PROFILE OF

Emissions Reduction Potentials

IN DEVELOPING COUNTRIES

SUMMARY OF 15 COUNTRY STUDIES

UNEP RISØ
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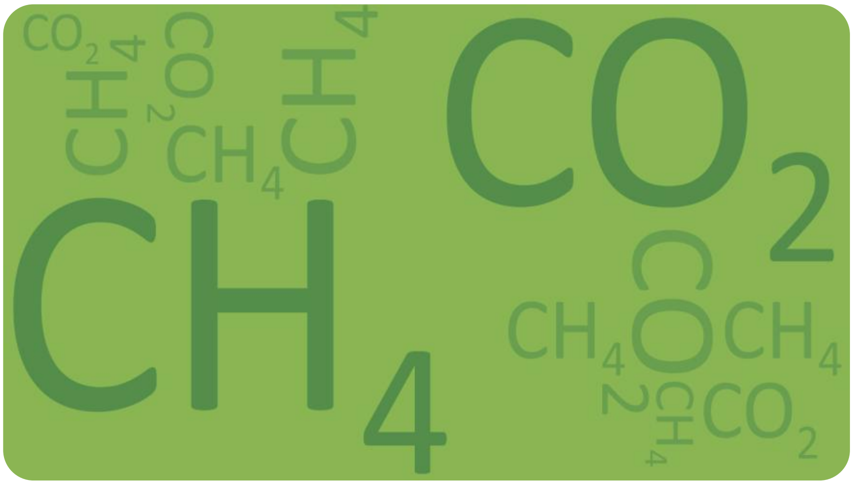
ACP-MEA & UNFCCC



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Foreword

A second commitment period of the Kyoto Protocol has just started. International climate negotiations consistently keep new market based approaches on the agenda. Nationally Appropriate Mitigation Actions are rapidly rising as a new signature concept for a future climate treaty. In response to this momentum, many countries still find themselves in search of concrete emissions reduction options.

UNEP Risoe, with the support of the UNFCCC Secretariat and the ACP-MEA Programme (www.acp-cd4cdm.org), has decided to assess the emissions reduction potential in 15 diverse countries. While most of these countries are not seen as obvious targets for emissions reduction activities, they are nevertheless likely to be involved in some form of future emissions reduction. Consequently, 15 country reports have been developed, from which this synthesis report gathers the main messages.

Ultimately, it is at the concrete implementation level that emissions are reduced – through the choice of technology for specific projects or activities. The Clean Development Mechanism has been responding to such project-based approaches for more than a decade, and continues to present itself as a relatively straight-forward instrument for identification of reduction options and methodologies for the calculation of emissions reduction potential. Experience on the performance of various technologies in different contexts is rapidly being accrued and has been employed in order to help establish an estimate for the overall national emissions reduction potential in all sectors of economic activity.

The definition of sectors and technologies used in these country reports takes its point of departure from UNEP Risoe's CDM Methodology and Technology Selection Tool (www.cdm-meth.org). This tool has been specifically developed for the identification of technologies and related CDM methodologies for exploitation of emissions reduction potentials in developing countries. This is supplemented by data from CDM projects already being implemented, extracted from UNEP Risoe's CDM Pipeline (www.cdmpipeline.org), which contains detailed information on more than 9000 CDM projects at different stages of development. It is hoped that by employing these resources systematically, the estimates will be complete and realistically achievable, and that no significant sectors or activities will be forgotten.

Typically, however, there tend to be omissions. Even systematic consideration of all existing technologies can never fully capture new ideas or approaches, which will have some reduction options left out. Moreover, there are probably overestimations of the potentials through the inclusion of options that, for different reasons, are not feasible in a given national context – administrative or political constraints are not considered, nor is general public opinion.

Therefore, while the goal is to provide complete and in-depth assessments of reduction potentials, there will undoubtedly be questions raised, examples providing evidence to the contrary, and suggestions for improvement from people and institutions that are better informed, have greater access to information or simply disagree with the methods adopted in these country assessments.

The team behind these country assessment reports welcome all constructive comments and suggestions for improvements and additions – or deletions – that can make the assessments more precise, complete and better founded. For this reason the country reports currently exist only in soft internet versions, facilitating such updating from readers or stakeholders based on new or additional information. Any comments are most welcome at snlu@dtu.dk.

While the current supply and demand balance in the global carbon market does not leave much room for a future supply of certified emissions reductions from new CDM activities, the investment in emissions reduction activities fortunately remains high on the agenda in most countries. This is either as a result of a specific climate change agenda, the development of Nationally Appropriate Mitigation Actions, or as a positive side effect of investment programmes in renewable energy. It is the aim of the team behind these country reports that the information provided could support such actions and further the emissions reduction agenda, including through the use of CDM under the right market conditions.

Søren E. Lütken

June 2013

Introduction

The Clean Development Mechanism (CDM) under the Kyoto Protocol has passed its 11th year of operation after the rulebook for the mechanism was elaborated through the Marrakech Accords in 2001. By devising the mechanism and, more importantly, the regulatory principles supporting it the regulatory bodies behind the mechanism – particularly the Conference of the Parties (COP) and the Subsidiary Body for Implementation (SBI), serviced by the Secretariat for the United Nations Framework Convention for Climate Change – launched what is possibly the greatest global regulatory experiment in history, and succeeded. Despite substantial uncertainties regarding the specific modalities and equally substantial uncertainties about the actual outcome of project developments, the world has embraced the mechanism – with all its flaws and shortcomings – as an instrument for international cooperation on greenhouse gas emissions reduction. According to the UNEP Risoe Centre's CDM Pipeline[1] about 7000 CDM projects have reached registration with the UNFCCC Secretariat and approximately 2000 more projects are under development. Each and every one of these projects has induced cross-border cooperation between a significant number of stakeholders, united by the emerging challenge of climate change.

While the regulators have reason to congratulate themselves, they have acknowledged that the mechanism does have its challenges, particularly regarding its geographical distribution. While projects have sprung up in Asia and Latin America from the very early days of CDM operation, Africa seemed to have been left behind, though much of this 'hesitation' in Africa may be explained by the relatively low level of emissions.

The mechanism was designed as a bottom-up approach essentially thriving on project developers and investors that carry on their business of building power plants, renovating distribution systems, disposing of waste, and harnessing renewable energy sources. In some instances the absence of project development may be attributed to the lack of project developers--either nationally or internationally. In other instances there may be political or other larger issues involved, such as natural catastrophes or recent civil wars. Overall, the geographical distribution of CDM activities has improved in recent years--particularly since the adoption of the Nairobi Framework in 2006, which has a specific objective "to help developing countries, especially those in sub-Saharan Africa, to improve their level of participation in the Clean Development Mechanism (CDM) and enhance the CDM's geographical scope"[2].

The instruments for achieving this objective are capacity building for the development of CDM project activities and the enhancement of capacities of CDM Designated National Authorities in CDM project host countries. Further, in a response to the concerns raised by G77, in terms of investment drivers, the Framework continues to promote investment opportunities in CDM projects in the

[1] The CDM Pipeline is published and updated monthly by UNEP/Risoe at http://cdmpipeline.org/publications/CDMpipeline.xlsx. All quantitative figures relating to CDM in this article are downloaded from the March 1 2011 version of the CDM Pipeline.

[2] http://unfccc.int/files/press/backgrounders/application/pdf/fact_sheet__nairobi_framework.pdf

targeted countries. Capacity building through technical assistance is being provided – not only by UN institutions like UNEP and UNDP, but also by a number of bilateral donors – to targeted countries to build capacity in project identification and design. Additionally, workshops for project developers and other stakeholders are being organized, amongst others, on developing Project Design Documents for traditional CDM projects as well as for Programmes of Activities (PoAs).

