in Latin America, nevertheless it still scores rather low on indicators for responsibility for climate change and its capability to mitigate. Its share of global cumulative emissions between 1990 and 2010 was only 0.15% and its per capita emissions were 2.7 tCO_2-eq. in 2010. With a per capita income of about US$ 3835 and an HDI of 0.73, it is in the medium range of the countries considered in this study. As a result, one can consider that Peru should mobilise the cost-effective part of its domestic reduction potential by itself, but still receive substantial support for more expensive measures. As no reliable data exists for mitigation potentials, this study cannot identify which areas should receive specific support.

The prospects for carbon markets to channel support to the electricity sector are rather positive. CDM has been popular in the sector and the potential for renewable energy is recognised by foreign investors. Peru has also been very proactive in facilitating the development of CDM projects. Peru, as the host of the next climate conference, additionally may have specific interest in promoting domestic mitigation activities further. The current barriers for mitigation and the insufficient policy framework in the electricity sector reveal the need for additional support in this area. A fall-back is the current data availability, which may improve with the current activities on GHG inventories and mitigation potentials. Nevertheless, covering the remote rural areas will be challenging.

While Peru recently has been mostly focusing on Nationally Appropriate Mitigation Actions to scale up its mitigation activities, the country may be an interesting case to develop new pilot market mechanisms and enhance market readiness of the electricity sector further. A potentially interesting area is renewable electricity generation for off-grid areas, which would lead to significant benefits for the population and is in line with Peru's development plans.

4.12 South Africa

4.12.1 The Electricity Sector in South Africa

4.12.1.1 General Description of the Sector

Table 20: South Africa's Electricity Sector at a Glance

Number of installations	ca. 50, 17 coal-based	**Absolute emissions**	ca. 237 $MtCO_2e$ (2010)
Number of companies	6 (dominated by 1 state-owned utility, Eskom)	**Percentage of national emissions**	45% (2003)
Number of CDM projects	33 registered, 8 at validation	**Estimated emission growth**	ca. 16% (275 $MtCO_2e/a$ emission limit imposed by IRP) in 2030
Emission reduction potential	35-38 $MtCO_2e/a$ in 2020 (renewables only)	**Emissions intensity**	0.8 tCO_2e/MWh (2010)
Policies and Measures existing	Comprehensive sectoral plan Linkage to development and Climate change plans by different gov't departments Various other PaMs	**Most important barriers**	Quasi-monopolistic structure of the sector High initial technology cost Grid integration of renewable energies Fragmented policy space Limited GHG inventory data
Level of market readiness	sector included in carbon tax plans options for carbon trading rejected		

The South African electricity sector is by far the largest source of emissions within the country, with 237 M tCO_2e in 2010 (Marquard, Trollip, and Winkler 2011). It represented 45% of national emissions in 2003 (KPMG 2011). Electricity generation currently almost exclusively relies on coal, which is abundant in South Africa. Industries and the residential sector rely heavily on electricity, not least because of very low prices (Hanna Fekete, Höhne, Hagemann, Wehnert, Mersmann, Vieweg, Rocha, Schäffer, et al. 2013). Other sources include one nuclear and two hydroelectric power stations, as well as a number of small gas turbine plants.

In 2008 South Africa faced a power supply crisis, with demand outstripping generation capacities. In order to meet future demands, two new supercritical coal power plants with generation capacities of 4800MW each are being built.

This capacity represents about 25% of the current total generating capacity in South Africa (Fouilloux and Otto 2009).

The sector is dominated by the state-owned utility Eskom, which will also run the supercritical coal plants. It also owns and operates South Africa's energy grid. With about 96% of South Africa's electricity production, Eskom can be considered a quasi-monopolist within the sector. It is highly influential in the development of South Africa's energy policies (Koen 2012).

Apart from Eskom, some companies generate electricity for their own use, and a few municipalities operate local power stations (Cloete, Robb, and Tyler 2010). There is a very small, but growing number of IPPs (independent power producers) which mainly focus on renewable energy generation under the REIPPPP (Renewable Energy Independent Power Procurement Programme), a system under which IPPs can bid for Power Purchasing Agreements with Eskom.[25] Currently, renewable energies play virtually no role in South Africa's electricity mix, but are expected to gain limited importance through the application of the scheme.

4.12.1.2 Mitigation Potential and Costs

South Africa's power sector is extremely carbon intensive, with 0.8 tCO_2e/MWh (as opposed to less than 0.4 tCO_2e/MWh in the EU in 2010) (Bolscher et al. 2012). A large mitigation potential lies within modernisation of Eskom's current power generators, but this is already included within the country's baseline scenario, so additional mitigation potentials are low (Fekete et al. 2013a; Winkler 2007). Potential Carbon Capture and Storage sites within the country are limited, and will have to be shared with other greenhouse gas emitting sectors (Cloete, Robb, and Tyler 2010).

Increasing South Africa's nuclear capacities could potentially yield high emission reductions due to the technology's potential to provide high almost carbon-neutral baseload power. However, nuclear power stations suffer from very long construction times (and come with high security risks as well as additional costs and uncertainties, e.g. waste storage capabilities) (Cloete, Robb, and Tyler 2010). South Africa's updated Integrated Resource Plan includes increased nuclear capacities not before 2025 (DoE 2013). In the shorter term (up to 2020), the technology's mitigation potential can be considered zero (Fekete et al. 2013).

[25] http://www.ipprenewables.co.za/

By far the highest mitigation potential lies in the use of various renewable energy technologies for electricity generation. Fekete et al. calculated an aggregate mitigation potential of 35-38 $MtCO_2e$/a in 2020 for wind, solar, and concentrated solar power (CSP) generators, based on various third-party mitigation assessments (Fekete et al. 2013). Electricity generation from renewable energy is currently underdeveloped in South Africa, with high wind potential especially in the coastal regions, and areas highly suited for solar power in the north of the country (Teske, Ferrial, and Smith 2009). Hydropower is limited by South Africa's scarcity of running water (Cloete, Robb, and Tyler 2010).

However, renewable energy development only recently showed an uptake, after regulatory reform. Eskom itself has been slow to adopt renewable energy options (Koen 2012).

Data on the cost of various mitigation options is very scarce. Winkler et al. (2007) calculated some potential cost for the influential Long-Term Mitigation Scenarios (LTMS), but due to the vintage of the data it can be assumed that current prices differ considerably from the assumptions made in the LTMS.

More recently, (Telsnig et al. 2013) conducted an abatement cost analysis of various low-carbon technologies in the urban area of Gauteng. Gauteng is the economically strongest area in South Africa, with more than 40% of the nation's industry and high levels of emissions (Telsnig et al. 2013). While their findings may not be wholly applicable to all of the country, they may serve as indicative figures of mitigation costs in South Africa, possibly even as an upper margin because of higher land values and limited space for power installations due to higher density of the population.

Further details on the mitigation potential are contained in Annex 6.9.

4.12.2 Iron&Steel Sector

4.12.2.1 General Description of the Sector

Table 21: South Africa's Iron&Steel Sector at a Glance

Number of installations	11	**Absolute emissions**	31.7 Mt Co_2e (2007)
Number of companies	6	**Percentage of national emissions**	3% (2000, production only)
Number of CDM projects	7 (6 registered)	**Estimated emission growth**	no data
Emission reduction potential		**Emissions intensity**	ca. 1.6 t CO_2-eq./t product (2003)
Policies and measures existing?	mainly non-binding energy efficiency incentives	**Most important barriers**	Access to capital, high ex-ante investment requirements, low availability of scrap,

			cheap electricity presents low incentive for energy efficiency inventments
Level of market readiness	sector included in carbon tax plans low		

South Africa is host to the largest steel production in Africa (44% of crude steel production in 2012). According to the World Steel Association, the country is the 21st largest producer of steel in the world.[26] South African steel production has dropped by ca. 8% from 2010 to 2012, as reported by the members of the sector's association, the South African Iron and Steel Institute. Current steel production stands at about 7 million tonnes. About 9% of steel products are imported to the country. Per-capita consumption is at less than 100 kg per year, well below global average (ibid.).[27] Emissions were 31.7 Mt CO_2e in 2007 (Haasz 2012). South Africa mainly exports primary products and raw ores, including 40% of the world's ferrochrome, which is used in steel production. The sector is very concentrated, with only six large companies dominating the market. ArcelorMittal has by far the largest market share (Cloete, Robb, and Tyler 2010).

4.12.2.2 Mitigation Potential and Costs

There is currently no information available on mitigation potentials of South Africa's iron and steel sector. Information presented in Annex 6.9 was taken from a study conducted on implementable mitigation options in South Africa's industrial sector conducted by Genesis Analytics for the Department of Trade and Industry in 2010 (Cloete, Robb, and Tyler 2010). The authors have undertaken a cost/risk analysis for various sectors including iron&steel, but could not provide absolute mitigation potentials due to insufficient data. To date, there is only very sparse publicly available information on sectoral emissions and mitigation potential. South Africa's second National Communication (DEA 2011a) provides some pointers on emission levels in 2000, but only at a highly aggregated level.[28]

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[26] www.worldsteel.org
[27] www.saisi.co.za
[28] Some work on mitigation options in the iron and steel sector in the Gauteng area is currently being conducted under the framework of the EnerKey project (www.enerkey.info, see also presentation by Haasz 2012), but no results have as yet been published.

4.12.3 Existing Policies and Measures

South Africa's approach to greenhouse gas mitigation comprises a set of high-level strategies and plans as well as a number of policies that aim at incentivising energy use reductions and energy efficiency improvements. An overview of the most important ones is given in the Annex.

The National Climate Change Response White Paper (NCCR) (DEA 2011b) acts as an over-all low-carbon development strategy for the country. It contains goals for both mitigation and adaptation. The included emissions trajectory of "Peak, Plateau, Decline" would require South Africa's emissions to peak between 398 and 614 Mt CO_2e/a, and to remain at that level up to 2035. After 2035, South Africa's emissions would have to decline to a level of 212 to 428 Mt CO_2e/a in 2050. An important part of South Africa's mitigation strategy under the NCCR is increased use of low- or zero-emission energy technologies for electricity generation, heightened energy efficiency and energy demand management (H. Fekete, Vieweg, and Mersmann 2013).

South Africa's Integrated Resource Plan for Electricity (IRP) (DoE 2011, DoE 2013) is a targeted sectoral strategy for the country's electricity mix up to 2030. It is updated regularly; the latest update is currently under preparation. It will now take into account the Peak, Plateau, Decline scenario for an extended emissions reduction scenario up to 2050, with a fixed percentage of 45% emissions contribution of the electricity sector. The target for 2030 remains at 275 MtCO_2e/a, but is now projected to decline to 210 MtCO_2e/a in 2050 (moderate decline scenario, marginally above 45% total contribution), or to 140 MtCO_2e/a (advanced decline scenario, within 45% range).

South Africa's Energy Efficiency Strategy (DoE 2005, DoE 2012) sets the target to reduce final energy demand in the industry and mining sectors by 15% in 2015. It is currently under revision. The revised Strategy does not list any compulsory efficiency measures to be applied in industrial policies, it does mention the adoption of two new standards that can be applied voluntarily for industrial processes.

The most prominent policy currently under preparation is the introduction of a carbon tax for all emitting sectors. The tax will only cover direct greenhouse gas emissions from stationary sources resulting from fuel combustion and gasification, and from industrial processes. As a complementary measure, tax incentives for energy savings will be introduced before roll-out of the carbon tax.

Further details on the existing policies and measures are contained in Annex 6.9.

4.12.4 Remaining Barriers and Potential Ways Forward

While South Africa has put in place a number of comprehensive strategies, plans and policies for greenhouse gas reductions both economy-wide and targeted towards its electricity and industrial sectors, implementation of concrete actions is slow to pick up (DBSA 2011; Tyler et al. 2013). A major general barrier seems to be the translation of high-level plans and targets to lower tiers of government, due to limited knowledge and capacities (Tyler et al. 2013). International support would therefore be helpful in the development of institutional capacities, especially within local governments and communities.

Financial barriers to technology deployment in the field of renewables and reduction of energy use are starting to be addressed more strongly by the South African government itself. Anyhow, these remain some of the strongest barriers, acting against full realisation of South Africa's potential in emissions reduction. Access to capital will therefore be crucial for a stronger uptake of abatement options.

Some other major barriers include:

- The strongly concentrated structure of both sectors which provides only limited incentives from markets;
- The need for grid renewal in order to transport energy to demand-heavy regions;
- The low price for electricity, which disincentivises energy efficiency measures and stronger uptake of renewable energy deployment.

Detailed information on the barriers is provided in Annex 6.9.

4.12.5 Scope for International Cooperation and Use of Carbon Markets

South Africa only ranks 121st on the 2013 Human Development Index, and faces strong developmental challenges. At the same time is the 13th largest emitter of greenhouse gases worldwide (Davies 2013) mainly attributable to its strong reliance on electricity derived from coal combustion as a main energy source. In 2007, its emissions per capita stood at 9 Tonnes CO_2e, more than the EU and 10 times as much as the rest of the sub-Saharan region (ibid.).

In terms of its share in global emissions reductions to achieve the 2° limit, South Africa's pledge to reduce its emissions by 34% vs. BAU in 2020 falls in line with commonly-used effort-sharing approaches, except for those that place strong emphasis on per-capita emissions (Hanna Fekete, Höhne, Hagemann, Wehnert, Mersmann, Vieweg, Rocha, Schäffer, et al. 2013) .

However, implementation of short term mitigation actions has been lagging behind its international pledge (DBSA 2011). In consequence, South Africa will now have to take strong strides in order to be still able to achieve its mitigation target, and will depend strongly on international support for high-cost measures, such as grid modernization, or large-scale renewable energy deployment (H. Fekete, Vieweg, and Mersmann 2013; Hanna Fekete, Höhne, Hagemann, Wehnert, Mersmann, Vieweg, Rocha, Schaeffer, et al. 2013).

South Africa is the largest host of CDM projects in Sub-Saharan Africa. According to the South African DNA, 209 Project Idea Notes and 138 Project Design Document have been submitted. 80 projects have been registered.[29] Considering that in 2010, only 17 CDM projects had been registered in total, overall market readiness in the country can be considered as increasingly high - already in 2010, the CDM investment climate index showed an above-average 86.1 points of 100 (Ehlers 2010).

Within the power sector, UNEP Risø lists 33 projects (plus 8 under validation): 10 (+6) wind projects, 6 landfill gas projects, 6 (+1) energy efficiency (own generation) projects, 5 (+1) solar, 4 biomass, and 2 hydro projects. This represents more than half of the total 71 (+2 PoAs) South African projects listed in the UNEP Risø pipeline (UNEP Risoe 2014).

However, use of the CDM within the iron and steel sector has been fairly limited. Cloete et al. report no projects in the sector in 2010 (Cloete, Robb, and Tyler 2010). The current CDM pipeline lists 7 projects (6 registered) (UNEP Risoe 2014). All these projects aim at cogenerating electricity from waste heat in iron and steel installations.

Thus, it can be concluded that market readiness within this sector is lower than within the power sector. Also, while the power sector is currently diversifying, albeit in a limited fashion, the iron and steel sector has been very stable in terms of market players. Of the six major companies, ArcelorMittal is heavily dominating the market. The company openly opposes the South African government's commitment to reduce emissions and the proposed carbon tax (ArcelorMittal 2012).

It needs to be noted that for any future carbon market instrument, a robust emissions inventory is absolutely key. South Africa seems to be lagging in this regard. While plans for a new inventory system have been on the table since 2011, and were to be implemented in 2013, there is currently no information on

[29] www.energy.gov.za

the status of South Africa's inventory. Regarding sectoral data, there is very limited information available. The observation of Kloete et al (2010) still proves valid: "...data on GHG emissions, abatement opportunities and mitigation costs is not readily available in South Africa. Furthermore, the data that does exist has predominantly been generated for the purposes of compliance with the national inventory requirements of the [UNFCCC], or for economy modeling in the LTMS. This information is too high-level to effectively inform policy development..." (Cloete, Robb, and Tyler 2010).