Even though the CDM as a current instrument for emissions reduction may attract less attention than it would in the future, the concrete projects that the mechanism has promoted over the past 10 years remain on the agenda. Once the conditions are right again CDM will promote further development of project activities in the markets. For an overall assessment, the CDM lends an entire vocabulary and a full set of methodologies for estimation of reduction potentials to assist in calculating the exact emissions reduction potential.

The assessment of the CDM potential in Angola, Belize, Burkina Faso, Democratic Republic of Congo (DRC), Fiji, Ghana, Haiti, Lesotho, Malawi, Mozambique, Myanmar, Rwanda, São Tomé & Principe, Senegal and Trinidad & Tobago may be seen in this context. These are countries that have not yet embarked decisively on the CDM, and while it might be too late for some of them to employ the mechanics of the mechanism, due to market circumstances, they may take advantage of new mechanisms and models for mitigation action, all of which, in practice, will possibly exist under similar conditions of emissions reduction calculation and evaluation as the CDM.

Point of Departure

The 15 countries addressed in this context do not stand out from either an emissions point of view or from a CDM project activity perspective. According to the United States Department of Energy's Carbon Dioxide Information Analysis Center (CDIAC), as calculated for the United Nations[3], the total emissions for the 15 countries combined amounts to about 114 million tCO_2e – by any measure a very limited amount -- almost half of which is represented by Trinidad & Tobago's 1.3 million inhabitants.

Country	Total emissions (000 tCO_2e/year)	Reduction assessment (000 tCO_2e/year)
Trinidad & Tobago	49,772	5,481
Angola	24,371	379,476
Myanmar	12,776	564,155
Ghana	8,592	358,954
Senegal	4,976	81,397

[3] http://en.wikipedia.org/wiki/List_of_countries_by_carbon_dioxide_emissions.

DRC	2,816	2,095,642
Haiti	2,435	3,674
Mozambique	2,314	67,169
Burkina Faso	1,856	108,516
Fiji	1,254	18,321
Malawi	1,228	15,717
Rwanda	704	116,130
Belize	425	17,954
São Tomé & Principe	128	111
Lesotho	-	462

Table 1 National emissions and reduction potentials

However, when comparing the national emissions of the 15 countries to the assessments of the total emissions reduction potential, as indicated in Table 1, an important conclusion from these country studies is evident: the current levels of emissions as recorded according to the source are not an upper limit for emissions reduction potentials. It is possible to reduce far more emissions than the current emissions record indicates. This is a result of the methodological approach in CDM, as well as a consequence of the method of estimating current emissions. In CDM, strictly speaking, it is possible to reduce emissions that currently do not occur. If a new technology is introduced where currently no facility is in place it is acceptable to use a higher emitting alternative as the baseline; e.g. if solar PV systems are rolled out in an area, where currently no service exists, and if in a neighbouring area the use of diesel generators is widespread, it is acceptable to assume that in the absence of the project activity, diesel generators would have been used causing emissions from combustion of diesel. In this way, a CDM project activity can reduce or eliminate emissions that actually do not occur – in this case from diesel generators that never existed. In some cases this may be a significant source of ‘reductions’. By contrast, the calculation of national emissions does not necessarily include all sources of emissions. The most prominent, but absent, source of emissions are those from deforestation. Nevertheless, in CDM and in reality, these emissions can be reduced through initiatives that minimize the pressure on scarce wood resources.

With these examples it is important to keep in mind that the reduction potentials do not necessarily reflect real reductions. Moreover, a disregarded fact is that the reduction potentials, if exploited under the CDM, will lead to the issuance of Certified Emission Reductions (CERs) that are used to offset emissions in other jurisdictions, thereby countering the reduction achieved. For the purpose of these reports, the assessed emissions reduction potentials, are expressed interchangeably as either CERs or tCO_2e.

An important factor in calculations of the potential is the grid emission factor of the countries. For countries with high grid emission factors, the potential gains from CDM projects for similar capacities will be higher than for those with lower ones. For this reason, a number of African countries stand to benefit from being part of the Southern African Power Pool (SAPP), which will include Angola, Botswana, Democratic Republic of Congo, Lesotho, Namibia, Malawi, Mozambique, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe. This will allow for countries with less carbon intensive power production systems to benefit from the relatively higher SAPP grid emission factor. The importance of a regional view of the power network can also be seen in the case of Belize, where the grid emission factor is as low as 0,0226 tCO_2/MWh, however when taking into consideration imports from Mexico, it grows to be 0,1463 tCO_2/MWh, which is a considerable difference in the context of CDM. Other grid emissions factors in West and Central Africa are currently under consideration. Additionally, recent developments in methodologies taking into consideration suppressed demand will add to the emissions reduction potential in the energy sector in developing countries with low grid connection rates.

CDM activity

The countries analyzed in this context do not appear prominently in CDM statistics. *Table 2* gives an overview of the current status of project development as downloaded from the CDMpipeline.org. As can be seen, 9 out of the 15 countries are represented, while 6 have no activities recorded.

Another 2 countries have embarked on Programmes of Activities, as indicated in *Table 3*, leaving only Belize, Burkina Faso, São Tomé & Principe and Trinidad & Tobago among the countries analyzed without any current activities recorded under the CDM. Technical assistance programmes are implemented by UNEP Risoe focusing on CDM project development in all these countries, with the exception of Burkina Faso. All 15 countries are involved with the CDM at different stages of development, though some are only at the application stage under the CDM Loan Scheme, and therefore without any official registration.

Very few project activities have reached registration – 12 out of a total of 37 CDM projects and 15 Programmes of Activities. Only 5 countries have registered projects and none of the countries have PoAs registered. However, compared to the generally low levels of emissions in the countries analyzed, the expected emission reductions from projects recorded are significant and include not only the largest CDM project ever under current development in Angola, but also large hydro, large wind power and large landfill flaring. Only a few very small projects appear on the list.

	Host country	Status	Type	Sub-typ
lant CDM Project - Angola	Angola	At Validation	Hydro	Existing
ı	Angola	At Validation	Wind	Wind
electric Power Plant CDM Project -	Angola	At Validation	Hydro	Existing
ect - Angola	Angola	At Validation	Hydro	Existing
tion of Associated Gas.	Angola	At Validation	Fugitive	Oil field
ject	Belize	At Validation	Landfill gas	Landfill
project for fuelwood production	Congo DR	Registered	Afforestation	Afforest
project	Congo DR	Registered	Landfill gas	Landfill
in Maringa-Lopori-Wamba region ment of the "Bonobo Peace Forest"	Congo DR	At Validation	Reforestation	Refores
ct	Congo DR	At Validation	EE households	Stoves
	Fiji	Registered	Hydro	Run of
mission Reduction Project	Fiji	Registered	Methane avoidance	Waste
	Fiji	At Validation	Hydro	Run of
& Utilization Project	Ghana	Request review	Fugitive	Oil field
unicipal Solid Waste in Accra area	Ghana	Registered	Methane avoidance	Compos
	Ghana	At Validation	EE supply side	Single
g Project	Ghana	At Validation	Landfill gas	Landfill
er Authority, Ghana	Ghana	At Validation	Fossil fuel switch	New na
esotho	Lesotho	Registered	EE households	Stoves
Cookstove and Cooking Fuel Project	Mozambique	At Validation	EE Households	Stoves
	Mozambique	At Validation	Reforestation	Refores
Myanmar	Myanmar	Registered	Hydro	New da
Lamp (CFL) distribution project	Rwanda	Registered	EE households	Lighting
eatment Systems for Rural Rwanda	Rwanda	Registered	Solar	Solar P
eatment Systems for Rural Rwanda u)	Rwanda	Registered	Solar	Solar P
	Rwanda	Registered	EE households	Lighting
CSS sugar mill	Senegal	Registered	Biomass energy	Bagass
	Senegal	Registered	Afforestation	Mangro
its and Biomass Residues in the	Senegal	Registered	Biomass energy	Agricult
al	Senegal	Registered	Wind	Wind
oject	Senegal	At Validation	Landfill gas	Landfill