Under the Partnership for Market Readiness, South Africa therefore has submitted the development of a registry or tracking tool as one of the core components for carbon market readiness (Partnership for Market Readiness (PMR) 2012). There is considerable scope to build institutional capacities in order to develop a coherent, transparent and effective registry system.

In the last years, there has been a debate within the domestic scientific community about options for carbon pricing, including domestic emissions trading systems and carbon taxes. Answers have remained inconclusive, but a number of constraints both specific to the South African case and general weigh heavily against the introduction of market-based instruments (Winkler, Marquard, and Jooste 2010):

- Volatility of international carbon prices heavily affects price and incentive structure within the country, especially concerning energy prices, which may be detrimental to the country's target of a stable development path;
- Transparency of prices is generally lower in a quantity-based instrument than in a tax regime, which may open doors to corruption;
- Carbon taxes create more stable revenue flows for governments, which may help fiscal strains in South Africa more than an ETS;
- A tax is seen as giving more long-term financial reassurance and flexibility to firms;
- The creation of a market is in principle seen as beneficial, but the strongly concentrated sectors with few and highly influential players within the South African context could exert too much influence in the design of the scheme, especially if grandfathering approaches are considered;
- Institutional capacities within the South African administration are too low to design and operate complex market mechanisms;
- Monitoring instruments at the required level of detail are not in place;

- There is limited experience with markets, especially within the South African energy sector.

On the side of the South African government, there is currently no push for market-based instruments for emissions control. The South African administration has recently opted to forego an emissions trading system in favour of a carbon tax model, citing similar constraints as listed above (National Treasury 2013).

Outlining its activities within the Partnership for Carbon Market Readiness of the World Bank, South Africa has reiterated its adherence to a carbon tax model, arguing that the oligopolistic structure of the energy sector would be counterproductive to a market-based model, and that the industry sector had not enough players and a market structure that inhibited effective use of markets (Partnership for Market Readiness (PMR) 2012). Under these circumstances, chances for the development of a new market mechanism in South Africa seem to be fairly low.

Opportunities for international cooperation, anyhow, are strong and varied: South Africa can profit from bi- and multilateral capacity support, e.g. through the International Partnership on Mitigation and MRV of which it is a founding member, or through the now-operational Climate Technology Centre and Network of the UNFCCC. Furthermore, through the REIPPPP, new investment options for renewable energy have been created for the private sector. There is already strong interest by international project developers (DoE 2012).

4.13 Thailand

The Cement Sector in Thailand

4.13.1.1 General Description of the Sector

Table 22: Thailand’s Cement Sector at a Glance

Number of installations	14 plants	**Absolute emissions**	20.6 $MtCO_{2e}$ (2005)
Number of companies	8	**Percentage of national emissions**	8% of energy- and process-related CO_2 emissions
Number of CDM projects	4 registered, 4 at validation, 9 validation terminated	**Estimated emission growth**	n.a.
Emission reduction potential	15% at negative or no costs (3.1 Mt CO_{2e})	**Emissions intensity**	0.7 t CO2/t cement (2005)
Policies and measures existing?	Long-term experience with energy efficiency. Openness towards market-based mechanisms	**Most important barriers**	Lack of attention to efficiency, lack of knowledge about mitigation options, policies perceived as complex, lack of enforcement
Level of market readiness	medium		

Thailand is among the top ten cement producers of the World. The Thai Cement Manufacturers Association (TCMA) has 8 member companies operating 14 plants with a total of 31 kilns (TCMA 2014). Thus the structure of the cement industry is more centralized compared to e.g. Germany (Cemnet 2014).

Production in 2012 was 33 Mt/a (TCMA 2014), a level which is comparable to the production in Germany (Cemnet 2014). According to (TCMA) production had peaked in 2006 at 33 Mt/a with an export share of 20%, dropping to less than 30 Mt/a in 2008 and a slow recovery since, reaching again 33 Mt/a in 2012 (TCMA 2014). Other sources indicate higher production levels in 2005 (40 Mt/a) (Baron, Buchner, and Ellis 2009), (Cemnet 2014) and higher export share (30%) (Cemnet 2014). Since the available mitigation potential and cost information are based on TCMA data (Hasanbeigi, Menke, and Price 2010), we use these for consistency reasons.

Greenhouse gas emissions from the sector were about 20.6 $MtCO_{2eq}$ in 2005 (Hasanbeigi, Menke, and Price 2010), which made up roughly 8 % of Thailand’s overall emissions (ONEP 2011). With respect to energy consumption, the cement sector is the largest single energy consuming sector, responsible for

16% of the energy consumption of the manufacturing sector (Hasanbeigi, Menke, and Pont 2009).

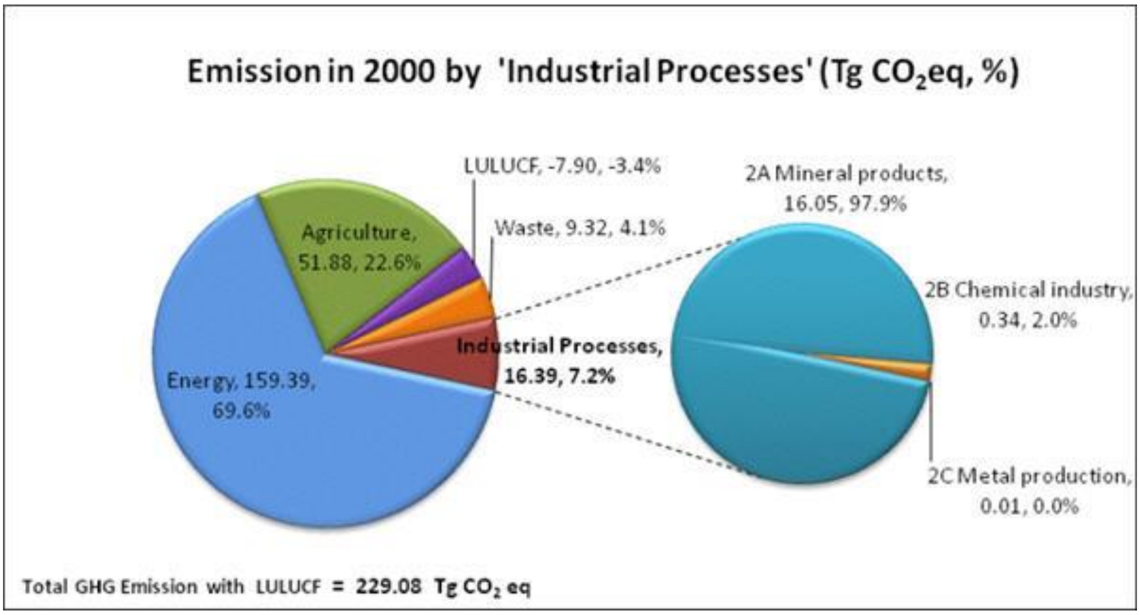

Figure 11: GHG emission from all sectors and industrial production processes in CO2 equivalent, for 2000

Source: GHG Inventory (TGO 2014) based on Thailand’s Second National Communication under the United Nations Framework Convention on Climate Change (ONEP 2011).

4.13.2 Mitigation Potential and Costs

According to (Hasanbeigi, Menke, and Price 2010) the cost-effective annual CO2 abatement potential for the Thai cement industry is 3 Mt CO2/year or about 15% of the industry’s total CO2 emissions. The study assessed 41 mitigation options specifically for the Thai cement sector and calculated mitigation potentials and costs during a 15-year scenario period (2010 - 2025). The vast majority of the potential comes at costs between -40 and 0 USD/t CO2. Interestingly, mitigation actions which are not cost-effective were found to have a potential of less than 50 ktonnes CO2/year or approximately 0.2 of the Thai cement industry’s total CO2 emissions in 2005 (see Figure 11 and Annex 6.10 for details).

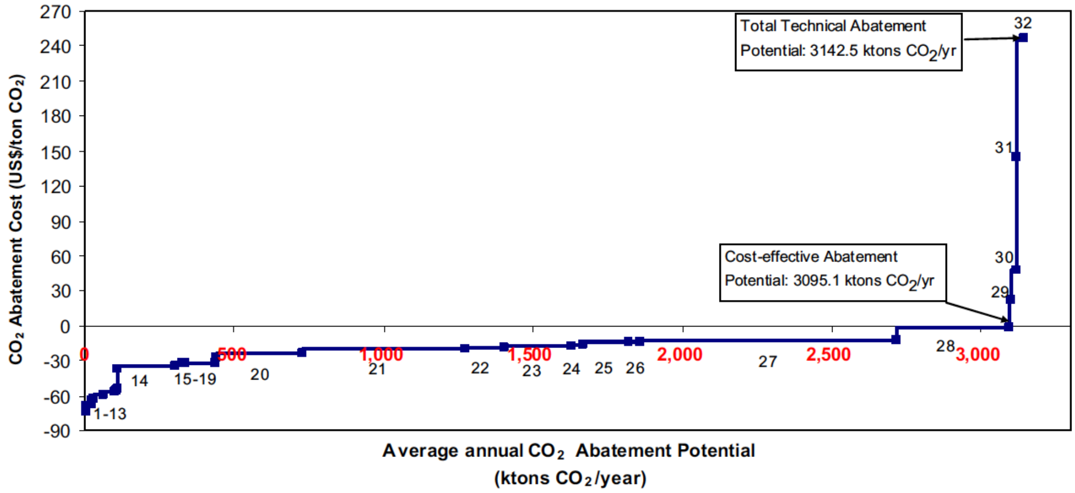

Figure 12: CO2 abatement cost curve for the Thai cement industry (Hasanbeigi, Menke, and Price 2010).

4.13.3 Existing Policies and Measures

Thailand has a long tradition of energy efficiency policy. In 1992 the Thai government passed the Energy Conservation and Promotion Act (ENCON Act), which comprises a variety of measures and has been adapted and extended since. However, despite a wide variety of EE measures implemented by the government, the overall energy intensity of the country has not improved significantly (TGO 2013a). In 2011, a 20-year Energy Efficiency Development Plan (EEDP) was formulated with a target to reduce energy intensity by 25% in 2030, compared to 2010 (Ministry of Energy 2013). Thailand's energy efficiency activities are largely driven by the objective to reduce energy consumption and subsequently energy costs and energy import dependencies. However, in recent years, the benefit of reducing GHG emissions has become more prominent. The EEDP is anticipated to reduce an annual average of 49 million tons of CO_2 emissions over the next 20 years, if implemented as planned (Ministry of Energy 2011).

In response to Thailand's heavily increasing GHG emissions, the 11th National Economic and Social Development Plan (NESDP 2012-2016) aims at redirecting the country to a low-carbon and environmentally friendly economy. In 2013 the government passed Thailand's Climate Change Master Plan 2013-2050.

However so far, Thailand has not pledged any GHG emission reduction target under the UNFCCC, nor has it submitted any NAMAs. However, Thailand is open towards and actively exploring options for market-based mitigation approaches (see below).

Further information on existing policies and measures is contained in Annex 6.10.

4.13.4 Remaining Barriers and Potential Ways Forward

Thailand has implemented a number of effective energy efficiency policies to limit energy demand growth. However, some key barriers exist, which have hindered greater success in the past. With a climate perspective it needs to be stressed that the energy efficiency policy aims at reducing energy consumption and not necessarily focuses on GHG emission reduction. Thus, fuel switches towards low-carbon fuels have not been incentivized through national energy efficiency policy, but are incentivized through the CDM. The introduction of a national emission trading scheme (s. below) could lead to a more targeted optimization towards GHG emission reductions. A policy scenario analysis by identified an energy-related CO_2 tax to be the most effective and efficient policy instrument to incentivize GHG emission reductions in the Thai cement sector.

In general the country lacks continuous and stringent MRV on energy saving (TGO 2013a). Furthermore, the Ministry of Energy (and subordinate institutions like EPPO and DEDE) have generally only assessed energy data, but not yet built adequate database management systems for converting from energy data into GHG emission data. A targeted MRV of mitigation successes could strongly improve the effectiveness of energy efficiency and mitigation policies.

Further problems in the past which have hampered an effective implementation of energy efficiency polices were cases of corruption and insufficient inter-ministerial coordination for implementation.

Specifically for the cement sector, Hasanbeigi u. a. 2009 assess key barriers which hinder decision makers in Thai industry to implement higher energy efficiency. Key findings are:

- The companies' management is more concerned about production issues rather than energy efficiency. The perceived costs for production losses due to potential production disruption and time required to implement energy efficiency projects are higher than assumed cost savings through lower energy consumption.
- Both on management and engineer level a lack of knowledge about low-carbon / energy efficient production processes and their benefits exists. Thus, there is a need for information and training.

- Some of the energy efficiency policies have been perceived as too complicated and difficult to implement, coming with high transaction costs for industry to access support schemes.
- There is a need to increase the degree of enforcing regulations.

Further information on existing barriers is contained in Annex 6.10.

4.13.5 Scope for International Cooperation and Use of Carbon Markets

Thailand has low-medium scores on indicators for responsibility and capability. Its overall emissions were at 300 $MtCO_{2eq}$ in 2010, corresponding to per capita emissions of 4.4 tCO_{2eq} (World Bank 2014a). GDP per capita was at 4,803 USD in 2010 (World Bank 2014b). Under BAU assumptions Thailand's overall emissions would quadruple between 2010 and 2050, with energy sector emissions contributing about 75% of total emissions.

The cement sector in Thailand has a 15% cost effective reduction potential, which is currently not tapped. Additional carbon credit revenues could compensate for perceived abatement risks (e.g. production disruptions) and could thus trigger higher mitigation. There are some additional barriers (e.g. information needs on low carbon options and intensification of MRV of GHG emissions in governmental institutions responsible for energy policy), which need to be overcome. But in summary it seems very likely that the barriers could be overcome in parallel to the introduction of a market based system.

In recent years, Thailand has been promoting market-based mechanisms, mainly through activities of TGO, including training and capacity building efforts, including a dedicated internet portal (http://carbonmarket.tgo.or.th). As of February 2014, a total of 142 CDM projects have been registered another 24 are in the validation stage. The focus is on renewable energy (biomass and solar) as well as methane avoidance. In the cement sector 3 projects have been registered and another 4 are at the validation stage, all of which are own generation using waste heat (UNEP Risoe 2014) replacing oil and coal by wood, rice husk and other agricultural wastes (South Pole Carbon 2013). Only one project aimed at clinker replacement, but was never successfully registered (UNEP Risoe 2014).

Additionally, in August 2013 the Thailand Carbon Offsetting Program (T-COP) was launched, aiming to use contributions from participants for supporting domestic GHG emission reduction activities, especially those under the Thailand Voluntary Emission Reduction Program (T-VER): T-VER is a domestic, project-based GHG crediting mechanism, using methodologies which derived from CDM and Japanese J-VER methodologies (TGO 2013b).

Highly relevant for Thailand's future carbon market readiness is the country's engagement with the World Bank's Partnership for Market Readiness Program (PMR) (TGO 2013a). Thailand proposed to establish an Energy Performance Certificate Scheme (EPC): in seven industrial sectors (Cement, Food & Beverage, Ceramic, Paper, Iron & Steel, Petro-Chemical and Thermal power plants) as well as four types of commercial buildings (Office, Hotel, Hospital and Department store). This voluntary target-and-trade scheme aims to achieve energy efficiency in energy-intensive factories & buildings and to build core market readiness components in order to be a foundation for establishing a future ETS. The demonstration phase of the EPC is planned to be between 2017-2019, with funding support through the World Bank and the ENCON fund.

Building on these experiences, Thailand is interested in exploring the possibility of developing a mandatory ETS, the preparation phase is to start in 2020, the mandatory phase in 2026.

In conclusion, Thailand's cement sector seems well fit for market-based approaches to reduce its carbon intensity. The country's PMR proposal defines a roadmap how such approaches could be implemented.