Table 2 CDM activity in the 15 countries

Title	Host country	Status	PoA-Type	Sub-type
Promotion of Energy-Efficient lighting using Compact Fluorescent Light Bulbs in rural areas in Senegal	Senegal	Registered	EE households	Lighting
CarbonSoft Open Source PoA: LED Lighting Distribution in East Africa	Malawi	At Validation	EE households	Lighting
Efficient Cook Stove Programme: Rwanda	Rwanda	At Validation	EE households	Stoves
African Improved Cooking Stoves Programme of Activities	Ghana	Registered	EE households	Stoves
Congo (DRC) Improved Cook Stoves program	Congo DR	At Validation	EE households	Stoves
Heat Retention Cooking in Less Developed Countries	Rwanda	At Validation	EE households	Stoves
Promotion of Energy Efficient Cook Stoves within Southern African Development Community	Malawi	At Validation	EE households	Stoves
Distribution of Improved Cook Stoves in Sub-Saharan Africa	Senegal	At Validation	EE households	Stoves
Standard Bank Renewable Energy Programme	Ghana	Registered	Mixed	Solar & wind & other
Standard Bank MSW Composting Programme	Ghana	Registered	Methane	Composting
Landfill gas capture, flaring and utilization program in Africa	Ghana	At Validation	Landfill gas	Landfill power
Improved Cookstoves Program for Malawi and cross-border regions of Mozambique	Malawi	At Validation	EE households	Stoves
CDM Africa Sustainable Energy Programme	Senegal	At Validation	EE households	Stoves
Clean Cook Stoves in Sub-Saharan Africa by ClimateCare Limited	Ghana	Registered	EE households	Stoves
Replacement of traditional charcoal stoves with efficient EcoRecho stoves in Haiti	Haiti	At Validation	EE households	Stoves
ENERCAP SunLighting™ Africa – Programme to replace kerosene lamps with micro PV LED systems in the Sub-Sahara region	Angola	At Validation	EE households	Lighting
Petrotrin Oil Fields Associated Gas Recovery and Utilization PoA	Trinidad and	At Validation	Fugitive	Oil field flaring
Impact Carbon Safe Water Access Program	Rwanda	At Validation	EE service	Water purification
Promoting Efficient Stove Dissemination and Use in West Africa	Burkina Faso	At Validation	EE households	Stoves
Mangrove Restoration Program in Senegal	Senegal	At Validation	Afforestation	Mangroves
Improved Cook Stoves programme for Rwanda	Rwanda	Registered	EE households	Stoves
Efficient Cook Stove Programme: Malawi	Malawi	At Validation	EE households	Stoves
Improved Cookstoves for Haiti	Haiti	At Validation	EE households	Stoves
CDM Africa Sustainable Energy Programme	Malawi	At Validation	EE households	Stoves

Table 3 Programme of Activity

Methodology

The goal to evaluate the reduction potential in many developing countries is long standing, and assessments have been undertaken by different institutions and at different times over the past years[4]. In many areas data and specific information is unavailable – and this challenge, by and large, remains. In this particular context, however, an extensive use of estimations based on indirect indicators, adjusted for country-specific conditions, have been accepted in order to present the potentials as complete as possible. Qualitative assessments have been allowed to a large extent, though never without being supported by data for available indicators. A number of assumptions and logical considerations have also been adopted in combination with methodological guidance provided by the IPCC assessment reports--all of which give a final ballpark figure for the reduction potential per sector. While the calculation methodology is simple and fully traceable to information sources that can be retrieved, first and foremost through web-based sources, it should be stressed that the final estimates cannot be precise, nor has it been the aim to provide exact figures. In practice, the evaluations undertaken also reveal which countries and sectors have the most obvious reduction potentials, though it was never the intention to compare the countries as hosts for emissions reduction projects.

The application of the CDM has undergone significant development over its short history. To date, more than 150 methodologies for calculating emissions reduction, from an almost equally large number of distinct technologies, have been adopted by the UNFCCC Executive Board for the CDM. Systematizing these into 8 specific sectors provides an easily accessible overview of the entire array of intervention areas. This has been done in the CDM Methodology and Technology Tool at www.cdm-meth.org, which provides the relations between technologies and methodologies while providing short technology overviews. The technology sectors are:

- Agriculture and Forestry
- Waste
- Conventional Power
- Heating Systems
- Renewable Energy
- Energy consumption
- Industry
- Transport

All of these, with the exception of heating systems (which is not relevant in any of the 15 countries), are introduced in each of the 15 countries as potential targets for emissions reduction activities. This is done along with calculations of the reduction potential on the basis of available information and, when relevant,

[4] *As an example, see the excellent study published by Wuppertal Institute and GFA Envest at http://www.jiko-bmu.de/files/basisinformationen/application/pdf/subsaharan_ldcs_cdm_potentials.pdf*

methodological approaches provided in the CDM guidelines. A sub-categorization is added from the Methodology and Technology Tool, which provides a closer alignment with the current labelling of CDM activities in the UNFCCC (cdm.unfccc.int) as well as in the CDM pipeline (www.cdmpipeline.org).

Sectors and Reduction Potentials

In the following sections a short account of the emissions reduction potential for all 15 countries in each of the 7 sectors is presented together with the methodologies employed for calculating the reduction potential. This is intended to highlight the most prominent sub-sections and technologies as well as the most common 'shortcuts' or assumptions made. The findings are not universally applicable as in some countries information is more readily available than in others, but they give an overall impression -- partly of the approach adopted for the entire exercise and partly for the reduction potentials.

Forestry

Assessment of the forestry sector examines the reduction potential from reduced or avoided deforestation and afforestation/reforestation activities. In theory, large-scale conservation efforts concerning forest lands will undeniably lead to significant emission reductions and present key opportunities for climate change mitigation in developing countries. Specifically, avoided deforestation or REDD+ (Reducing Emissions from Deforestation and forest Degradation) is considered to be the forest mitigation option, which in the short term presents the lowest cost and largest carbon stock impact[5]. In practice, however, forest carbon activities still face substantial barriers that must be overcome. Afforestation and reforestation of degraded lands have been included in the CDM, though these types of activities have remained underdeveloped compared to other CDM projects. This is mainly related to the complexity of the A/R CDM procedures and the limited market demand for A/R CDM credits, since CERs from these projects are not eligible in the European Emission Trading System. Furthermore, in order to address issues related to non-permanence, only temporary CERs are issued to A/R CDM projects. Additionally, the MRV aspect of such projects faces obstacles due to the uncertainty of the data for establishing baselines. Legal issues related to land tenure, forest ownership and carbon rights require much stronger influence from governments through national legislation, which poses significant challenges for countries with limited governance capacity.

In addition to reforestation/afforestation activities for increasing fuelwood quantity and improving forest management through rehabilitation, decreasing the demand for fuelwood is also an important strategy to reduce drivers of deforestation and the exhaustion of natural resources. Such activities include sustainable charcoal production as well as improved fuel-efficient cook stoves and alternative-fuels and techniques for cooking, which is elaborated under energy consumption.

[5] *http://www.ipcc.ch/pdf/assessment-report/ar4/wg3/ar4-wg3-chapter9.pdf*

Charcoal constitutes the primary urban fuel in the majority of the least developed countries and is a major source of both income and environmental degradation in rural areas. The production, transport and combustion of charcoal constitute a critical energy and economic cycle of many developing nations. Charcoal production is contributing to GHG emissions due to the release of methane – especially in the traditional open pits process. Emission reduction projects are implemented in two different processes: 1) improvements in kiln design for better temperature control and greater control of carbonization variables, which reduce methane emissions, or 2) capturing methane released from the charcoaling plant and combusting it to generate electricity (e.g. in a gas engine). Since charcoal production also involves tree removal from forests, sustainable wood supply is an important concern and aspect of charcoal production. Therefore, introduction of efficient charcoal production technologies should be encouraged, such as facilities that have allocated woodlots for sustainable fuelwood plantations. If charcoal is sustainably produced through plantations and methane project emissions are zero, charcoal production becomes carbon neutral since all emitted carbon would subsequently be sequestered in replanted trees.

Assessment of the mitigation potential in the forestry sector for the selected countries was based on forest data from FAOSTAT and country-specific estimates of carbon stock in living forest biomass[6]. Changes in forest cover based on annual time series was used to illustrate trends in deforestation or afforestation/forest regeneration. The countries' potential for emission reductions from halting deforestation, or through afforestation, was calculated on the basis of trends in forest cover changes and the capacity to store carbon in forest biomass.

It should be noted that due to the data quality, these figures are rough estimates and are meant as an overall indication of the potential in the respective countries rather than an accurate estimate of carbon content and CO_2 reductions. Furthermore, mitigation options for either avoided deforestation or afforestation initiatives should not be compared as they are based on different area scenarios. Avoided deforestation is based on the average rate of annual deforestation in hectares, which serves as the baseline (historical emissions) from which the maximum mitigation potential is calculated, if average annual deforestation is avoided completely. Mitigation potential for afforestation/reforestation initiatives for this study is calculated based on the assumption of a 50% replantation of the annual change in forest cover over a 5 year period. It should be stressed that these calculations do not take into account whether the deforested land is still available for A/R activities and if so, whether reducing deforestation is still the most cost-effective mitigation option in the short term.

Country	REDD+ / Avoided deforestation	Afforestation/ reforestation	Charcoal production	Biofuels	TOTAL (tCO_2e)
Angola	37,557,312	281,679,840	228,044		**319,465,196**

[6] *http://www.fao.org/docrep/013/i2000e/i2000e.pdf*

Belize	1,274,958	16,496,965			**17,771,923**
Burkina Faso	9,672,652	96,726,520	455,525	3,600	**106,858,297**
DR Congo	202,536,290	1,878,381,200	1,573,467		**2,082,490,957**
Fiji		17,579,300		71,700	**17,651,000**
Ghana	38,116,620	313,785,000	688,904	66,328	**352,656,852**
Haiti		2,174,475	24,492		**2,198,967**
Lesotho		38,902	75,082		**113,984**
Malawi	8,624,500	2,846,085	393,387	57,000	**11,920,972**
Mozambique	24,779,106	12,457,815	402,913	0	**37,639,834**
Myanmar	133,883,430	419,363,560	127,920		**553,374,910**
Rwanda		109,733,000	37,296	65,000	**109,835,296**
Sao Tomé and Principe			6,866		**6,866**
Senegal	6,904,188	69,041,875	233,100	1,738,970	**77,918,133**
Trinidad & Tobago	286,260	1,717,560		12,000	**2,015,820**

Table 4 Forestry sector emissions reduction

All of the investigated countries are located in the tropics, which are considered to present the largest forestry mitigation potentials in the world. This is also reflected in the figures for possible emission reductions in the countries. Compared to the other sectors, the enhancement and conservation of standing forest stock present the most significant mitigation actions. DRC is the country with the largest mitigation potential by far, due to its immense forest resources including the Congo basin -- the world's second largest rainforest. This is reflected by the number of international institutions currently supporting DRC's readiness process for a National REDD+ Programme. In addition to DRC, several of the investigated countries currently constitute net sinks due to their carbon stocks in standing forests, although the GHG emissions related to land use change in these countries are undeniably one of their major sources. Most of the selected countries are also participating in different international programmes aimed at building capacity for readiness and implementation of national REDD+ strategies. This is really the most crucial element for countries that have the potential but not yet the capacity to tap the benefits from curbing deforestation. Nearly all of the selected countries do not yet have the institutional and regulatory capacities necessary to implement frameworks for forest governance, tenure rights and community engagement, which are all necessary to make sustainable forest management competitive against deforestation.

Charcoal and other biofuels, if produced sustainably, also present important measures for emission reductions in the forestry sector. Potential emission reductions from improved charcoal production were based on annual charcoal production reporting extracted from FAOSTAT and estimated for the countries where data was available. According to a recently registered CDM project, by using renewable charcoal from forest plantations and shifting from traditional open kilns to efficient kilns, employing methodology AM0041[7], the anticipated methane emissions reduction per ton of produced charcoal is 0.037 tons[8]. This corresponds to 0.777 tons of carbon emissions reduced per ton of produced charcoal, based on the global warming factor of 21. Assuming that project emissions are zero, based on fuelwood supplied from sustainable plantations, the potential emissions reduction from transforming a country's entire charcoal production from a baseline of 100% open kiln production is estimated by multiplying the total annual charcoal production with 0.777. Such projects might be viable, however, significant uncertainties are associated with this calculation--either on the actual emissions reduction potential and projected emissions, or on the current production methods and the outlook for including the entire charcoal production under one CDM activity.

Actual figures highlight that very few charcoal CDM projects are able to reach registration, which indicates challenges related to the existing methodologies. Therefore, these calculations are simply meant as a general idea of the possibilities and scale of GHG reductions from such initiatives. The estimates indicate considerable potential in all of the investigated African countries, as charcoal production is high and fuelwood remains the main source of primary energy consumption.

Conventional Power

The assessments within the section for conventional power aim at identifying the emissions reduction opportunities through improved efficiency of existing power plants or options for utilization of less CO_2 intensive fuels in the power production sector.

Many of the countries analysed have very small power sectors with limited grid coverage; therefore, their installed capacities are generally minimal. Moreover, they have large shares of hydropower. DRC is 100% hydropower based, as is Lesotho with exports to South Africa and Malawi – who are just as dependent and have additional prospects of exporting hydropower to the Southern African Power Pool once a transmission line is established. For other countries lack of data hinders assessment. Belize's power system consists partly of hydro and partly of imports from Mexico, which does not leave any options in their conventional power sector.

Calculations are based on available information on operational and planned power plants, as well as grid emission factors of the countries. The final emissions

[7] *http://cdm.unfccc.int/filestorage/A/P/Q/APQY8M2DU796JH10G3SKEW5ZR4TBXN/05072010_PDD_Charcole.pdf?t=V298bTZrcmtxfDCc85eDOxwk3EIdOherlYZR*

[8] *http://www.fao.org/docrep/x2740E/x2740e60.pdf*

reduction potential is highly dependent on the detail of information available on the type, production and fuel of the specific power plants. In many cases such information has not been publicly available; therefore, the assessment does not claim to have included the full potential -- assuming that additional opportunities might exist within power plants that are not reported on in the available documents. Similarly, the calculated potentials may be lower in practice, where technical constraints of fuel conversion/technology improvements exist, where efficiency improvements have taken place since last reported, or where external barriers to the specific solutions stand in the way of possible CDM projects.

Analysis of the emissions reduction potential within the conventional power sector showed that a number of countries hold yet to be explored mitigation potentials. The table below contains study results for the sector, across all countries.

Country	Fossil fuel switch	Single to combined cycle	New natural gas plant	Waste heat recovery and biodiesel	Total (tCO2e)
Angola	52,500				**52,500**
Belize					-
Burkina Faso					-
DR Congo					-
Fiji					-
Ghana		587,417			**587,417**
Haiti	45,000				**45,000**
Lesotho					-
Malawi					-
Mozambique			485,198		**485,198**
Myanmar	1,706,353				**1,706,353**
Rwanda				100,000	**100,000**
Sao Tomé and Principe					-
Senegal		109,901			**109,901**
Trinidad & Tobago					-

Table 5 Conventional power sector emissions reduction

As can be seen from the study results, Myanmar, Mozambique and Ghana were considered to have the highest potential for reductions in the sector, while a number of countries have very little or no potential at all. For many of the surveyed countries with low reduction potential, hydropower is the source of the majority of power production, which in turn means that there is little reduction potential within the context of CDM. In most of these cases, investment in renewable energy would be more beneficial.