If these initiatives come to fruition they will open new vistas for direct international cooperation of the basis of market systems very similar to the situation in India. Donor countries could use international climate finance for the purchase of EPCs in order to ensure a meaningful price signal for what is an innovative domestic policy instrument. Alternatively, EPCs could be converted into internationally fungible carbon units such as CERs. If Thailand ultimately adopted a domestic ETS, this would create options for direct linkage with other systems such as the EU ETS.

5 Annex Country Grouping

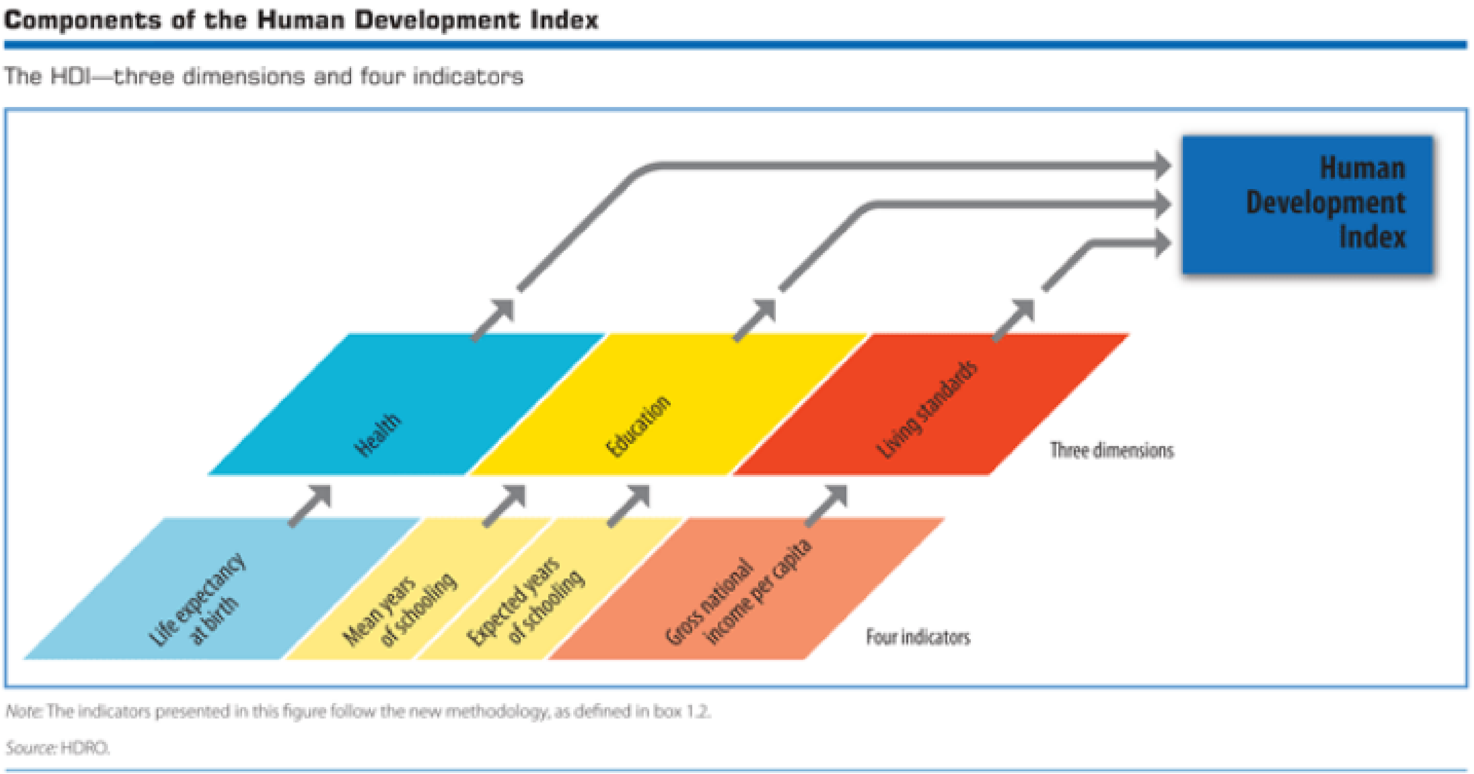

Figure 13: Indicators underlying the HDI

Source: UNDP 2013

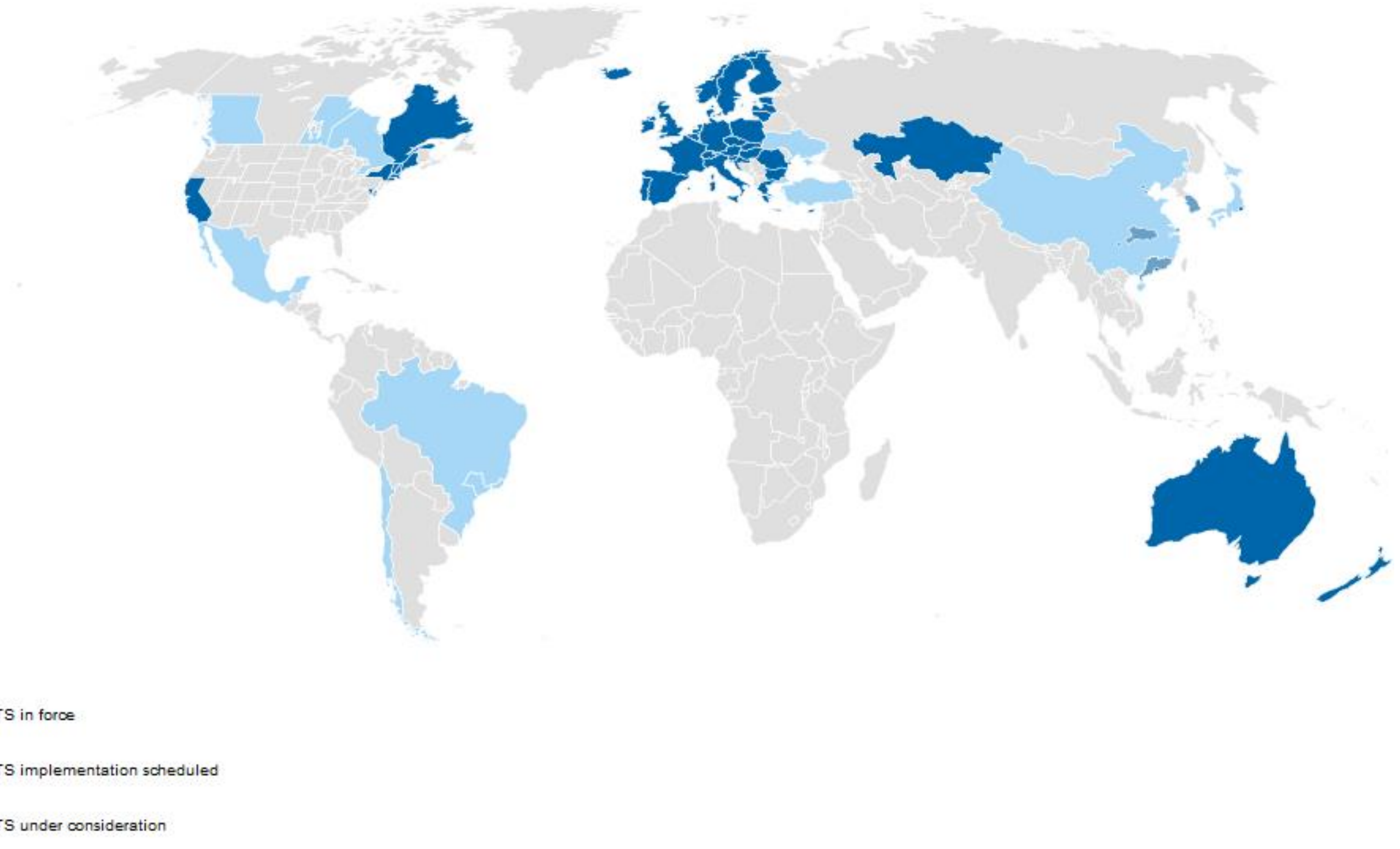

Figure 14: Overview of ETS worldwide

Source: International Carbon Action Partnership 2013

6 Annex Country Studies

6.1 Brazil

Table 23: Emission Reduction Potential in the Brazilian electricity sector

Measure	Finance requirements	Mitigation Potential
Transmission line Brazil-Venezuela	23/23/21 EUR/tCO_2 (discount rate of 8%/4%/12%)	28 Mt CO_2 2010-2030
Sugarcane cogeneration	76/160/31 EUR/tCO_2 (discount rate of 8%/4%/12%)	158 Mt CO_2 2010-2030
Wind power	9/118/47 EUR/tCO_2 (discount rate of 8%/4%/12%) 0.039-0.084 US$/kWh	19 Mt CO_2 2010-2030 (from expansion of wind power to 15 GW) Technical wind energy potential: 143 GW
Solar	n.a.	Brazil's PNE 2030 assumes costs of US$ 3,000/kW. Therefore, it assumes that solar power will only play a marginal role in 2030 (EPE 2007: 179). Technical solar energy potential: 114 GW
Hydropower	n.a.	According to Gouvello et al., with the realisation of Brazil's National Energy Plan 2030 (Plano Nacional de Energía (PNE) 2030), most of Brazil's main remaining large-hydropower potential will already be fully exploited by 2030. According to the PNE 2030, of Brazil's inventarized potential of 204 GW, - 78 GW are already exploited, in construction or granted, - another 20 GW to be built between 2009 and 2015 and - another 76 GW to be exploited until 2030. This adds up to 174 GW. In addition to the inventarized potential of 204 GW, there are another 48 GW estimated to exist. Even though this leaves 30 GW inventarized potential to be exploited, Gouvello et al. assumed no further opportunities to significantly reduce emissions via hydropower expansion beyond that.
Wave energy	0.40-0.88 US$/kWh	Technical wave energy potential: 122 GW

Sources: (Empresa de Pesquisa Energética (EPE) 2007); (Gouvello et al. 2010); (Meisen, Peter and Hubert, Jordi 2010)

Table 24: Emission Reduction Potential in the Brazilian Waste Sector

Measure	Mitigation cost	Mitigation Potential
Recycling	26/39/18 EUR/tCO_2 (discount rate of 8%/4%/12%)	75 Mt CO_2 2010-2030
Recycling new solid waste (e.g. reusing metals and papers as inputs in production chains)	-15 EUR/t CO_2	In 2030: 47 MtCO_2e
Composting new solid waste	1 EUR/t CO_2	In 2030: 1 MtCO_2e
Landfill methane destruction	2/3/1 EUR/tCO_2 (discount rate of 8%/4%/12%)	963 Mt CO_2 2010-2030
Landfill gas direct use	-35 EUR/t CO_2	In 2030: 5 MtCO_2e
Landfill gas electricity generation	-10 EUR/t CO_2	In 2030: 9 MtCO_2e
Wastewater treatment and methane destruction (residential and commercial)	7/10/6 EUR/tCO_2 (discount rate of 8%/4%/12%)	116 Mt CO_2 2010-2030
Wastewater treatment and methane destruction (industrial)	75/102/58 EUR/tCO_2 (discount rate of 8%/4%/12%)	238 Mt CO_2 2010-2030

Sources: (Gouvello et al. 2010); (McKinsey 2009a)

Table 25: Existing Policies and Measures in Brazil Relevant for Electricity and Waste

Type of PAM	
Framework legislation	
National Policy on Climate Change (PNMC) and Decree No. 7.390	Brazil's overarching legal instrument for reaching its voluntary emission reduction target (36.1 to 38.9% below BAU in 2020; total national emissions not to surpass 2Gt by 2020). Instruments to be applied for PNMC's objectives: • National Plan on Climate Change (see below) • Sector Plans of Mitigation and Adaptation to Climate Change

	(see below for the energy sector's plan) • National Fund on Climate Change (FNMC) (see below) • Brazilian Emissions Reductions Market (MBRE) (see below)
National Plan on Climate Change	• Implementing instrument of the PNMC • Definition of actions and measures for Brazil regarding mitigation, such as R&D, training, and others • Target of generation of more than 80% of Brazil's power to come from renewables through to 2030 • Promotion of solar, wind, hydro and energy from solid waste as well as bagasse plants • Provision on energy efficiency to be created to reduce electricity consumption by 10% by 2030
National Policy on Solid Residues (PNRS)	• Promotion of strategies to minimise the generation of solid residues, domestic sewerage and industrial effluents • Incentives for selective collection, recycling and reuse of rubbish • Promotion of, inter alia, capacity building on solid residues; public private technical and financial cooperation for the integrated management of solid residues; sustainable public procurement; environmental labelling and consumption • Guiding principles: prevention and precaution, "polluter pays", "protector receives", sustainable development, shared responsibility for product life cycle • Call on states, regions and municipalities to elaborate local strategies to implement the PNRS
National Plan on Solid Residues	• One of the most important instruments of the PNRS • Identification of problems regarding different types of waste • Identification of alternative waste management options
10 Year National Energy Expansion Plan (PDE 2021)	Brazil's sector plan for energy: • Energy efficiency (reduction of 12-15 MtCO_2e) • Increased use of biofuels (reduction of 48-60 MtCO_2e) • Increased hydroelectric power supply (reduction of 79-99 MtCO_2e) • Alternative energy sources (reduction of 26-33 MtCO_2e)

Plano Nacional de Energía 2030 (PNE 2030)	National Energy Plan until 2030:
	• Investment in electricity production:
	  o US$ 117 billion in large hydro power
	  o US$ 22 billion in other alternative energy sources
	  o US$ 17 billion in conventional thermal power stations
	  o US$ 12 billion in nuclear power
	• Transmission of electricity: expansion and enhancement of transmission network, new interconnections between existing sub-systems (US$ 68 billion)
	• Distribution of electricity: installation of new equipment, expansion of medium and low voltage power lines (US$ 48-52 billion)

General economic and fiscal	
Brazilian Emissions Reductions Market (MBRE)	• Joint initiative between the Ministry of Development, Industry and Foreign Trade and the Brazilian Futures Stock Exchange • Support for negotiations of carbon credits from CDM projects
Regional cap and trade systems	Development of respective plans in the States of Sao Paulo and of Rio de Janeiro
Targeted economic and fiscal	
National Fund on Climate Change (FNMC)	Support for projects, studies and undertakings aiming at mitigation and adaptation, e.g. the development and diffusion of technologies for mitigation, project and inventory systems and methodologies. Sources:

	oil proceedings (60%), Federal Government's Annual Budget, public and private donations, resources from state and municipal bodies
Levies	Sources of funding for energy efficiency and renewable energy via the Fuel Consumption Account (CCC) for power grid generation in the Amazon region, the Energy Development Account (CDE), the Global Reversion Reserve (RGR), the Constitutional Fund of the Northern, Northeastern, and Center-West Regions (FNO, FNE, FCO)
Programme of Incentives for Alternative Electricity Sources (PROINFA)	Used to be largest national plan promoting alternative energy sources and other programmes but is no longer being pursued.
Economic incentives to promote renewables	Financial provisions from the federal budget (mainly via BNDES and Eletrobras)
Energy efficiency credit line PROESCO (BNDES)	• Credit lines for energy service companies (16.5 million US$ approved in 2011) • Finance studies, installations, new equipment, technical service, monitoring and information systems
Administrative Directive No. 227	Eletrobras to hold a public call for proposals to get an overview of the surplus energy available from cogeneration. Mechanisms for the purchase of surplus electricity to be developed and implemented.
International Action Programme (IAP)	• Brazil's Hydropower Programme • Project implementation depends on public auction to reach lower tariffs and smaller environmental impacts, Power Purchase Agreements (PPA) of 15-30 years between distribution utilities and project developers • 2,819 MW to be produced
Law No. 9648	Incentives for small hydro (< 30MW): • Exemption from paying financial compensation for the use of water resources and from public bidding process • 50% reduction on transmission and distribution tariffs • Allowance to sell energy directly to consumers > 500kW • Use of resources from Fuel Consumption Cost Account (CCC) when thermal generation is replaced with hydroelectric generation
Resolution ANEEL 482/2013	Grid connection of decentralized generation of up to 1 MW (Net-Metering)
Resolution ANEEL 219	50% discount on electricity tariffs for utilities generating electricity from wind and biomass
National Programme for Energy Development of States and Municipalities (PRODEEM)	Target: Electrification of agricultural communities using renewable resources; focus on community buildings rather than households. Procurement and distribution of required equipment by the government
Projecto Ribeirinhas	Target: Study of the viability of providing energy to small, rural communities using renewable energy
Resolution 245	Fuel Concessionaire Account (CCC) for electricity generation in isolated electricity systems which either replace power from fossil fuel or meet new load demand
Urban Solid Waste program	• Support for the development of management and administration processes for urban solid wastes • Aim: Increase the coverage and efficiency of municipal urban cleaning services, collection, treatment and final disposal from a perspective of universalization and sustainability of the enterprises, focusing on social inclusions, the closing of waste dumps and on environmental quality (encouragement to

	reducte, reuse and recycle urban solid wastes), the promotion of social insertion of waste pickers and the elimination of child labour
Standards and voluntary agreements	
National Electrical Energy Conservation Program (PROCEL)	Among other activities, this program aims at the reduction of losses in the electrical system
Information, know-how transfer and education	
GEF/UNEP project: Mitigation Options of GHG emissions in key sectors in Brazil	Technical capacity building supporting the implementation of mitigation actions in, inter alia, the energy and the waste sector
Research and technology transfer	

Sources: (Brasil, Presidência da República 2010); (Comitê Interministerial sobre Mudança do Clima 2008); (Empresa de Pesquisa Energética (EPE) 2007); (Instituto Ethos de Empresas e Responsabilidade Social 2012); (La Rovere et al. 2012); (MCTI (Ministério da Ciência, Tecnologia e Inovação) 2010); (MCTI (Ministério da Ciência, Tecnologia e Inovação), SEPED (Secretaria de Políticas e Programas de Pesquisa e Desenvolvimento), and CGMC (Coordenação Geral de Mudanças Globais de Clima) 2013); (Ministério do Meio Ambiente 2012); (Moss, Hamilton 2012); (Townshend et al. 2013)

Table 26: Barriers to Low-Emission Investment in Brazil's Electricity and Waste Sectors

Barrier Type	
Financial & Economic	Electricity-specific • Cost of interconnecting bagasse cogeneration and wind energy projects in the back country with the main power grid. So far, this cost has to be borne by the corresponding sugar mills and wind-farm developers. • High upfront investment costs for wind power. • High investment requirement of solar energy (US$ 3,000/kW) assumed in PNE 2030 Waste-specific • Lack of carbon-based incentives to destroy or use landfill gas • Costs of establishing and operating sewage services and wastewater treatment systems hinder the universalization of collection and treatment services • Low investment and lack of economic resources • Underinvestment and little private-sector participation in the waste-management sector due to a lack of long-term planning, insufficient allocated funds, and a lack of incentives.
Institutional & Political	Cross-cutting • There is substantial and comprehensive environmental legislation but enforcement by the authorities could be improved Electricity-specific • Environmental licensing process limits participation of hydro-energy at new energy auctions • Conflicting goals between growth strategies and emission reduction targets (e.g. 65% of the programme for acceleration of economic growth's budget is to be invested in the expansion of infrastructure measures for natural gas and oil while only a small amount is

	envisaged for renewable energy and energy efficiency) • Adverse environmental and social impacts of renewable energy projects, especially of hydropower, may delay power expansion plans Waste-specific • High level of institutional complexity and decentralization in both solid and liquid waste management complicate leveraging the money needed • Lack of inter-municipal coordination • Unclear regulations and PPPs • Lack of legal mechanisms to facilitate appropriate charges/tax collection regarding waste collection and treatment • Lack of tax-incentive mechanisms for implementing techniques focusing on water re-use and cleaner production as well as for reverse logistics and selective waste collection
Technical	Electricity-specific • Envisaged hydropower generation capacity to be developed extremely fast • Substantial hydropower potential is difficult to develop because it is located in the eastern part of the country, far away from load centres • High dependency on hydropower causes high risk of blackouts in case of droughts • The nationalization index of 70% for steel plates and cement for wind turbine towers aimed at creating a national industry for equipment causes difficulties in accessing equipment Waste-specific • Lack of technical treatment in systems for biogas collection, burning, and recover and use in energy production • Lack of use of systems capable of delivering a high level of efficiency regarding the discharge, control, and mitigation of emissions of atmospheric gases and effluents
Awareness / Information / Capacity	Electricity-specific • Lack of training capacity Waste-specific • Lack of awareness of consumption patterns and the culture of recycling • Lack of technical know-how and information on the environmental fallout from incineration system operations • Lack of control of water losses • Lack of long-term planning and project development capacity in municipalities
Others	

Sources: (Empresa de Pesquisa Energética (EPE) 2007, 179); (H. Fekete, Vieweg, and Mersmann 2013); (Gouvello et al. 2010); (McKinsey 2009a); (Meisen, Peter and Hubert, Jordi 2010); (Stephan Nielsen 2013); (Townshend et al. 2013)

6.2 China

Table 27: Emission Reduction Potential in China's Electricity Sector

Measure	**Mitigation cost (EUR/tCO_2e)**	**Mitigation Potential in 2030**
Introduction of circulating fluidized bed combustion (CFBC) technology in power plants	Negative cost.	4 $MtCO_2e/a$
Reconstruction of conventional power plants	Ca. €4.5 due to co-benefits	34 $MtCO_2e/a$
Other energy efficiency improvements in power plants, including introduction of Integrated Gasification Combined Cycle (IGCC) plants	€24 – €29	9 – 77 $MtCO_2e/a$
Combined Heat and Power plans under the 2010 *CHP Development Planning and 2020 Development Goal*	Unknown	13 $MtCO_2e/a$
Fuel switch from coal to gas	€29.5	3 $MtCO_2e/a$
Increased use of nuclear energy	€2 - €14	86 – 246 $MtCO_2e/a$
Increased use of non-bio renewables	Uncertain, but decreasing	120 – 571 $MtCO_2e/a$
Increased use of sustainable biofuels	Unknown	13 – 54 $MtCO_2e/a$
Decrease of distribution losses	Unknown	Unknown
Use of Carbon Capture and Storage (CCS) in energy production	Unknown	Unknown

Sources: (H. Fekete et al. 2013)

Table 28: Emission Reduction Potential in China's Cement Sector

Measure	**Mitigation cost (EUR/tCO_2e)**	**Mitigation Potential in 2030**
Energy saving processes in cement production: e.g. shift from shaft kiln to pre-calciner kiln	Anticipated BAU	100 $MtCO_2e/a$
Improved quality and performance of cement	Anticipated BAU	120 $MtCO_2e/a$
Maximisation of clinker substitution using fly ash and slag	-€1 (negative)	165 $MtCO_2e/a$

Agricultural waste as alternative fuel for co-firing in cement kilns	€0 EUR (even)	145 $MtCO_2e/a$
Use of Carbon Capture and Storage in Industry (Includes Cement, Steel and Chemical)	65 EUR	210 $MtCO_2$ e/a

Sources: (McKinsey & Company 2009)

Table 29: Existing Policies and Measures Relevant for China's Electricity and Cement Sectors

Type of PAM	
Framework legislation	
China's 12th Five Year Plan (2011-2016)	• Including target for 11.4% of non-fossil fuel by 2015. Later updated to 20% renewable energy by 2015 • Promotes mergers and acquisitions in cement industry in an attempt to make the top-10 cement firms account for 35% of the domestic market.
China's 11th Five Year Plan	• Shut down inefficient industrial facilities including 250 Mt of cement, and stricter rules for new plants.
Wind Power Technology Development 12th Five Year Special Planning (2012)	Government plans the construction of six onshore and two offshore and coastal wind power bases in the upcoming five years under the 12th five year plan for wind power technology development. The target is to add 10MW of offshore wind prototypes by 2015. Over course of next five years industry will be focused on development of following offshore wind systems: -3 - 5MW direct-drive permanent magnet synchronous generator wind turbine and component design and manufacturing and industrialization, and -7MW class wind turbine and component design manufacture, installation and operation of complete industrialization of technology and promote the industrialization of China's large-capacity wind turbine.
Solar Power Technology Development 12th Five Year Special Planning (2012)	Solar Power Technology Development 12th Five Year Special Plan aims to increase China's solar large scale production and to lower costs of electricity generation from solar installation so they will be competitive with conventional power production. The goal is to increase energy efficiency of: -crystalline silicon cells by 20% -silicon thin-film cell efficiency above 10%, and -cadmium telluride, copper indium gallium selenide thin-film batteries to the level of commercial application; Currently, a cost of electricity generation from grid-connected PV systems is CNY 1.2-1.3 per KWh. It is planned to lower this costs to CNY 1.2-1.3 per KWh or less. Further goals for reduction of production costs: -polysilicon materials by 30%, -supporting materials by 50% In order to ensure smooth implementation of decisions embodied in the planning as well as to reach established goals and targets, the Ministry of Science and Technology will take steps to encourage investments as well as inform clearly interested parties on available in China financial and fiscal incentives. The Ministry will act to solve major technical problems in the industrial development, and to break a monopoly of foreign technologies protectionist behaviour of the PV markets.
Other climate change strategies:	• China's Policies and Actions for Addressing Climate Change (2008) • National Science and Technology Plan for Climate Change

	(2007) • National Climate Change Programme (2007) • Climate Action Plan of the Industrial Field (2012-2020) • China's Climate Change Law (in drafting phase)
General economic and fiscal	
Carbon Trading Pilot Schemes	Carbon Trading Pilot Schemes in 7 provinces: Beijing, Shanghai, Tianjin, Chongqing, Guangdong, Hubei, and Shenzhen
Top-1000 and Top-10,000	• Energy conservation targets for top-1,000 energy consuming enterprises (2006) • Energy conservation targets for top-10,000 energy consuming enterprises (2011)
Other	Several energy efficiency funds at national and provincial level
Targeted economic and fiscal	
Feed in tariffs	Feed-in tariffs (FIT) for onshore wind (0.08 – 0.10 USD/kWh) solar PV (0.16 – 0.19 USD/kWh) and biomass (0.06 USD/kWh on top of local coal-fired generation price). Prices compare to average of 0.06 USD/kWh for coal-fired plants.
Golden Sun Programme (2009)	Subsidy scheme for investments in solar energy
Standards and voluntary agreements	
Emissions intensity standards (2014)	NOx emission limit is set at 400 mg/m3, on par with international standards, and significantly lower than the previous standard of 800 mg/m3.
Regulation on the Administration of Power Generation from Renewable Energy	Requirement for grid operators to purchase electricity from renewable energy
Information, know-how transfer and education	
Information	Creation of renewable energy surveys and information systems
Research and technology transfer	
Technology transfer	Localisation of renewable energy manufacturing facilities
Research	Significant government funded research on renewable energy
Other	
Interim Measure of Distributed Solar Power Generation On-grid Service Agreement	State Grid Cooperation for China (SGCC) announced a plan to allow small-scale distributed solar power generators to connect to its power lines and allow solar power generators with less than 6 MW of installed capacity and lower than 10,000 kV to be connected to the grid.

Sources: (McKinsey & Company 2009; H. Fekete, Vieweg, and Mersmann 2013; Lynn Price et al. 2011; REN21 2013; IEA 2014; Ministry of Environmental Protection 2014)

Table 30: Barriers to Low-Emission Investment in China's Electricity and Cement Sectors

Barrier Type	
Financial & Economic	• High costs of renewable energy installation, despite the feed-in tariffs. In particular, solar power remains much more expensive than cheap coal-fired electricity. • Investment costs in industrial energy efficiency for SMEs are prohibitively high, even though economically rational over time. • Lack of economic incentive policies for upfront investment. • High interest rates on credit facilities
Institutional & Political	• Centralised approach somewhat hinders locally appropriate action • Some regulations lack clarity, giving room for unconducive

	interpretations and creating difficulties for enforcement. • Renewable energy regulations are designed by several authorities, sometimes with conflicting incentives. • Top-down manner of policies and measures disregards differences in technical potentials amongst installations
Technical	• Structural issues within MRV – disparities between provincial and national data, and no calculation of co-benefits. • Low quality of renewable energy equipment due to missing technology standards and significant black market trade. • Limited grid connectivity hinders the establishment of renewable energy facilities in remote areas. • Approximately 50% of high-value parts for renewable energy manufacturing are imported, although the expertise for their use and maintenance remains low. • Impact of clinker substitution will be limited by insufficient production of slag and fly-ash until 2020.
Awareness / Information / Capacity	• Little public awareness of climate change issues and opportunities, leading to poor consumption habits and ample room for industrial lobbying. • Knowledge on best practices, as well as the availability of technical skills to implement them, is limited in SMEs • Low awareness and low pressure from the public
Others	• China currently only collects a small proportion of its agricultural waste – undermining potential for alternative fuel co-firing • Enforcement of environmental regulations in industry is weak

Sources: (H. Fekete, Vieweg, and Mersmann 2013; McKinsey & Company 2009)

6.3 Costa Rica

Table 31: Emission Reduction Potential in the Costa Rican Agroindustry Sector

Measure	Finance requirements	Mitigation Potential
Improved pastures, agropastoral systems and reduced use of synthetic fertilizers and agrochemicals	2010-2030: 25 US$/t CO_2e	2010-2030: • Accumulated mitigation: 304,890,795 t CO_2e • Average annual mitigation: 400,000 t CO_2e
Improvements in handling pasture and better management of nitrogenous fertilizer	n/a	With -Δ10% fertilizer and -Δ5% pasture: • 2010: 0.429 Mt CO_2e (8.11%) • 2014: 0.436 Mt CO_2e (8.13%) • 2018: 0.444 Mt CO_2e (8.15%) • 2021: 0.449 Mt CO_2e (8.17%) With -Δ15% fertilizer and –Δ8% pasture: • 2010: 0.654 Mt CO_2e (12.37%) • 2014: 0.664 Mt CO_2e (12.39%) • 2018: 0.676 Mt CO_2e (12.40%) • 2021: 0.683 Mt CO_2e (12.42%)
Change in animal diet (inclusion of green banana and concentrated food) and change of frequency of animal grazing	n/a	168,560 t CO_2e/year/100,000 animals
Implementation of no-tillage practices	n/a	n/a
Better use of fertilizers through improved nitrogen application technologies	n/a	n/a
Conservation practices maximizing carbon sequestration and storage	n/a	n/a
In livestock: Agro-pastoral and cattle productivity improvements (reduction of methane from cattle farms, increased area of improved pastures, adjustment of grazing cycles depending on forage availability and nutritional quality); reduction of fertilizer uses; promotion of reforestation of pastures (implementation of a mechanism for	n/a	n/a

environmental services applicable on farms)		
In coffee production: Reduction of fertilization, especially nitrogen fertilization; instead application of phosphorus, potassium, magnesium and boron; fertilizer application and adjustment according to the absorption capacity of the culture	n/a	n/a
In coffee milling: improved practices to reduce water	n/a	n/a
In sugarcane: Inter alia, controlled release of fertilizer nitrogen and other actions to improve the carbon cycle. Large emissions in the sugarcane sub-sector result from agricultural field burning of agricultural residues. Substantial mitigation potential could be tapped here.	n/a	n/a

Sources: (Agra-TEG (Agrar- und Umwelttechnik GmbH Göttingen)/ GIZ (Gesellschaft für Internationale Zusammenarbeit) / GfRS (Gesellschaft für Ressourcenschutz mbH) 2011); (MINAE 2013); (MINAET and IMN 2009); (Pratt, Rivera, and Sancho 2010); (Zamora Quirós)