Within the existing power production facilities in the surveyed countries, efficiency improvements and change to cleaner fuels appear to have the highest gains in terms of emission reductions. In Rwanda, for instance, a heat recovery system in the Jabana power plant could potentially yield up to an estimated 30,000 CERs. In Burkina Faso, some room for improvement could exist by introducing more use of biodiesel, conditioned so that jatropha or other biodiesel plants can be grown locally, without compromising the use of lands for food production. In Ghana, conversion from single cycle to combined cycle power generation in one of the thermal power plants is already underway as a CDM activity in the pipeline, with estimated annual reductions of 346,000 CERs. Additional potentials of roughly 241,000 CERs exist in similar efficiency improvements within the remaining power production facilities. The same conversion could also be done in Senegal, resulting in potential reductions of over 100,000 tons of CO_2.

Where natural gas is available, it can be used as a less carbon intensive fossil fuel substitute to diesel and HFO. In Myanmar, the approximate potential for replacing coal with natural gas was calculated to be more than 1.7 million CERs. In Angola, where the majority of energy comes from hydropower production, some 80,000 tons of CO_2 could be reduced from fossil fuel change in the existing facilities, by switching from diesel to natural gas. In Fiji some potential might exist for substituting HFO with diesel, but in light of the necessary investments it would be more advantageous to make use of the opportunities of switching to renewable energy sources.

For a number of the surveyed countries there was no significant potential for any CDM projects within the conventional power production sector, as most production is hydro-based. For Trinidad & Tobago – with nearly 100% reliance on natural gas, the best options for emission reductions lie in exploring opportunities within renewable energies, rather than the existing power production modes.

Less explored options, to date, relate to transmission, which accounts for considerable losses of produced power. Studies showed that in Angola the losses were as high as 14.6% in 2011, whereas in Haiti they reached up to 55% - though the majority of this power loss was assumed to be from theft and therefore actually used.

For all of the countries surveyed, the significance of reducing fossil fuel power generation lies in more than the mere reduction of GHG emissions. For countries like Malawi, where the majority of fossil fuels are imported, greening the power sector could also yield significant economic and energy security benefits.

Renewable Energy

The assessments of renewable energy potentials are not the same as those of the theoretical technical potential. In all of the surveyed countries it would be theoretically possible to establish solar PV for a significant proportion of the national consumption. In practice, however, the potential would be indicated on the basis of already existing assessments or considerations by government or project developers in a given country; otherwise, it may be based on household solutions that are seen in some countries with solar PV lighting initiatives. The somewhat open ended potentials, in technical terms, also pertain to wind energy and hydropower, though the latter is often based on concrete assessments undertaken by government institutions, while wind energy potentials are rarely assessed – unless the wind regimes are overtly attractive. The consistency in assessments is therefore difficult to establish as it depends on activities by developers and/or other institutions in the countries, which are not necessarily relative to the actual potential. Moreover, the lack of current activity is not proof that there is no potential.

Country	Hydro	Solar	Wind	Total (tCO2e)
Angola	384,000	240,000	384,000	**1,008,000**
Belize	24,812	36,456	10,975	**72,243**
Burkina Faso	68,250	222,000		**290,250**
DR Congo	8,997,000	960,000		**9,957,000**
Fiji	312,260	10,160		**322,420**
Ghana	2,018,407	21,815	218,563	**2,258,785**
Haiti				-
Lesotho		36,200		**36,200**
Malawi	22,005	522,000		**544,005**
Mozambique	9,922,926	8,739,252		**18,662,178**
Myanmar	47,901		655,750	**703,651**
Rwanda	200,000	470,000		**670,000**
Sao Tomé and Principe	86,764			**86,764**
Senegal	369,090	32,844	264,420	**666,354**
Trinidad & Tobago		162,082	96,250	**258,332**

Table 6 Renewable energy sector emissions reduction

In this report, renewable energy is defined as energy from solar, wind, hydro and geothermal sources. Biomass is placed under “Waste”. The potential for renewable energy in the 14 countries assessed in this report is huge. However, the potential for developing CDM renewable energy projects varies more due to the grid emission factor, which is not available in some of the countries and is very low in others. The amount of different micro, small and large-scale technologies within renewable energy is immense. The outlined technologies in this report are limited to those that have the biggest emission reduction potential in the countries and are already proven feasible.

Wind

There is very limited research on wind power in Africa and there are only assessments of the wind power potential in a few regions. The available research indicates that onshore wind resource in Africa is approximately 1750 GW. Its quality varies, but the North-West Atlantic coast, the Red Sea, the Horn of Africa, South Africa and Namibia all have high-quality resources. Better mapping and data is still needed to tap Africa's wind resources. The full use of Africa's wind potential will also require significant investments in the transmission system to connect these resources to demand centres.[9] The lack of existing or available data has limited the investigation of the CDM wind projects in the noted countries.

The African countries focused on in this research, which have a documented potential for wind power, are Angola, Ghana and Senegal. Angola is currently in the process of building its first wind turbines. The wind turbines will have a total capacity of 100 MW and the government has set an ambitious target of installing 5,000 MW wind energy capacity by 2016, corresponding to 768,000 CERs/year (using the IEA emission grid factor: 0.368). The Ministry of Energy in Ghana estimates that the wind power potential in the country is 5,600 MW. In the foreseeable future the potential will be around 200-300 MW. The instalment of 200 MW wind energy capacity would generate around 218,000 CERs/year using the grid emission factor calculated by IEA (0.563). Senegal has some coastal areas where the development of wind power is economically feasible, and has submitted one 125 MW CDM project which is registered. Furthermore, there is one major project in the planning phase; the so-called Gantour project has an expected capacity of 50 MW.

The objective of Trinidad & Tobago is to generate electricity from wind power that will contribute 5% in the national energy matrix by 2020. However, investment in wind power in Trinidad & Tobago, as with anywhere else, requires site surveys to be conducted and various wind resource analyses – which are necessary before the potential for wind energy can be assessed.

The installed capacity from wind power in Myanmar is currently 2046 MW. The existing assessment of the wind potential by the Ministry of Electric Power identifies 36 wind turbine projects for implementation with a total installed capacity of 39,720 MW. Using Myanmar's grid emission factor[10], this equals emission savings of up to 25 million tons of CO_2 based on 2500 full load hours. Installations of this magnitude would, however, influence the grid emission factor downwards. Furthermore, the probability of establishing all the projects seem doubtful and the potential has been arbitrarily reduced by half to 12 million tCO_2e. According to the Ministry the total potential in Myanmar yields more than 100,000 MW of installed capacity.

[9] *Jacob A. Wisse, Kees Stigter (2007)*

[10] *Emissions reductions are calculated using grid emission factor of 0.2623 (Pedro Carqueija, 2012, UNEP Risoe)*

Fiji has high potential for the exploitation of wind power through small wind turbines. A study from 1999 determined that the average wind speeds are between 4 and 6 m/s[11]. A 10 MW Butoni wind farm has been installed so far. However, the Butoni wind farm is not producing electricity as planned due to underperformance and hurricanes. For the time being there is no information on new wind power projects.

The wind measurements in São Tomé & Principe indicate that wind power development has relatively low potential; nevertheless some options for utilization of wind power do exist. A 2 MW wind power scheme was launched in the district of Caue in 2007, with the technical support of German companies[12]. There is, however, no information on additional projects planned in the future, and no estimates of the exact wind power potential.

Belize has sites with excellent wind resources that could provide a large quantity of renewable energy, compared to the country's needs. On the Baldy Beacon in the Cayo District, the average annual wind speed is 7 m/s. It is estimated that wind could deliver an additional 20 MW of electricity[13], though the grid emission factor renders such projects insignificant for emissions reduction.

Hydro

The world, and in particular the African Continent, is endowed with an enormous hydropower potential. Despite this potential, which is enough to meet all the electricity needs of the continent, only a small fraction has been exploited due to the major technical, financial and environmental challenges that need to be overcome. Renewable energy currently constitutes about 17% of the global energy mix with hydropower making up about 90% of this.