Table 32: Existing Policies and Measures in Costa Rica Relevant for Agroindustry

Type of PAM	
Framework legislation	
National Climate Change Plan (PND)	Objectives: Generation of a national vision and an inter-institutional coordinating mechanism to deal with challenges and opportunities resulting from climate change in diverse sectors Research relating to, inter alia, the GHG inventory, analysis of mitigation measures and research studies in preparation for the National Communication.
National Strategy for Climate Change (ENCC)	• Integrated, long-term strategy for sustainable development aligning economic competitiveness and climate change strategies • Calls all public institutions, local governments and autonomous institutions to elaborate and implement short-, medium- and long-term plans on, inter alia, mitigation, MRV, capacity building and technology transfer. • Objective: carbon neutrality in 2021. • Cornerstones of mitigation: emission reductions, carbon capture and storage and carbon markets in, inter alia, agriculture
Costa Rica Carbon Neutral 2021	• National mitigation target • Starts with low-carbon development aiming at increasing the efficiency of productive systems and at reducing the emission intensity of production • Compensation or removal of emissions envisaged after the limit of reductions is reached • Proposals for policies and measures regarding agriculture: ➢ Knowledge and technology generation and transfer to farms: Development of a research, action and technical support program for the handling of pasture and diets in

	the principal cattle farming zones in coordination with test farms at universities and the private sector and for the integrated management of nitrogen fertilizer in farms aiming at a methane reduction of 25% as well as for the promotion of renewable energy and better production and environmental practices ➢ Creation of space for the diffusion of mitigation technology: Biannual trade fair on technologies for the agriculture sector allowing for the diffusion of technologies in coordination with the private sector, universities and international actors. ➢ Incentives for the substitution of chemical fertilizer with organic fertilizer: Setting of targets for emissions associated with the use of nitrogenous fertilizer per cultivation and size of farm (reaching from voluntary programmes to emission standards). Establishment of a national MRV programme for GHG emissions for the farms of a certain size. Support for local producers of organic fertilizer.
Climate Change Strategy for the Region Huetar Norte	Region Huetar Norte to be a test model region for the implementation of the ENCC Objective: carbon neutrality in 2021 Pillars include, inter alia, mitigation, greenhouse gas inventory, development of local capacities and public awareness and education
Regional Agro-environmental and Health Strategy (ERAS)	• Regional strategy of the Centro-American Integration System relating to, among other things, sustainable handling of land and agro-environmental negotiations. Includes, among others, options for mitigation actions.
General economic and fiscal	
Domestic Carbon Market	• Primary policy tool to achieve Carbon Neutrality target • Launched in September 2013 • Initially, participation is voluntary • Domestic offsets (Costa Rican Compensation Units (UCC)) or CERs and VERs to be used • Priority sectors: agriculture and livestock, energy, solid waste management, transport, and sustainable construction
Partnership for Market Readiness	With this partnership, the World Bank supports countries by developing, designing and implementing market readiness activities. Such activities include: • Designing domestic carbon markets (legal, institutional and regulatory aspects as well as registry platform/tracking tools • Increasing demand (assessment of policy options and implementation of pilot activities with firms aiming to become carbon neutral • Consolidating supply (mitigation and offset activities)
Targeted economic and fiscal	
Action Plan for Climate Change and Agro-Environmental Management 2011-2014	Mitigation actions with technical options targeting a reduction of GHG release as well as capturing and retaining of carbon on farms.
Sectoral Program for Agriculture and Livestock	• Participation in Domestic Carbon Market with cattle (40% of agriculture's emissions), coffee (iconic export product) and sugar cane (problematic harvesting burning practices) Focus on livestock grazing, cattle productivity improvement, reduction of N_20 from fertilizer use, reforestation of pastures • Sectoral baseline or benchmark

Coffee NAMA	Objectives: • Efficient use of nitrogenous fertilizers and improvement of organic mater content of soil • Efficient handling of water and energy benefiting coffee • Promotion programme for agroforestry systems as options for carbon capture and storage Expected results: • Emission reductions of ca. 30,000 t CO_2/year; 1,850,000 t CO_2 in 20 years • Carbon sinks of ca. 90,000 t CO_2/year • 120,000 t CO_2/year until 2024 at full implementation of NAMA • Eco-competitiveness in coffee cultivation (cost saving, diversification, access to new markets, reduction of environmental impact) • Resilience of more than 50,000 coffee producing families
Livestock Farms NAMA	Objectives: • Improvement of pasture handling and promotion of improved alimentation and nutrition level of animals • Incentives for improving the physical characteristics and the organic matter content of soil (reduction of soil compaction, promotion of field rotation), support for silvo-pasture systems • Efficient use of nitrogen in different biological processes (innovation in fertilization, improvement of pasture and forage, studies on nitrification in soils) • Increase of production and reproduction indices Mitigation potential: 12,923,718 tCO_2e over a 15-year period (1,243,578 tCO_2e of emission reductions, 11,680,140 tCO_2e carbon capture)
Sugar Cane NAMA	Strategy in planning phase
Individual projects	e.g. transformations throughout the sugarcane value chain focused on reducing and offsetting emissions at Azucarera El Viejo S.A.; promotion of low-emission productive systems and cultural practice in organic, sustainable and conventional agriculture
Standards and voluntary agreements	
Plan de Acción para el Cambio Climático del Sector Bananero	Action plan of the banana farmer's organization "Corporación Bananera Nacional (CORBANA)" with the objective of a carbon neutral production of bananas in 2021 by using organic fertilizer and pesticides and compostable plastic as well as reforestation projects and energy saving programmes
Information, know-how transfer and education	
Programa Competitividad y Medio Ambiente (CYMA)	Includes analysis and reduction of GHG emissions in companies, inter alia, in transnational as well as small national companies in agriculture such as Chiquita Brands (banana), Dole (banana and other fruit), Platanera Río Sixola (bananas) and Sun Ferns (flowers).
Research and technology transfer	

Sources: (Agra-TEG (Agrar- und Umwelttechnik GmbH Göttingen)/ GIZ (Gesellschaft für Internationale Zusammenarbeit) / GfRS (Gesellschaft für Ressourcenschutz mbH) 2011); (Azucarera El Viejo S.A.); (MAG / MINAE / UNDP / LECBP, 4); (MINAE 2013); (MINAET and IMN 2009); (Zamora Quirós 2013b); (Worldbank 2009)

Table 33: Barriers to Low-Emission Investment in Costa Rica's Agroindustry Sector

Barrier Type	
Financial & Economic	• Lack of public financial resources has prevented the full, effective implementation of some laws and programs on sustainable agriculture which are based on financial incentives for the provision of environmental services • Limited allocation of resources to advanced technologies that contribute to mitigating emissions due to political barriers, market distortions and special interests • Lack of financial resources to improve weaknesses in management and use of fertilizer • Low and late return of investment in coffee production • Cash flow problems of coffee growers and millers • Insufficient access to market niches for coffee producers • Weak market incentives for mitigation and substitution of fertilizers
Institutional & Political	• Lack of acknowledgement of supremacy of international conventions and regulations • Lack of inter-sectorial coordination of sectors and institutions in planning and implementing global environmental conventions • Lack of clear division of responsibilities and decision-making power • Lack of coordination of plans and budgets impedes the clear attribution of costs of actions, plans and programmes • Low regulatory incentives to capital investment and process innovation
Technical	• Lack of emissions reporting system for the production sector
Awareness / Information / Capacity	• Lack of data availability and quality in the three sub-sectors covered by the Domestic Carbon Market (livestock, coffee and sugar cane) • Lack of adequate recording system for impacts of policies and the efficiency of the efforts directed at the compliance with international conventions • Lack of awareness of the financial benefits of accurate agriculture with good environmental management • Producers' resistance to change behaviour and adopt new production practices mitigating emissions (e.g. changing fertilizers or the amounts of fertilizer used). • Lack of ability of some producers to identify themselves with the country's international commitments leads to their rejection of mitigation actions • Some people only see the immediate costs resulting from mitigation actions and not the benefits
Others	

Sources: (Pratt, Rivera, and Sancho 2010); (MINAE 2013); (MINAET and IMN 2009); (Zamora Quirós 2013a)

6.4 Ethiopia

Table 34: Emission Reduction Potential in Ethiopia's Electricity Sector

Measure	Mitigation cost (EUR/tCO_2e)	Mitigation Potential in 2020
Switching off remaining diesel power plants and off-grid generators.	Nil. Dependant on the implementation of the third measure.	3 Mt CO2e
Replacement of rural residential fossil-fuel energy generation through universal electrification.	Negative, due to the economic co-benefits of increased electrification.	
Replacing the traditional energy mix in neighbouring countries through exports of renewable energy. (Developing renewable energy generation capacity to 98 TWh, and exceeding domestic demand).	Negative. Net benefit of €3.5 per ton (excluding potential revenues from electricity export). Initial investment of $38bn USD required to increase the renewable energy generation capacity to 98 TWh.	20 Mt CO2e (in 2030)

Source: (Federal Democratic Republic of Ethiopia 2011)

Table 35: Emission Reduction Potential in Ethiopia's Agriculture Sector

Measure	Mitigation cost (EUR/tCO_2e)	Mitigation Potential in 2030
Pastoral		
Enhancing and intensification of diversifying animal mix (More poultry, less beef)	€5.5	17.7 Mt CO2e/a
Value chain efficiency improvements for pastoralists (reducing herd headcounts)	€15	4.9 Mt CO2e/a
Value chain efficiency improvements for cattle farmers	€19	11.2 Mt CO2e/a
Small scale mechanisation (reducing demand for oxen power)	€15	7.3 Mt CO2e/a
Large scale mechanisation (further reducing demand for oxen power)	€21.5	3.9 Mt CO2e/a
Rangeland and pastureland management: increasing soil carbon, and improve land productivity.	Unknown	2.7 Mt CO2e/a

Arable		
Enhancing of yield-increasing techniques through improved seeds , basic technology and best practices (reducing land required and deforestation)	-€15 (negative)	27.2 Mt CO2e/a
Agricultural intensification through small scale irrigation	-€9.5 (negative)	Ca. 2.5 Mt CO2e/a
Large scale irrigation (creation of agricultural land in arid areas, reducing need for deforestation)	€34.5	Ca. 8.1 Mt CO2e/a
Lower emitting techniques	€5	40 Mt CO2e/a
Sequestration from reduced tillage	Nil	Unknown

Sources: (Federal Democratic Republic of Ethiopia 2011; FAO 2013; Brown et al. 2012)

Table 36: Existing Policies and Measures Relevant for Ethiopia's Electricity and Cement Sectors

Type of PAM	
Framework legislation	
Climate Resilient Green Economy (2011)	CRGE includes a package of measures to continue Ethiopia's trend of high GDP growth, whilst freezing emissions at 2010 levels up until 2030.
Growth and Transformation Plan (2010)	GTP is the 2010-2015 development plan, and includes plans for expansion of electrification and the development of an additional 8 GW of renewable energy generation capacity. Ethiopia targets near-zero emission electricity generation for its entire population by 2030, under its BAU scenario. Includes plans for annual agriculture sector growth of 9.5%.
Ethiopia Energy Policy (1994)	Introduced the nation's aims to increase access to reliable electricity through expansion of hydro-electric facilities and energy conservation measures
The Rural Development Policy and Strategies (RDPS, 2003)	Includes a goal for "proper utilisation of agricultural land" by guaranteeing the availability of land for those who demonstrate plans for its optimal use.
Agricultural Development-Led Industrialisation (ADLI) (1991)	Strategy includes a major focus on promoting more efficient use of land and water resources, enhancing access to financial services, and improving access to domestic and international markets.
General economic and fiscal	
2005-2010 Plan for Accelerated and Sustained Development to End Poverty (PASDEP)	This included measures for market-based agricultural development, increased private sector investment and improved rural-urban linkages.

Targeted economic and fiscal	
Rural Electrification Fund intervention	Tax exemptions for PV and modern lighting products using renewable sources.
Feed-in tariff	A feed in tariff proposal was drafted in October 2011, but as of 2013, it is still unclear if and when it will be passed as law.[30]
Standards and voluntary agreements	
-	-
Information, know-how transfer and education	
-	-
Research and technology transfer	
-	-
Other	
-	-

Sources: (Ministry of Finance and Economic Development 2010; Federal Democratic Republic of Ethiopia 2011; Townshend et al. 2013; Lighting Africa 2012) (Ministry of Agriculture and Rural Development 2010; Ministry of Finance and Economic Development 2010)

Table 37: Barriers to Low-Emission Investment in Ethiopia's Electricity and Cement Sectors

Barrier Type	
Financial & Economic	• Finance mobilisation is a major challenge. • Renewable energy is economically attractive, but the upfront investment costs are beyond the country's capacities. • Funding gap of $20bn USD, or $1bn USD per year. • Finance is largely inaccessible for the private sector. The financial sector is small, fragmented and uncompetitive. • Most agricultural measures are not economically attractive, and even those that carry substantial economic benefits require prohibitively large investment costs. • Individual farmers are unable to self-finance improved inputs and technologies.
Institutional & Political	• The political arguments associated with the large required investments for large-scale irrigation and the potential unequal distribution of its benefits is a barrier to investment. • Issues with neighbouring countries regarding the environmental impacts of proposed activities. • Political relations with some neighbours remain tense. • Political instability in the region hinders long-term power purchase agreements. • Institutional setup is not conducive to private sector participation: o Long/complex processes for approval of private investment. o No policy instruments to encourage renewable energy investments. o Negative public perception of private sector. o Economic disincentives exist: e.g. duties for tech imports o Political instability in areas of high resource endowment. o Insecure land tenure - land is publically owned with temporary rights issued.

[30] 2013 Investment Climate Statement – Ethiopia http://www.state.gov/e/eb/rls/othr/ics/2013/204639.htm

Technical	• Abatement through exports is dependent on domestic demand forecasts, which between 2020 and 2030 is difficult to predict. • Exports are dependent on interconnection capacity, the infrastructure for which will not be ready until at least 2020. • Expansion of the domestic grid is likely to be orientated towards centralised generation, and not small-scale private investment. • The poor availability, affordability and local-suitability of agricultural technology in Ethiopia is a considerable barrier to the mechanisation of processes. • Fragmented land use in the highlands, hampers community-level adoption of technologies
Awareness / Information / Capacity	• Lack of skills, awareness and knowledge on relevant issues. • Increasing chain efficiency required increased awareness across all parties, which in turn, requires improved coordination throughout the supply chain and a strengthening of grassroots extension systems. • Farmers are in some cases reluctant to change longstanding practices.
Others	• Ethiopia's overreliance on hydro may leave it more vulnerable to climate change impacts, particularly drought.

Sources: (Federal Democratic Republic of Ethiopia 2011; Ministry of Finance and Economic Development 2010; Derbew 2013; African Development Bank 2011; Lighting Africa 2012)

6.5 India

Table 38: Emission Reduction Potential in the Indian Cement Sector

Measure	Finance requirements	Mitigation Potential
Alternative fuel and raw materials (AFR) Use of AFR such as waste is currently very low at 0.6% of thermal energy, global average is about 4%, in some countries as high as 30% (WBCSD and IEA 2013).	Additional investment USD 3-4 bln until 2020, 2-4 bln in 2020-2030 (WBCSD and IEA 2013) Abatement cost ca. 30 EUR/t CO_2-eq. (McKinsey 2009b)	42 Mt in 2030 (McKinsey 2009b) 21-37 Mt in 2050, depending on size of production (WBCSD and IEA 2013)
Thermal and electrical energy efficiency Comparing Indian plants with globally best performing plants, Bushan sees an energy saving potential of about 20%. Options include adoption of latest grinding technology, efficient raw meal transportation and blending systems, high efficiency vertical roller mills and roller presses, high efficiency motors, fans and compressed air systems (Bushan 2010).	Additional investment USD 3-5 bln until 2020, about 1 bln in 2020-2030 (WBCSD and IEA 2013)	25 Mt CO_2 in 2050 (WBCSD and IEA 2013)
Clinker substitution Ordinary Portland Cement (OPC) contains 95% clinker and 5% gypsum. Clinker production is highly energy intensive, accounting for 3/4 of the energy used in cement production. Less energy-intensive alternatives are Portland Pozzalona Cement (PPC), a blend of clinker and fly ash, Portland Slag Cement (PSC), a blend of clinker and blast furnace slag, and Portland Limestone Cement (PLC). Fly-ash and slag are by-products, cost mainly relates to transport and handling, while disposal of waste in landfills is costly (Parikh et al. 2009). Current Indian clinker-to-cement ratio is already comparatively low, estimated at 0.74, while global average is 0.80. By 2050, ratio is expected to decrease to 0.73-0.58 (WBCSD and IEA 2013) McKinsey estimates potential of using ratio of 30% of fly ash and 60% of blast furnace slag for 12% and 10% of total production respectively (McKinsey 2009b).	Additional investment USD 0.1 bln until 2020, 0.2 bln in 2020-2030 (WBCSD and IEA 2013) Abatement cost fly ash: ca. -35 EUR/t CO_2-eq.; slag: ca. -10 EUR/t CO_2-eq. (McKinsey 2009b)	Fly ash substitution 41 Mt and slag substitution 32 Mt in 2030 (McKinsey 2009b) 95-150 Mt CO_2 in 2050 at 0.58 ratio, depending on size of production (WBCSD and IEA 2013)
Waste heat recovery (WHR) Only 12 out of 183 large kilns have adopted WHR, 110 MW out of potential of around 555 MW.	n.a.	3 Mt in 2030 (McKinsey 2009b)

Depending on demand, 5,000-10,000 GWh of electricity could be saved in 2050 (WBCSD and IEA 2013).		
Captive power plants (CPP) Somewhat uniquely, about 60% of power requirement comes from CPP; reduction potential includes efficiency improvements and use of renewables (WBCSD and IEA 2013).	n.a.	80-150 Mt CO_2 in 2050 with efficiency and 50% renewables and assuming continued CPP share of 60%, depending on size of production (WBCSD and IEA 2013).
New technologies Development of new types of cement and new production processes, only CCS expected to be commercially viable within next decades (WBCSD and IEA 2013).	Additional investment USD 1 bln until 2020, 3-5 bln in 2020-2030; abatement cost estimates range from 40 to 170 US$/t CO_2-eq. (WBCSD and IEA 2013)	86-171 Mt CO_2 from CCS, depending on size of production (WBCSD and IEA 2013)

Table 39: Emission Reduction Potential in the Indian Iron&Steel Sector

Measure	Finance requirements	Mitigation Potential
Energy efficient technologies and processes 0.5% improvement per year through e.g. improved motor systems, top-pressure recovery turbines, pulverised coal injection, coke dry quenching, waste heat recovery.	Ca. -20 EUR/t CO_2e (McKinsey 2009b)	86 Mt CO_2e in 2030 (McKinsey 2009b) WHR 8 Mt CO_2e in 2007-08 (Bushan 2010)
Shift to scrap-based Electric Arc Furnace (EAF) Use of scrap requires 1/3 of energy of standard Blast Furnace – Basic Oxygen Furnace (BF-BOF) using iron ore, McKinsey considers 5% shift from BF-BOF by 2030	Ca. 45 EUR/t CO_2e (McKinsey 2009b)	21 Mt CO_2e in 2030 (McKinsey 2009b)
Shift to gas-based direct reduced iron (DRI) 7% shift from BF-BOF to DRI followed by EAF (McKinsey 2009b)	Ca. 40 EUR/t CO_2e (McKinsey 2009)	17 Mt CO_2e in 2030 (McKinsey 2009b)

Larger blast furnaces Larger furnaces consume less energy (McKinsey 2009b)	n.a.	12 Mt CO_2e in 2030 (McKinsey 2009b)
Coke substitution Replacement of 10% of coke as primary blast furnace fuel with charcoal, waste etc. (McKinsey 2009b)	n.a.	9 Mt CO_2e in 2030 (McKinsey 2009b)
Direct casting Move to near-net-shape casting technique for after treatment (McKinsey 2009b)	n.a.	7 Mt CO_2e in 2030 (McKinsey 2009b)
Cogeneration Use of waste heat in BF (McKinsey 2009b)	n.a.	5 Mt CO_2e in 2030 (McKinsey 2009b)

Table 40: Existing Policies and Measures in India Relevant for Cement and Iron&Steel

Type of PAM	
Framework legislation	
12 Five-Year Plan (2013-2017)	The Five-Year Plans aim to support the short and mid-term targets of the country and to translate general aims into more concrete planning. Primary objective of Indian policy interventions is poverty eradication and sustainable social development. The 12th FYP for the period from 2013-2017 for the first time dedicated a chapter to sustainable development. The plan inter alia highlights the need to decrease the energy intensity of production. The government had previously established an Expert Group on Low Carbon Strategy for Inclusive Growth with the mandate to develop a roadmap for low-carbon development. The Group's recommendations are a central part of the 12th FYP.
National Action Plan on Climate Change (NAPCC)	Dating from 2008, the major pillar of climate policy, containing targets and strategies for eight priority areas, the "missions", covering the time period up to 2022. Each state within the country also has to outline the actions it will undertake in each of the sectors in their state climate change action plans. The missions are further translated into concrete policies. Missions are institutionalised by respective ministries and through inter-sectoral groups including the finance ministry, the Planning Commission, and experts from industry, academia and civil society. Several missions focus on adaptation, those that are relevant for mitigation are: the National Solar Mission, the National Mission for Enhanced Energy Efficiency, the National Mission on Sustainable Habitat (buildings, waste and urban transport), and the National Mission for a Green India (foresty). Government also established an Advisory Council on Climate Change chaired by the Prime Minister and with representation from industry and civil society to set out broad policy directions, provide guidance on national actions and international negotiations and review implementation of the NAPCC and each individual mission.
National Mission for Enhanced Energy Efficiency	One of the NAPCC missions, building on existing initiatives, in particular the Energy Conservation Act of 2001, with four new programmes (see details on each programme below): Perform,

	Achieve, and Trade", Market Transformation for Energy Efficiency, the Energy Efficiency Financing Platform, and the Framework for Energy Efficient Economic Development. Aim is to avoid capacity addition of about 19.5GW by 2017.
Integrated Energy Policy	Dating from 2006, in addition to increasing supply also emphasises importance of increasing efficiency across all sectors.
Energy Conservation Act	Dating from 2001, provides legal framework, institutional arrangements and regulatory mechanism at national and state level. Measures include inter alia requirement for large energy-intensive industries to undertake energy audits, a Standards and Labeling Program to identify energy efficient appliances and equipment, formulation of energy efficiency codes and standards, introducing educational programs to increase awareness, introduction of Energy Conservation Awards. Also mandated establishment of Bureau of Energy Efficiency (BEE) to introduce energy conservation norms for energy generation, supply and consumption. 2008 NAAPC built on this legislation to achieve efficiency targets. Implementation of energy consumption reporting and auditing requirements was low until start of PAT scheme (see below).
General economic and fiscal	
Coal Levy	Levy of Rs. 50 (US$ 1) per tonne domestically produced or imported coal, accruing around US$ 500 million per year (to fund National Clean Energy Fund).
Targeted economic and fiscal	
Perform, Achieve, Trade (PAT)	The most prominent and advanced NMEE policy. Launched in 2012, covers 478 large-scale facilities. Operators have to reach a Specific Energy Consumption target (SEC; energy consumed per unit of production) by 2015. Sectoral targets are based on sector's contribution in energy consumption. Each facility is then assigned a target based on their energy consumption within the sector. Overachievement results in issuance of tradable certificates that can be sold to other participants. Indian government estimates to save 23 Mtco in coal, gas and petroleum products every year until 2015. Implementing institution is the BEE. Is supposed to help to reduce emissions by 25 Mt CO_2-eq. by 2014-2015.
Market Transformation for Energy Efficiency	Part of NMEE, aim at using international financial mechanisms including CDM through aggregating small-scale demand-side management activities. Flagship example is Bachat Lamp Yojana PoA, which has so far distributed over 20 million CFLs. Also aims at demand side management through mandatory labelling for industrial projects, amending public procurement rules, ESCo accreditation and capacity building, including for energy auditors and managers.
Energy Efficiency Financing Platform	Part of NMEE, main objective is to improve access to commercial lending for Energy Service Company (ESCo) projects by rating ESCOs, promoting ESCos to financial institutions, capacity building of financial sector.
Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE)	Part of the Framework for Energy Efficient Economic Development (FEED) under the NMEE, aim is to stimulate commercial lending for energy efficiency by building capacity in the finance sector and lowering lending risks through acting as first loss debt guarantor.
Credit Guarantee Trust Fund Scheme for Micro and Small Enterprises (CGTMSE)	Aims to alleviate problems of small-scale companies in accessing bank credit because of inability to provide adequate collateral.
Information, know-how transfer and education	
Energy audits	Energy audits were made mandatory for large industrial consumers in 9 sectors, including cement and iron&steel, in 2007. "Designated

	consumers" are also required to employ certified energy managers and to report energy consumption and conservation data annually .
Small and Medium Enterprise Programme	Aim to promote efficiency through knowledge sharing, capacity building and innovative finance mechanisms, development of industry-specific manuals by BEE.
Research and technology transfer	
National Clean Energy Fund	Aim to fund research and innovative projects in renewable energy and energy efficiency.
Venture Capital Fund for Energy Efficiency (VCFEE)	Part of the Framework for Energy Efficient Economic Development (FEED) under the NMEE, aims to support innovative technologies.

Sources: (Government of India 2008; Government of India 2011; Government of India 2012; Limaye et al. 2012; Pahuja et al. 2014; Regan and Mehta 2012; Singh 2013; Townshend et al. 2013; WBCSD and IEA 2013)

Table 41: Barriers to Low-Emission Investment in the Indian Cement and Iron&Steel Sectors

Barrier Type	
Financial & Economic	Cross-cutting • High electricity prices charged to industry and high risk of blackouts stimulate self-generation using relatively inefficient generators. • Limited access to finance, in particular for but not limited to investing in EE projects, especially for SME, in particular for longer-term loans. • Small energy efficiency project sizes with high project development and transaction costs. • Substantial efficiency improvements at older plants require major retrofits with high investment costs. Cement-specific • High investment costs for transportation, storage and handling of cement additives. • High investment cost for use of alternative fuels in cement production. • High capital costs for installing WHR systems of about USD 2.4 million per MW and long payback period, while captive power plants cost about USD 1 mio. per MW. Iron&Steel-specific • High investment cost of waste heat recovery.
Institutional & Political	Cross-cutting • Decentralised law-making at federal and state level takes time and is often not co-ordinated. • Political focus on economic growth, low budgets for environmental issues. • Lacking co-operation between cement and steel industries, specifically on activating non-granulated blast furnace slag and producing granulated slag economically. Cement-specific • Lack of standards in cement industry for clinker and final products • Indian waste policy does not support co-incineration of waste by industry, and public acceptance is low. • Indian standard limits fly ash addition in PPC to maximum 35%, while European standards allow up to 55%; there is no Indian standard specification for PLC.

Technical	Cement-specific • Use of alternative fuels is more complex than use of coal. • Availability and quality of alternative fuels is often lacking, in particular due to lack of structured waste processing industry. • Geographical distance and logistics (rail connectivity) to transport alternative fuels and blending materials to cement plants is often complex. Iron&Steel-specific • Poor quality of coal (high ash content) and of iron ore (high silica and alumina content) limit use of energy savings potential in iron&steel sector. • Low availability of scrap. • Limited policy support to formalise R&D.
Awareness / Information / Capacity	Cross-cutting • Lack of information on EE options. • Lack of corporate attention to energy efficiency, reluctance to invest in efficiency. • Lack of understanding, business models and financial products for energy efficiency. • Lack of trained staff for operating modern equipment. • Non-familiarity of operators with use of alternative fuels and WHR. Cement-specific • Lacking acceptance of blended cement by public and customers.

Sources: (Bushan 2010; H. Fekete, Vieweg, and Mersmann 2013; Government of India 2011; Limaye et al. 2012; Pahuja et al. 2014; Parikh et al. 2009; WBCSD and IEA 2013; WBCSD 2012; World Bank 2011)

6.6 Kenya

Table 42: Emission Reduction Potential in Kenya’s Agriculture Sector

Measure	Mitigation cost (EUR/tCO_2e)	Mitigation Potential in 2030
Agroforestry	ca. €10 (€5-€15)	4.2 MtCO_2e/a
Conservation tillage	€23	1.1 MtCO_2e/a
Limiting use of fire in range and cropland management	€15.5	1.18 MtCO_2e/a
Livestock management (enteric fermentation): Stage 1	Nil	0.5% of livestock emissions
Livestock management (enteric fermentation): Stage 2	€11	2.1% of livestock emissions
Reduce N_2O from cropland management: Stage 1	Nil	10.6% N_2O reduction
Reduce N_2O from cropland management: Stage 2	€11	13.5% N_2O reduction
Livestock substitution	Unknown	Unknown

Sources: (Stockholm Environment Institute 2009; Republic of Kenya 2012; FAO 2013)

Table 43: Existing Policies and Measures Relevant for Kenya’s Agriculture Sector

Type of PAM	
Framework & legislation	
Vision 2030	Agriculture as the driving force for high economic growth. Includes strategies for improving land-use efficiency and institutional reform to encourage private sector growth.
First Medium Term Plan (2008-2012)	Focuses primarily on rural extension services and facilities for resource poor farmers.
Second Medium Term Plan 2013-2017	Includes action plan for accelerated access to inputs, credit and markets.
National Climate Change Action Plan (2012)	Contains a package of measures for mitigation potential in agriculture, upon which parts of this case study are based.
General economic and fiscal	
Agricultural Sector Development Strategy 2010-2020	Strategy aims to increase productivity, competitiveness and private sector conditions, to support the *Vision 2030*.
Targeted economic and fiscal	
-	-
Standards and voluntary agreements	
-	-

Information, know-how transfer and education	
-	-
Research and technology transfer	
-	-
Other	
Development of NAMAs	The agroforestry, conservation tillage and fire-use limitation measures listed in Table 42 are being developed into NAMAs.

Sources: (Republic of Kenya 2012; Republic of Kenya 2013a)

Table 44: Barriers to Low-Emission Investment in Kenya's Agriculture Sector

Barrier Type	
Financial & Economic	• Mitigation options require upfront investment with no short term returns. • Agroforestry measures are more labour intensive.
Institutional & Political	• There is a lack of market and market information for agro-forestry inputs. • Weak market infrastructure also prevents smallholders from achieving the diverse benefits of agroforestry and its associated products. • Land tenure constraints restrain the development of agroforestry. • Finance sector not prepared for emissions trading, (and potentially less in agro-industrial sector?)
Technical	• Conservation tillage techniques may require changes in crop mixes, tool use, and intensive weed control. Otherwise there is a risk of yield reduction. • Reduced tillage may require more pesticide use, and higher concentrations of soil carbon may cause increased N_2O emissions. More research on the specific situation for Kenya is required.
Awareness / Information / Capacity	• Poor awareness and human capacity are key barriers to the implementation of most modern techniques and technologies. • Negative experiences with previous experimentation has influenced farmers' opinion negatively with regards to the adoption of new inputs and techniques. • The NCCAP finds that reducing crop and rangeland burning by 60% will require significant improvements in awareness across the remote pastoralist population. Improved extension services must be made available to 3.5 million households.
Others	• Limited research into the local significance and potential of some wedges (e.g. livestock substitution, manure management, organic agriculture, flooding rice).