Angola, Ghana, DRC, Mozambique, Lesotho and Senegal, are the countries with the biggest potential for hydropower. The estimated potential is 150,000 GWh/year in Angola, 150,000 GWh/year in DRC, 49,000 GWh/year in Mozambique, 3,570 GWh/year in Ghana, 4,250 GWh/year in Senegal and 2,000 GWh/year in Lesotho. However, in a CDM context, the large amount of hydropower can only replace 400 MW diesel-generated electricity in the current energy mix in Angola. Whether the high potential for hydropower in Mozambique, DRC and Lesotho (with grid emission factors close to or at zero) can be converted into CDM projects depends on the approval of the Southern African Power Pool grid emission factor of 0.93 tCO_2/MWh. Ghana and Senegal have relatively high grid emission factors and can take advantage of CDM when developing hydropower plants.

The potential for hydropower in Burkina Faso, Rwanda, São Tomé & Principe and Malawi is less than in the other African countries in this report. In Burkina Faso the potential is around 215 GWh/year and in Rwanda it is 500 GWh/year. Both countries have grid emission factors that make it attractive to develop CDM hydro projects. In São Tomé & Principe the potential is around 125 GWh/year.

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[11] REEGLE, 2012, http://www.reegle.info/countries/fiji-energy-profile/FJ

[12] REEGLE, 2012, http://www.reegle.info/countries/sao-tome-and-principe-energy-profile/ST

[13] Belize Second National Communication to UNFCCC, 2011

In Trinidad & Tobago and Belize the potential for hydropower is zero (there is no available research) and around 240 GWh/year, respectively. However, as the grid emission factor in Belize is 0.0732, potential generation of CERs/year is only around 20,000 unless export to the Mexican grid is considered.

Myanmar and Fiji have the potential for developing both small and large-scale hydro projects. In Myanmar 34 sites with a potential power production of 18,262 GWh have been identified and estimated to be suitable for the development of hydropower. Even with a low grid emission factor CDM projects are an attractive option – particularly if Myanmar's current significant power exports to China are included in calculations. China's grid emission factor is 4 times higher than Myanmar's. If 8000 GWh are exported and the rest remain for domestic consumption, the emissions reduction calculation could yield about 12 million tCO_2e. Fiji has already developed PDDs and PINs for various CDM hydro projects and the CER potential for the identified CDM projects, as well as another identified site that has an estimated potential of 360 GWh, is 312,260 CERs/year.

Solar

The world has immense solar resources easily capable of meeting global energy demands. Africa could theoretically produce 42 billion megawatt-hours, more than 80 times its current demand. As with hydro and wind, the potential is unexploited mainly due to financial and technical barriers. Solar power can be generated via many small and large-scale technologies.

The potential for developing solar power projects in the African countries is high. The average solar radiation in Angola, DRC, Ghana, Burkina Faso and Mozambique is between 5 and 6 kWh/m2/day, which is sufficient to develop financially viable micro, small and large-scale solar power projects. The high radiation makes off-grid solar power projects attractive. Currently, a solar PV project is being developed as a PoA under CDM, the 'ENERCAP SunLighting™ Africa – Programme', which replaces kerosene lamps with micro PV LED systems in the Sub-Sahara region. This project targets Angola, Ghana, DRC and Senegal, which have 12.9 million, 11 million, 57 million and 7.4 million people, respectively, living without access to electricity and therefore reliant on kerosene for lighting. Distribution of 750,000 solar lamps will generate up to 60,000 CERs. Burkina Faso's 11 million people without access to electricity are not part of this project, however a similar activity could be developed. Lesotho has similar options for exploiting the high solar radiation, although solar PV is already used in private homes and public buildings. The government of Lesotho has implemented codes of practice for certain solar PV and solar heater installations. São Tomé & Principe lacks research on solar energy, however with a solar radiation above 5 kWh/m2/day the option for developing CDM solar energy projects should not be neglected.

Trinidad & Tobago has an average global horizontal solar radiation that is around 6.0 kWh/m2/day. Belize has a high potential for both residential solar water heating and large-scale solar PV. A nationwide solar water heater initiative is under consideration and a private company has been assessing the possibilities for developing a 50 MW solar PV plant.

Results from existing assessments show that Fiji has a high potential within solar lighting for replacing streetlights, residential solar water heating and micro-scale solar PV. Fiji has already implemented different small-scale projects, such as solar street lighting and solar water pumps. A recent assessment also showed the potential for developing a CDM project by installing solar home systems in 20,000 households, which would generate around 10,000 CERs/year. Myanmar is equally endowed with significant solar resources that could benefit the large rural population, but there has been no basis for estimating the potential.

Energy consumption

The section on energy efficiency does not claim to have a complete assessment of all efficiency options, as these exist in practically every area of energy consumption. The assessment focuses on household installations, the public sector, and service businesses such as hotels; it leaves out industry, which has its own specific section. The level of retrievable information varies considerably between countries, and many assumptions have been employed, like household size and relevance of efficient lighting. In many countries some assessments have been excluded, like usage of efficient A/Cs -- which in the poorest countries are assumed not to be a common appliance and therefore volumes are too small to consider specific programmes for implementation. Nevertheless, very small reduction options exist in these countries. In energy efficiency, the dominant reduction potential lies with efficient cook stoves. The reduction options here by far surpass any other, although this is based on the assumption that in most countries efficient stoves are either not in use or have a limited application (with the exception of Rwanda, which needs to have its real adoption rates confirmed). In many cases the calculation of households applicable for conversion to efficient cook stoves excludes grid-connected households. However, it is very likely that most grid-connected households still use traditional cook stoves and only a small fraction in the cities might use electricity for cooking.

Country	CFL distributio n/HVAC	Efficient stoves	Elecrification	Aircon effecientc y	Street light	Water pumping	TOTAL (tCO_2e)
Angola	120,000	3,000,000					**3,120,000**
Belize	20,000						**20,000**
Burkina Faso		1,000,000					**1,000,000**
DRC	240,000	2,000,000	720,000				**2,960,000**
Fiji	50,000	30,000					**80,000**
Ghana		1,500,000					**1,500,000**
Haiti	25,000	1,000,000					**1,025,000**
Lesotho	3,000	200,000					**203,000**

Malawi		1,500,000					**1,500,000**
Mozambique	16,000	8,500,000					**8,516,000**
Myanmar	150,000	6,500,000					**6,650,000**
Rwanda		5,000,000	100,000				**5,100,000**
Sao Tome & Principe	2,000	16,000					**18,000**
Senegal	463,000	784,000					**1,247,000**
Trinidad & Tobago	100,000			100,000	8,000	25,000	**233,000**

Table 7 Energy consumption emissions reduction

Greater efficiency in the consumption of energy is an attractive option to reduce CO_2 emissions due to its dual benefits: reducing CO_2 emissions and reducing the consumers energy expenses. In the African countries the options for this type of emission reductions are mainly efficient cook stoves and, to a certain degree, efficient lighting. In the cities there is potential for CFL distribution programmes to households and public buildings. Another option is to replace the lighting in the streets with CFL or even more efficient bulbs.