Sources: (Ministry of Environment and Natural Resources 2005; Republic of Kenya 2013c; Republic of Kenya 2012)

6.7 Morocco

Table 45: Emission Reduction Potential in the Moroccan Electricity Sector

Measure	Finance requirements	Mitigation Potential
Energy efficiency Feasible potential 1,820 MW in 2020 for buildings, industry and transport, not differentiated by sector (Perspectives and Alcor 2011)	Energy efficient lighting US$134/t CO_2e, appliances US$118/t CO_2e (Government of Morocco 2010) Invest requirement €1bln by 2020 (Perspectives and Alcor 2011)	Energy efficient lighting and appliances: 1.16 Mt CO_2e in 2030 (Government of Morocco 2010) 8.1 Mt CO_2e in 2020 for buildings, industry and transport, not differentiated by sector (Perspectives and Alcor 2011)
Biomass Feasible potential 950 MW in 2020 (Perspectives and Alcor 2011)	Invest requirement €2bln (Perspectives and Alcor 2011)	4.8 Mt CO_2e in 2020, not differentiated by energy use (Perspectives and Alcor 2011)
Hydro energy Potential of 5,000 GWh/a, of which currently 40% used (Karakosta and Psarras 2013) Large potential for pumped-storage hydro in Atlas (Perspectives and Alcor 2011)	US$90/t CO_2e for large-scale and US$296/t CO_2e for small-scale (Government of Morocco 2010)	2.2 Mt CO_2-eq. in 2030 with installation of 530MW (Government of Morocco 2010)
Solar energy Conditions very favourable with 2,800h/a sunlight in the North and 3,000h/a in the South (Karakosta and Psarras 2013) Feasible potential 1GW in PV by 2020 (Perspectives and Alcor 2011)	US$70.5/t CO_2e for large-scale and US$98 for small-scale (Government of Morocco 2010) About US$50/t CO_2 (Galeazzi 2009)	4.1Mt CO_2e in 2030 with installation of 2.3GW in 2030 (Government of Morocco 2010) 4.76 Mt CO_2e in 2030 with current energy strategy; 9.97 Mt CO_2e in ambitious scenario with 70% RE (Galeazzi 2009)

Wind energy Total potential of 25GW, 4-7GW estimated to be feasible by 2020 (Karakosta and Psarras 2013; Perspectives and Alcor 2011) Wind speed quite constant, periods of calm are short and low in frequency, allowing capacity factor of >40% with ½ of European generation cost (Galeazzi 2009)	US$50/t CO_2e (Government of Morocco 2010) About US$7/t CO_2 (Galeazzi 2009)	17.6 Mt CO_2e in 2030 with installation of 5GW (Government of Morocco 2010) Potential 13.5 Mt CO_2e in 2020, current plans of 2GW would achieve 4.5 Mt (Perspectives and Alcor 2011) 18.7 Mt CO_2e in 2030 with current energy strategy, 39.18 Mt CO_2e in ambitious scenario (Galeazzi 2009)
Combined cycle plants	US$5.5/t CO_2e (Government of Morocco 2010)	4.8 Mt CO_2e in 2030 with installation of 1GW (Government of Morocco 2010)
Nuclear energy	US$18.6/t CO_2e (Government of Morocco 2010)	9.7 Mt CO_2e in 2030 with installation of 2GW (Government of Morocco 2010)

Table 46: Existing Policies and Measures in the Moroccan Electricity Sector

Type of PAM	
Framework legislation	
National energy strategy	Issued in 2008, objectives inter alia to reduce energy consumption in industry, transport and buildings by 12-15% by 2020 and 20% by 2030, to meet 10-12% of primary energy demand by 2020 and 15-20% by 2030 from renewables, specifically to increase renewables share of installed electricity capacity to 42% by 2020, including 2GW of concentrated solar power. Implementation of efficiency and renewables targets projected to avoid 7Mt CO_2-eq. per year.
PNAP (Plan National d'Actions Prioritaires)	Launched 2008, objectives security of energy supply, access to energy, the promotion of renewable energy and energy efficiency, and regional energy integration among Euro-Mediterranean markets.

	Targets to double capacity from 2008 to 2015, with renewables reaching 18.6%, power price incentives to reduce peak-hour consumption, subsidies for replacement of incandescent bulbs.
National Plan Against Global Warming	Issued in 2009 and presented in Copenhagen, confirms energy strategy and PNAP and summarises existing and planned mitigation and adaptation measures.
National Charter for Environment and Sustainable Development	Presented in 2011, voted on in January 2014, framework for future environmental policy.
Targeted economic and fiscal	
PERG	Started in 1996, aim universal electrification, for 10% of households achieved through small-scale solar.
PROMASOL	Started in 2002, integrated solar water heaters and PV programme, focus on SWH, aim 1.7 millon m2 in 2020.
EnergiPro	Launched in 2006, offers of two types of incentives by ONEE, either an agreement that ONEE will transmit all electricity from a site of (self-)generation to other at a fixed transit tariff, or purchase any excess generation of industrial manufacturers at 60% of the wholesale price. Initiative was developed for CDM, developers are entitled to CERs.
Renewable Energy Law (Law 13-09)	Modification of existing Decree of 1968 establishing ONEE (Enzili 2010), allows self-production for own consumption by industrial investors for installations up to 50 MW; projects developed by private investors aimed at selling electricity to third parties; engineering, procurement and construction contracts with ONEE; and projects by independent producers within a long-term power purchase agreement with ONEE. Government covers difference between the price at which MASEN buys and then sells power.
Moroccan Integrated Programme of Wind Energy	Call for tender to implement the 2GW wind energy target for 2020 conducted by ONEE.
Plan Solaire	Specifies energy strategy's 2GW solar target as to be achieved by constructing five large solar power plants. Government committed US$ 9 bln and set up Moroccan Agency for Solar Energy (MASEN) (see below). 470MW plant at Ain Beni Mathar already operational, construction of 500MW plant Ourzazate is underway.
Law for the Creation of the Moroccan Agency for Solar Energy (MASEN) (Law 57-09)	Creation of agency tasked with implementation of 2GW solar target for 2020. It manages the competitive bidding procedures for the solar plants as well as allocation of land and coordination of the combination of grants and loans by multilateral and bilateral donors. Other activities include design of integrated solar projects, technical, economic and financial studies, project management, realisation of infrastructure for grid connection, programme promotion to foreign investors, contribution to development of training modules and research and innovation.
Societé d'Investissement Energetiques (SIE)	Established in 2010, manages Energy Development Fund endowed with US$ 1 billion (from Saudi Arabia, United Arab Emirates and Hassan II Fund for Economic and Social Development), seeks to mobilise further capital. Focus on increasing energy production capabilities, reinforcing renewable energy resources, and strengthening energy efficiency.
Solar water pumps programme	Government mobilised €36 million in 2013 to install 3,000 pumps with cumulative capacity of 15MW.
Standards and voluntary agreements	
Law 47-09 on energy efficiency	Sets criteria of "minimum energy performance" for appliances and electrical equipment sold in Morocco. Also introduces mandatory energy audits for companies and institutions in production,

	transmission and distribution of energy, and performance of energy impact study for new construction and urban projects.
Information, know-how transfer and education	
Law for the Creation of the National Agency for the Development of Renewable Energies and Energy Efficiency (ADEREE) (Law 16-09)	Adopted in 2009, provides for restructuring and renaming of former Center for Development and Renewable Energies (CDER) established in 1982. Responsible for the preparation of plans, maps and resource assessments with specific focus on wind power, making proposals for project sites and incentive frameworks, initiating pilot projects, performing quality-control checks (in particular on PV equipment), training renewables specialists.
Research Institute on Renewable Energy (IRESEN)	Established in 2009, aim to link private sector and research institutions.

Sources: (Andriani et al. 2013; Enzili 2010; Fujiwara, Alessi, and Georgiev 2012; Galeazzi 2009; Government of Morocco 2010; Perspectives and Alcor 2011; Vidican et al. 2013)

Table 47: Barriers to Low-Emission Investment in the Moroccan Electricity Sector

Barrier Type	
Financial & Economic	• High upfront investment requirement of renewables and correspondingly high risk; e.g. as much as 87% of cost of electricity from solar thermal plants is initial investment cost. • Lack of access to investment capital, in particular for SMEs. • Limited investment capacity of households for small-scale RE installations.
Institutional & Political	• Virtual monopoly position of ONEE, which is single buyer of electricity from IPPs. • Lack of energy regulator, all issues have to be addressed to ONEE. • Lack of investment certainty to due relatively short-time horizon and lack of clarity about technology choice of Plan Solaire. • Electricity distributors have disincentive to support decentralised solar. • High fossil fuel subsidies disadvantage RE applications. • Lack of incentives for decentralised installation such as FIT or net metering; aversion to FIT due to concern over setting too high or low and financial burden. • No access to low-voltage grid (for distributed solar). • Correspondingly small market for small-scale applications. • No provision for independent electricity producers to sell to the grid or directly to customers, apart from power purchase agreements strictly controlled by the ONEE, which strongly inhibits private sector involvement. • Lack of technical standards and quality control. • Limited R&D funding. • Limited cooperation between academia, private sector and policy-makers.
Awareness / Information / Capacity	• Limited capacity of local industry to manufacture RE components. • Lack of RE experts and skilled workforce to operate and maintain RE plants. • Reluctance to invest in renewables among investors and banks

	due to limited knowledge and higher risks. • Limited information on RE among population.

Sources: (Enzili 2010; Fujiwara, Alessi, and Georgiev 2012; Hering 2012; Karakosta and Psarras 2013; Vidican et al. 2013)

6.8 Peru

Table 48: Emission Reduction Potential in Peru's Electricity Sector

Technology	Potential
Hydro	Technical potential estimated at 58,937 MW
Wind	Potential capacity of 22 GW
Solar	High technical potential - 5.24 kWh/m^2.
Biomass	Estimated high potential
National strategy	**Potential**
Increase share of non-hydro renewable energy in the National Integrated Electricity System (SEIN) to 5%	1.9 $MtCO_2e/a$
Increase share of hydro power in the SEIN to 65%.	Unknown
Increase use of combined cycle in gas plants to 60%	2.1 $MtCO_2e/a$
Generation of electricity in new mining projects from renewable energy	15.5 $ktCO_2e/a$
Develop rural electrification through renewable energies	Unknown
Improve the knowledge base necessary for sustainable business in biomass technologies	Unknown
Commercialisation of vegetable oil as a substitute for diesel	Unknown
Installation of micro-scale renewable energy in poor rural areas.	Reduce use of dirty fuels and contribute to sustainable development.
Increased use of solar power in "communicaciones" and in the residential sector, for rural electrification and lighting.	Unknown

Sources: (MINAM Peru 2010)

Table 49: Existing Policies and Measures Relevant for Peru's Electricity Sector

Type of PAM	
Framework & legislation	
Law to create a market for biofuels (2005)	

Law on the politics of energy efficiency	Declares the promotion of efficient energy use as a matter of national priority.
General economic and fiscal	
Targeted economic and fiscal	
Tender process (2008)	Tender process for private development of renewable energy facilities. 411 MW of renewable energy generating capacity was contracted in 2008.
Tax incentives	Exemption of renewable energy powered electricity from value added tax (2006)
Decree 1002	Premiums may be set for renewable energy powered electricity, where marginal generating costs are deemed too high. Renewable energy gets priority dispatch and priority connection in the grid.
Standards and voluntary agreements	
-	-
Information, know-how transfer and education	
-	-
Research and technology transfer	
Feasibility studies	In 2009, the government contracted 60 feasibility studies for wind energy potential in coastal areas,
Other	
-	-

Sources:(Stadelmann and Eschmann 2011; MINAM Peru 2010; REN21 2013; IRENA 2013)

Table 50: Barriers to Low-Emission Investment in Peru’s Electricity Sector.

Barrier Type	
Financial & Economic	• Renewable energy technologies have higher upfront investment costs and construction periods than gas plants.
Institutional & Political	• Political incentives for natural gas (inc tax incentives) were institutionalised in laws in 1998 and 2001. The national energy plan projects natural gas to be the key source of energy supply growth up to 2030.
Technical	• The grid is not expansive enough, and does not stretch to many areas of high renewable energy resource potential.
Awareness / Information / Capacity	• Feasibility of some renewable energy technologies uncertain, and technical knowledge is sparse.
Others	• Changing rainfall patterns creates uncertainty and risk for hydro power. • The majority of renewable energy technology components are imported, and therefore expensive. • There is a high level of informality with regards to legislation in many rural areas of high resource potential.

Sources: (MINAM Peru 2010)

6.9 South Africa

Table 51: Emission Reduction Potential in the South African Electricity Sector

Measure	Finance requirements	Mitigation Potential in 2020
Non-bio renewable energy:		
Wind	<EUR100/t CO_2e, Gauteng area (Telsnig et al. 2013)	35-38 MtCO_2e/a (aggregate value Wind, PV, CSP (Hanna Fekete, Höhne, Hagemann, Wehnert, Mersmann, Vieweg, Rocha, Schäffer, et al. 2013))
Concentrated Solar Power	ca. EUR200/t CO_2e, Gauteng area (Telsnig et al. 2013)	
Photovoltaics	>EUR350/t CO_2e, Gauteng area (Telsnig et al. 2013)	
Hydro	0 - negative cost, Gauteng area (Telsnig et al. 2013)	no data (potential limited, larger-scale imports possible) (Cloete, Robb, and Tyler 2010)
Cleaner coal		
IGCC/UGCC	n.a.	4.4 MtCO_2e/a (World Bank 2002)
Super-critical coal	n.a.	3.6 MtCO_2e/a (World Bank 2002) (only indicative due to vintage of data, no data for 2020)
CCS	<EUR100/t CO_2e (Cloete, Robb, and Tyler 2010)	no data, but only very limited storage capacity (Cloete, Robb, and Tyler 2010), see also (Winkler 2007)
Other		
Landfill / sewage gas to electricity	low cost (close to 0), Gauteng area (Telsnig et al. 2013)	no data
Biomass to electricity	n.a.	very low overall potential (Cloete, Robb, and Tyler 2010),
Nuclear	n.a.	no potential in 2020 (Hanna Fekete, Höhne, Hagemann, Wehnert, Mersmann, Vieweg, Rocha, Schäffer, et al. 2013)

Table 52: Emission Reduction Potential in the South African Iron&Steel Sector

Measure	Finance requirements	Mitigation Potential
Energy efficient technologies and processes		
Low cost		
Continuous improvement, preventative and better	Ca. 20 EUR/t	0.29t CO_2 per

planned maintenance, furnace insulation, process flow improvements, sinter plant heat recovery, coal moisture control, pulverised coal injection Moderate cost Oxygen injection in EAF, scrap preheating, flue gas monitoring, improvement of recuperative burners, improved motors and pumps, BF gas recycling, advanced heat recovery	CO_2e. (McKinsey 2009 in Cloete et al. 2010) initial abatement cost, likely payback over time 40 EUR/t CO_2e (McKinsey 2009 in Cloete et al. 2010)	t/steel, ca. 10% reduction vs. current production (IEA 2008 in Cloete et al. 2010) 0.2 efficiency increase (McKinsey 2009 in Cloete et al. 2010)
Shift to scrap-based Electric Arc Furnace (EAF) Use of scrap requires 1/3 of energy of standard Blast Furnace – Basic Oxygen Furnace (BF-BOF) using iron ore. Use limited by availability of scrap (Cloete, Robb, and Tyler 2010). Current use in South Africa: 10% (www.saisi.co.za)	Ca. 45 EUR/t CO_2-eq. (McKinsey 2009 in Cloete et al. 2010)	50-95% emission reductions possible vs. traditional BF/BOF (Cloete et al. 2010) limited overall future potential because of already high scrap use
Coke substitution Replacement of 10% of coke as primary blast furnace fuel with charcoal, waste, biomass etc. (McKinsey 2009 in Cloete et al. 2010)	-10 EUR/t CO_2-e McKinsey 2009 in Cloete et al. 2010)	Limited to small furnaces, limited overall potential (Cloete et al. 2010)
Direct casting Move to near-net-shape casting technique for after treatment (McKinsey 2009 in Cloete et al. 2010); continuous casting is already widely in use in South Africa. Direct casting can only be integrated in new builds	High capital costs: 150-200 EUR per t/steel, but lower than new build of continuous caster (IEA 2008 in Cloete et al. 2010)	
Cogeneration Use of process gases and waste heat in BF for electricity generation (McKinsey 2009)	-65 EUR/t CO_2-e. (McKinsey 2009 in Cloete et al. 2010)	
Smelt reduction Integrated process of ore preparation, coke-making and BF iron-making. Technology still in optimisation process. Efficiency gains mainly through combination with cogeneration; combination with CCS possible (Cloete, Robb, and Tyler 2010)	High investment costs (Cloete et al. 2010)	Possibly -8% direct energy use vs. traditional BF designs (McKinsey 2009 in Cloete et al. 2010), but conflicting reports on potential (Cloete et al. 2010)