The electrification rate in Angola is relatively high as 37.5% of the population has access to electricity. A CFL distribution programme could potentially distribute 1 CFL bulb to 2 million households, reducing the electricity consumption by about 131,000 MWh. If the Southern African Power Pool (SAPP) grid emission factor is approved and adopted, the energy savings would generate around 120,000 CERs/year. The estimated amount of CERs generated by distributing efficient cook stoves to the approximately 2.5 million households that rely on fuelwood is around 3,000,000 CERs -- based on a penetration rate of 30%. Ghana also has a high potential for efficient cook stove projects. The country already has several PoAs in the pipeline aiming to distribute efficient cook stoves, and if just 25% of the households without access to electricity adopt efficient cook stoves the generation of CERs would be around 1,500,000 a year. The potential for replacing inefficient light bulbs with CFLs is limited, as the government already implemented such a programme back in 2001 and prohibited import of inefficient light bulbs. This potential has, therefore, not been assessed. DRC and Burkina Faso both have a low percentage of electrification, consequently the potential for distributing efficient cook stoves is high. The electrification rate in Burkina Faso is only 9%, and previous attempts to enhance the use of efficient cook stoves have not been successful. Theoretically, about 1,000,000 efficient cook stoves could be installed generating 2,700,000 CERs/year. The estimated CER potential, however, is 1,000,000 CERs/year as the penetration rate is rarely more than 30% of the available households. CFL distribution is estimated to be able to generate around 40,000 CERs/year both in Burkina Faso and DRC. GFA[14] estimates DRC and Mozambique to have the highest potential for efficient cook stoves in Africa. About

[14] http://www.jiko-bmu.de/files/basisinformationen/application/pdf/subsaharan_ldcs_cdm_potentials.pdf

2,000,000 CERs/year are expected to be the outcome if efficient cook stoves are distributed throughout the countries, with a penetration rate of 25%. There is one PoA in DRC, under validation, aiming at distributing 12,700 efficient cook stoves and generating around 44,000 CERs/year. A CDM project in Mozambique aims at replacing traditional cook stoves with ethanol ones. If using the correlation between the amount of distributed stoves and generated CERs from the existing CDM project in Mozambique, the estimated amount of CERs/year generated by distributing ethanol stoves to 50% of the households relying on charcoal would be 7,000,000. The Endev programme in Mozambique aims at expanding the grid and, in the process, replacing kerosene lighting with CFL bulbs. If this continues, 300,000 households will be connected over the next 5 years, which would potentially generate 16,000 CERs/year. There are two PoAs in Malawi estimated to generate around 60,000 CERs/year. However, if efficient cook stoves are distributed to the approximately 3 million households in Malawi that rely on fuelwood, around 3,000,000 CERs/year could potentielly be generated (with 30% penetration).

Senegal initiated the *Programme Prioritaire d'Electrification Rurale* with the objective to scale up rural eletricification to 50% in 2012. The distribution of CFL light bulbs is part of the project and could potentially generate 463,000 CERs if the project reaches 50% of the rural households (365,000). If efficient cook stoves were distributed to the same households, the potential emission reduction would be 784,000 CERs/year. Rwanda was one of the first movers on efficient cook stove programmes, and estimations show that only few options remain for further penetration of this technology. Most fuelwood in Lesotho is still burnt in inefficient, traditional three-stone cooking fires. There has been little adoption of improved stoves and it is estimated that if 25% of the households acquire efficient cook stoves, the emission reduction potential would be 200,000 CERs. The potential for replacing CFL light bulbs is limited to 2000-3000 CERs/year, as only about 10% of households use electricity for lighting (56% use gas/oil for lighting and about 38% use candles).

São Tomé & Principe has 32,000 households relying on fuelwood for cooking and 40,000 households with access to electricity. An efficient cook stove programme with a penetration rate of 25% would generate 16,000 CERs/year; and if half of the households with access to electricity replaced two inefficient light bulbs with CFLs, the emission reduction would be around 2000 CERs/year.

Myanmar has a high potential for distributing efficient cook stoves, as 88% of the population and 95% of the rual population rely on fuelwood for cooking. Some initiatives to exploit the potential of an estimated 6,500,000 CERs/year are being undertaken, but no CDM projects or PoAs are in the pipeline yet. There is no data on the usage of CFL light bulbs in Myanmar. A CFL programme including the 1.8 million households with access to electricity would generate 25,000 CERs/year. If such a programme were expanded further than the 1.8 million households that rely on diesel generators, a total amount of 150,000 CERs could be generated annually.

In contrast to Myanmar, Fiji is a relatively developed country where 80% of the households have access to electricity. The high electrification rate is a good basis for a CFL programme involving households and the public sector, as well as a programme for the exchange of inefficient A/C equipment with more efficient versions. Such initiatives are estimated to be able to generate 25,000-50,000 CERs per year.

Trinidad & Tobago has an average energy use that is 6 times higher than the world average, which clearly indicates a significant potential for energy efficiency projects. However, due to the heavily subsidized domestic energy prices it is a challenge to make such projects financially viable. The total emission reduction potential is estimated to be 233,000 CERs/year -- divided between CFL programmes, replacement of inefficient A/Cs, more efficient water pumps and LED street and traffic lights.

Belize is fully electrified and it is estimated that an improvement of the building envelopes could save up to 100,000 MWh/year. The official grid emission factor is close to zero, therefore, the large energy savings would not create any CERs; however, as the effect would reduce import from Mexico, there will be a subsequent reduction of emissions in Mexico with the Mexican grid emission factor of about 0.35. A calculation of the Belizean grid emission factor, by UNEP Risoe, using the tool for import of electricity (Belize imports electricity from Mexico) returns a grid emission factor of 0.1463. Using this grid emission factor, a nation-wide HVAC project would generate around 20,000 CERs/year.

Industry

The industry section is the most diverse section of all. Industrialization varies widely among the 15 countries, as do the characteristics and sectors of industrial activity. For those countries where industrial activity is limited there are assessments of a few small-scale options, while these are typically left out in countries with more large-scale options. Generally, however, the entire industry section is suffering from a severe lack of information. This is also true for the large-scale industrial activity of mining, where generally no information is available about energy consumption or any related emissions from the mines — such as methane. While information about cement production is available, the type of cement, type of clinker, source of energy and potential for efficiency measures is normally not available. Therefore, the common assumption for cement has been to use the option of installing waste heat recovery systems relative to the size of the production. Similar considerations have been made for the few countries that have steel production, while the potentials have not been considered in smaller industries like glass, simply due to lack of information. A number of the 15 countries have oil and gas exploration activities, at widely differing scales. Reduction options have also been assessed based on assumptions related to flaring and flaring reduction, specifically indicated in the texts based on information retrievable through web searches. Light industries such as garment production, plastics, furniture or assembly lines for different products, including cars, have not been considered. Efficiency potentials for such activities require individual assessments that have not been possible to make.

The summary of findings in the industrial sector can be seen in the table below.

Country	Oil field flaring reduction	Food & drink industry	Cement	Mining (Gold and Coal)	Vertical shaft brick kilns	Fuel switch in industry	Energy efficiency and waste heat recovery	TOTAL (tCO_2e)
Angola	54,800,000						28,000	**54,828,000**
Belize	20,000	5,500						**25,500**
Burkina Faso		3,600	5,300	100,000				**108,900**
DR Congo								-
Fiji								-
Ghana			35,000				30,000	**65,000**
Haiti								-
Lesotho								-
Malawi				5,500	650,000	350,000		**1,005,500**
Mozambique			18,000		650,000		282,000	**950,000**
Myanmar					500,000			**500,000**
Rwanda			52,500			100,000		**152,500**
Sao Tomé and Principe								-
Senegal			553,000					**553,000**
Trinidad & Tobago	1,587,000		11,800				530,000	**2,128,800**

Table 8 Industry sector emissions reduction

As can be seen from the table, the countries with the highest identified emissions reduction potential are Angola, Trinidad & Tobago, and Malawi. From available technological options, most reductions of emissions can be found in reducing oil field flaring and introducing vertical shaft brick kilns. Improvements in cement production through waste heat recovery and switching to use of biomass were also found to hold significant potential.

For oil producing countries such as Angola, Belize, Ghana and Trinidad & Tobago, the oil industry accounts for the majority of GHG emissions. Depending on currently employed technologies, there are options for reducing emissions from oil exploration -- either by flaring methane that is currently vented, or by utilizing it for production purposes. In Angola, natural gas production is tied directly to oil production and is often vented or flared. With a CDM project activity in oil field flaring reduction already under development, the full potential in reduction from flaring and LPG production could potentially be as high as 54,800,000 tons of CO_2.