Carbon Capture and Storage Possible only with oxygen-injected BF, lowers energy efficiency (Cloete, Robb, and Tyler 2010)**,** not available yet		

Table 53: Existing Policies and Measures in South Africa Relevant for Electricity and Iron&Steel

Type of PAM	
Framework legislation	
National Climate Change Response White Paper	The NCCR represents South Africa's overall low carbon development strategy, containing goals for both adaptation and mitigation. As a mitigation target, the NCCR reiterates South Africa's NAMA submission under the UNFCCC to reduce emissions by 34% below BAU in 2020 and 42% below BAU in 2025, conditional to international support. The included emissions trajectory of "Peak, Plateau, Decline" would require South Africa's emissions to peak between 398 and 614 Mt CO_2e/a, and to remain at that level up to 2035. After 2035, South Africa's emissions would have to decline to a level of 212 to 428 Mt CO_2e/a in 2050. This level is calculated as a range of plus/minus 108 Mt CO_2e/a around the LTMS "Required by Science" scenario endpoint of 320 Mt CO_2e/a in 2050. An important part of South Africa's mitigation strategy is increased use of low- or zero-emission energy technologies for electricity generation, heightened energy efficiency and energy demand management.
Integrated Resource Plan for Electricity (IRP) 2010-2030	The IRP is a sectoral strategy for the future energy mix in South Africa, developed in 2010 and revised in 2011. It contains the Ministry of Energy's scenario for the development of the energy sector up to 2030, to be revised every two years. The revision for 2013 is currently under preparation. A final draft for Cabinet approval will be available by March 2014 (planned). The update *inter alia* takes into account the development of the energy sector over two years, and changed energy demand projections for 2030: 345-416 TWh instead of 454 TWh, leading to 6600 MW less capacity requirements. The IRP now takes into account South Africa's Peak, Plateau, and Decline emissions scenario for an extended mitigation scenario up to 2050, with a fixed percentage of 45% emissions contribution of the electricity sector. The target for 2030 remains at 275 MtCO_2e/a, but is now projected to decline to 210 MtCO_2e/a in 2050 (moderate decline scenario, marginally above 45% total contribution), or to 140 MtCO_2e/a (advanced decline scenario, within 45% range).
White Paper on Renewable Energy	The White Paper set a target of 10,000 GWh/a of renewable energy by 2013. The DoE's Annual Report 2011-2012 (DoE 2012a) lists the actual output from renewable energies at only 2,000 GWh in 2010/2011.
Energy Efficiency Strategy	South Africa's Energy Efficiency Strategy sets the target to reduce final energy demand in the industry and mining sectors by 15% in 2015. It is currently under revision. The revised Strategy does not list any compulsory efficiency measures to be applied in industrial policies, it does mention the adoption of two new standards that can be applied voluntarily for industrial processes.
General economic and fiscal	
Carbon tax (planned)	In early 2013, the National Treasury announced its intent to introduce a general carbon tax in 2015(Treasury 2013).

	The carbon tax will only cover direct greenhouse gas emissions from stationary sources resulting from fuel combustion and gasification, and from industrial processes. As a complementary measure, tax incentives for energy savings will be introduced before roll-out of the carbon tax. The proposed tax will be gradually phased in. The tax rate is set at 120 R/tCO_2e (ca. 12 USD) above the tax-free threshold, and will increase by 10% each year until 2019. After that the tax rate will be revised. From 2015 to 2019, 60% of emissions will be tax-free across all covered sectors. Trade-exposed sectors receive an additional allowance of 10%, and some sectors receive additional allowances for process emissions. 10% of emissions (5% for sectors with process emissions allowances) may be offset through carbon credits. The threshold will be reduced in the next phase until 2025, after which an absolute emissions threshold may be introduced.
Targeted economic and fiscal	
REIPPPP	REIPPPP is an auctioning process to win a long-term purchasing power agreement (PPA) with Eskom. It requires project developers of renewable energy projects to pass two sets of evaluation criteria. First, proposals are weighed against economic development, legal issues, land use and acquisition, as well as environmental, financial and technical elements. After the first phase, project proposals undergo a second assessment on feasibility and price. The auctioning process has led to considerable competition from international project developers, and PPAs for 1,415 MW of renewable energy were awarded in the first round up to 2012.
South African Renewables Initiative (SARI)	SARI aims at the development of the renewables sector in South Africa, and to mobilise international and national support for accelerated renewables deployment. It was launched in 2011 during COP17 in Durban as a collaborative project of South Africa, the European Investment Bank, Denmark, Germany, Norway, and the United Kingdom. SARI has not started working yet, but if implemented fully, could lead to a relative saving of up to 1.2 billion tonnes on CO_2e.
Standards and voluntary agreements	
Energy Efficiency Accord (DoE 2006)	The Accord is a voluntary agreement with businesses, and mainly aimed at the industry and mining sector, with the aim of contributing to the 15% energy efficiency improvement target. The last Assessment Report reports only limited effectiveness.
SANS 50001	The standard is an equivalent to ISO 500001. It introduces energy management systems for industrial and commercial applications. The standard may be applied voluntarily.
SANS 50010	This is a domestic measurement and verification standard. The standard needs to be applied if companies or individuals wish to claim tax savings on the basis of energy efficiency.
Information, know-how transfer and education	
SARI	(see above)

Sources: (DEA 2011a; DEA 2011b; DoE 2005; DoE 2006; DoE 2008; H. Fekete, Vieweg, and Mersmann 2013; Greenwell Consulting 2012; National Treasury 2013; Parker and Gilder 2013; Townshend et al. 2013).

Table 54: Barriers to Low-Emission Investment in the South African Electricity and Iron&Steel Sectors

Barrier Type	
Financial & Economic	Cross-cutting • Low electricity prices do not provide incentives for higher efficiency on the demand side

	Electricity-specific • High initial technology cost for renewables Iron&steel-specific • High capital cost for refit and new installations
Institutional & Political	Cross-cutting • Limited political commitment • No coherent strategy for access to international support Electricity-specific • Fragmented policy space for renewable energy development: split responsibilities between Environment and Energy Ministries • Energy security and full electrification are development priorities, possibly overriding low-carbon options within the sector • Slow uptake of renewable energy generation by state provider Eskom • Quasi-monopolistic structure of the sector may limit full uptake of available option Iron&steel-specific • Mostly voluntary measures for enhanced energy efficiency • Oligopolistic structure of the sector
Technical	Electricity-specific • Grid integration: Strong RE potential in the north, away from population centers, but currently only limited grid capacities • Centralised electricity provision and distribution detrimental to decentralised renewable energy generation Iron&steel-specific • Some technologies only possible by completely new builds • Low availability of scrap
Awareness / Information / Capacity	Cross-cutting • Limited institutional knowledge and capacities, especially within lower tiers of government Iron&steel-specific • Risk aversion to fuel switch • Lack of awareness on process optimisation gains

Sources: (Cloete, Robb, and Tyler 2010; H. Fekete, Vieweg, and Mersmann 2013; Gets 2013; IEA 2011; Kiratu 2011; Koen 2012; Tyler et al. 2013; Ziuku and Meyer 2012a; Ziuku and Meyer 2012b).

6.10 Thailand

Mitigation Costs and Potentials

Our assessment on mitigation costs and potentials is based on a study by (Hasanbeigi, Menke, and Price 2010) which assessed 41 mitigation options specifically for the Thai cement sector within a 15-year scenario period (2010 - 2025). Costs range between -73 USD/t CO2 and + 246 USD/t CO2. However, the vast majority of the potential comes at costs between -40 and 0 USD/t CO2. The study lists the top eight cost-effective mitigation potentials, which cover more than 85% of the cost-effective potential (see Table 55). Measures which are not cost-effective only have a very limited mitigation potential (see Table 56).

Table 55: Emission Reduction Potential in the Thai Cement Sector

Measure	Finance requirements	Mitigation Potential
Product change - Blended cement The production of blended cement is identified as the measure with the highest abatement potential. - Portland limestone cement The production of portland limestone cement is a comparable cost-effective measure, though the average annual CO2 abatement over the scenario period is significantly lower.	Abatement cost blended cement: -12.89 (US$/ton CO2) Abatement cost portland limestone cement: -14.38 (US$/ton CO2)	861.58 (ktons CO2/year) 156.86 (ktons CO2/year)
Finish grinding - Replacing a ball mill with vertical roller mill - High pressure roller press as pre-grinding to ball mill	-35.26 (US$/ton CO2) -32.51 (US$/ton CO2)	190.37 (ktons CO2/year) 100.12 (ktons CO2/year)
Clinker making - Kiln shell heat loss reduction - Upgrading the preheater from 4 stages to 5 stages or from 5 stages to 6 stages - Low temperature waste heat recovery for power generation	-19.76 (US$/ton CO2) -1.37 (US$/ton CO2) -23.11 (US$/ton CO2)	545.73 (ktons CO2/year) 377.34 (ktons CO2/year) 290.68 (ktons CO2/year)

Alternative fuels - Use of alternative fuel (biomass) All registered CDM projects have targeted this potential	-19.18 (US$/ton CO2)	129.13 (ktons CO2/year)

Table 56: Emission Reduction Potential in the Thai Cement Sector – key non-cost effective potentials

Measure	Finance requirements	Mitigation Potential
Raw materials preparation		
- High-efficiency vertical roller mill for raw material grinding	47.33 (US$/ton CO2)	19.97 (ktons CO2/year)
- Efficient transport system (mechanical transport instead of pneumatic transport)	145.15 (US$/ton CO2)	1.33 (ktons CO2/year)
- Use of gravity system instead of pneumatic system in raw meal blending	246.35 (US$/ton CO2)	23.92 (ktons CO2/year)
The above measures are identified as not cost-effective, thus, non of these is said to have a significant abatement potential.		

Table 57: Existing Policies and Measures in Thailand Relevant for the Cement Sector

Type of PAM	
Framework legislation	
Climate Policy	The 11th National Economic and Social Development Plan (NESDP 2012-2016) aims at redirecting the country to a low-carbon and environmentally friendly economy. In 2013 the government has passed Thailand's Climate Change Master Plan 2013-2050.
Energy Efficiency	In 1992 the Thai government passed the Energy Conservation and Promotion Act (ENCON Act) which comprises a variety of measures and has adapted and extended since. In 2011 a 20-year Energy Efficiency Development Plan (EEDP) was formulated with a target to reduce energy intensity by 25% in 2030, compared to 2010.
Renewable and Alternative Energy	In 2012 a 10-year Alternative Energy Development Plan (2012-2021) was prepared by the Department of Alternative Energy Development and Efficiency (DEDE). The plan aims at promoting alternative energy usage to 25% of energy consumption and at reducing dependency on

	energy import.
General economic and fiscal	
Cost-based tax incentives	Companies receive a 25% tax break for investing in projects that result in efficiency improvement. These tax breaks are applicable to the first 50 million Baht investment (approximately US $1.25 million) and spread over 5 years.
Incentive through Board of Investment	This subsidy program allows for import duty and cooperate tax exemption on new investments in Energy Efficiency business and Renewable Energy production business.
Targeted economic and fiscal	
Energy Conservation (ENCON) Fund	The ENCON fund is part of the ENCON Program that was initiated by the 1992 Energy Conservation and Promotion Act. The fund aimed at providing financial support for the implementation of energy efficiency and renewable energy projects of government agencies, NGOs, businesses, universities etc..
Energy Efficiency Revolving Fund (EERF)	In 2003 the Energy Efficiency Revolving Fund was established under the ENCON Program. The fund provided low interest loans to banks, which then financed Energy Efficency projects. Thailand began to phase out the EERF in 2011 since data suggested that banks gained understanding and capacity to be able to provide financing without government support.
Energy Services Company (ESCO) Fund	In 2008 the Energy Services Company (ESCO) Fund was established as a mechanism of the ENCON Program. Since the EERF mainly adressed large companies, the ESCO Fund aimed to provided financial support small and medium enterprises. The ESCO Fund will be maintained under the government's 10-year Alternative Energy Development Plan (2012-2021).
Information, know-how transfer and education	
Energy Audits	The ECON Act required the owners of designated factories and buildings to audit and analyse energy utilization in the factory/building. However, the mandatory energy auditing was stopped.
Public Awareness Creation and Behavioral Change	Measures under the Energy Efficiency Development Plan (EEDP) comprise: Public relations and provision of knowledge about energy conservation to the general public, via the teaching/learning process in educational institutions, fostering youth awareness, and other PA activities, such as eco-driving; fostering cooperation between local administration organizations and the business sector in the planning and implementation of activities that will lead to reduction of GHG emissions and efficient use of energy.
Thailand Greenhouse Gas Management Organization (TGO) CDM	TGO provides information, training and capacity bulding for project developers, designated operational entities and consultants for CDM projects and market based approaches. Dedicated internet portal: http://carbonmarket.tgo.or.th.
Research and technology transfer	
Promotion of Technology Development and Innovation	Measures under the Energy Efficiency Development Plan (EEDP) aim at promoting research, technology development and innovation: Promotion of research and development to improve energy efficiency and reduce technological costs; promotion of energy efficiency technologies which have been technically proven but have not been commercialized on the domestic market.

Sources: (CCAP 2013); (Chappoz and Laponche 2013); (Grüning et al. 2012); (Hasanbeigi, Menke, and Pont 2009); (Irawan and Heikens 2012); (Ministry of Energy 2011); (Ministry of Energy 2013); (Ministry of Energy 2014); (UNEP 2006a).

Table 58: Barriers to Low-Emission Investment in the Thai Cement Sector

Barrier Type	
Financial & Economic	Cross-cutting • Lack of financial resources especially in SMEs • Lack of financial incentives (in various forms) • Current fiscal incentives are not working well (complicated procedure and problems in the implementation of the programs) • Concerns that new technologies may not comply with future environmental or energy regulations • Fluctuation of energy price • Price of energy in Thailand is still highly subsidized; the real price of energy without subsidies would force industry to improve their energy efficiency • Substantial efficiency improvements at older plants require major retrofits with high investment costs Cement-specific • High investment cost for use of alternative fuels in cement production • Management concerns about the investment costs of energy efficiency measures • Management concerns about time required to improve energy efficiency • Concerns about production disruption • Management finds production more important
Institutional & Political	Cross-cutting • Lack of coordination between different government agencies • Lack of enforcement for government regulations • Policy conflict: energy is important but not urgent • Conflict between economic growth and environmental policy, so energy is subsidized instead of energy efficiency promoted • There is a lack of policies, procedures and systems within companies Cement-specific • Lack of coordination between external organizations
Technical	Cross-cutting • Uncertainty about the performance and future cost of energy-efficient technologies in industry Cement-specific • Use of alternative fuels is more complex than use of coal • Availability and quality of alternative fuels is often lacking, in particular due to lack of structured waste processing industry • Demand for high cement performance (requirements for very fine grinding; significantly more power than low-performing cement) • Current installations are already considered efficient
Awareness / Information / Capacity	Cross-cutting • Lack of top management commitment/understanding/vision • Lack of information and knowledge in companies especially in SMEs • Lack of expertise and personnel in Thai industry with enough

	knowledge about energy efficiency Cement-specific • Lack of training on energy-efficient technologies and on energy management system • Lack of information about government policies/legislation/fiscal incentives; about energy-efficient technologies; and about energy management system

Sources: (CCAP 2009); (Hasanbeigi, Menke, and Pont 2009); (UNEP 2006b); (WBCSD and IEA 2009).

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