An additional 28,000 tons could be reduced by capturing waste heat in refineries. In Trinidad & Tobago, reducing associated gasses from onshore oil production has the potential to cut 1,587,000 tons of CO_2 annually. In Belize, where a smaller oil industry has been established since 2002, the analysis showed an approximate potential of 20,000 tCO_2e/year in reductions from utilizing flared gas. In Ghana, oil field flaring is not legal, but a potential of around 30,000 tCO_2/y can be exploited in waste heat recovery in oil refineries.

In production of building materials, and bricks in particular, introduction of vertical shaft brick kilns was found to have a significant emissions reduction effect in a number of the surveyed countries. In Malawi, full conversion to vertical shaft brick kilns could yield emissions savings of about 650,000 tCO_2e/y. A similar potential is also likely to exist in the neighbouring Mozambique. In Myanmar, a conservative estimate for the same conversion is about 500,000 tCO_2 annually.

A number of industries generate large amounts of waste heat and gas, which can be utilized for power generation or steam. Efficiency improvements and waste heat recovery in the cement industry hold potential for emission reductions in Burkina Faso (5,300 tCO_2/y), Ghana (35,000 tCO_2/y), Trinidad & Tobago (11,800 tCO_2/y), and an estimated 35,000 tCO_2/y in Mozambique. Some potential might also exist in Fiji and Malawi, but it is likely too small to be a viable option in the context of a CDM. The same is true for Myanmar, where the CDM project activities within the cement industry might not be attractive due to the relatively low grid emission factor. In Haiti there is existing data on cement production capacity prior to the earthquake, however there is a lack of data on the current production. Some potential in energy efficiency of cement production may be available but would require further investigation into the current operating capacity.

Energy efficiency improvements in the kiln technologies for cement production could also translate into a savings of 45,000-60,000 tCO_2/y in Rwanda, with an additional savings of 100,000 from switching to a less carbon intensive fuel such as biomass. In Senegal, a similar project has already been registered as a CDM project activity. In Malawi, fuel switch to biomass in cement production would remove 350,000 tCO_2/y. Additionally, other industrial activities could benefit from energy efficiency improvements through waste heat recovery. In steel and glass production, in Trinidad & Tobago, there is a total of 530,000 tCO_2/y potential in emissions savings.

Extraction and mining processes are a major source of GHG, and particularly methane, emissions. Mining remains a significant source of income and GDP for a number of developing countries, especially in Africa. Methane reduction efforts in mining processes present the opportunity to both reduce GHG emissions costs efficiently and to bring about important health benefits for workers. In Burkina Faso, installing methane extraction systems in gold mines could yield up to 100,000 tCO_2 reduction, over a period of 20 years. More data on mining energy consumption patterns are needed to assess the feasibility potential for emissions reductions in the mining industries in Ghana, Lesotho, Mozambique, Rwanda and Senegal. In cases where the majority of the mining is done by artisan miners, as in DRC and Mozambique, its placement within the informal sector would most likely leave the mining industry out of reach of emissions reduction initiatives.

Other identified options for emission reductions include, methane destruction in wastewater from the fishery activities in Belize, efficiency improvements in beer production in Burkina Faso, projects in coal mine methane reduction in Malawi and energy efficiency improvements in aluminium smelter in Mozambique.

For a number of the countries investigated, the industrial sector is either undeveloped or the existing activities are limited to cottage industries, such as small-scale brick production or even household-based production like textiles. In most cases these do not represent noteworthy emissions reduction options, as is the case in São Tomé, where the only industrial activity is cocoa production. For DR Congo, Fiji, Haiti and Lesotho, no emissions reduction potential was calculated. This does not exclude the possibilities for emission reduction projects. The list of identified opportunities is not exhaustive and more opportunities might exist, particularly in mining and brick production, where countries like Ghana, DRC, Burkina Faso, Lesotho and Mozambique could hold considerable potential.

Waste

The assessment of the potential within the waste sector is divided into two main categories: agricultural waste (and domestic livestock hereunder) and municipal waste. The potential emission reduction, in terms of waste energy from industrial processes, is described in the industry section, and waste products from the oil & gas and mining sector, in terms of mainly waste gasses, are described in the conventional power section. The potential in agricultural wastes is based on available data, and the emission reduction potential is primarily from the energy generation potential. The avoided methane emissions are more difficult to calculate as the potential greatly depends on the actual on-site situation, in terms of waste storage and disposal practises. The calculations made on the potential within municipal waste management systems, landfills and wastewater treatment plants are based on most recent available load and existing inflow numbers from local sources. In cases where not enough data is available for calculating the actual potential, examples are used from already registered CDM projects from similar climatic areas and from countries with the same type of waste management system and waste fractions. If the needed numbers are available, an internal calculation tool based on CDM methodologies is used to perform the more complex emission reduction calculations.

Waste handling, waste types, waste fractions, rural waste usage and urban waste management systems are very different from country to country. These conditions can often be determined from the geographical and economic characteristics of the country. In low-income countries with low levels of urbanisation, the potential is mainly in the agricultural sector--hereunder the potential in small rural household units--whereas in more developed urbanised countries, the potential is found in urban waste management systems and from agro industrial wastes.

Potential emission reductions can be through the avoidance of direct emissions from the waste itself or by utilizing the waste for energy purposes and, thereby, displacing more carbon intensive energy/fuels. The two approaches can also be combined, for example, by avoiding the emission of methane from waste left to decay, by using the methane for energy purposes and at the same time displacing the use of fossil fuels.

Overall, it can be concluded that the potential for GHG emission reductions in waste is high across all fractions, but in some cases difficult to realize and greatly dependent on the local social, economic and geographical conditions.

In the least developed target countries the focus is on rural households with medium and large sized rural livestock herds, agricultural processing facilities, and any existing functional landfills and wastewater management systems. In terms of agricultural facilities, the focus should be on units processing maize, sugar canes and rice. The potential in the waste from maize and sugar is mainly in Africa, while the potential in rice residues is in Myanmar and the Caribbean target countries.

Target countries that have already been undergoing some urbanisation and economic development have more focus on the potential in urban waste handling and in bigger agro industrial units. The potential in emission reductions from landfills and wastewater treatment systems is high and relatively easy to implement here, as the amount of waste per capita is large and the gathering and management of it already exists in a centrally organized and functioning manner.

The potential for emission reductions in the waste sector is an important focus area in the selected countries, as waste is always in abundance but often not utilized for energy purposes or as a focus area for emission reductions.

As seen from the table below, the potential is spread over all areas of the waste sector. Both the domestic and the agricultural sector have potential for emission reducing actions, whereas the potential in the industrial sector is more limited. The results should not be seen as the absolute potential in a given country or in one of the focus areas, but more as a guide to where the effort for emission reduction actions should be put, within a national and regional context.

In the domestic sector, there are three main categories: small rural households, urban solid, and fluid waste. As seen from the table, the potential for utilizing the methane from livestock and household waste for cooking and lighting is relatively high. The technology needed to utilize this potential is small household biogas systems, which is a proven and usable technology that has already been implemented in numerous countries as CDM projects. The potential is high, almost unexploited and easily implemented in many of the target countries, which are dominated by small-scale farming societies. However, there are some limitations. First, a domestic biogas system requires a livestock herd of five cows or an equivalent number of other household animals to produce the needed manure. Second, the manure and household waste should not be used for any other purpose, such as fertilizer. As the resources in these areas are often scarce, such alternative uses are probably common, however, these uses have significant influence on the potential emission reductions.

In the urban waste sector the potential is also relatively high, with landfill gas (LFG) projects being the most promising. The technology needed in the collection and utilization of methane is a widely spread and proven technology, already used in a large number of CDM projects. This is also the case for utilizing the potential in wastewater management systems. Compared to the above-mentioned difficulties in the implementation of many small biogas systems, LFG and wastewater projects are easier to realise as their implementation is limited to a central location and does not involve many stakeholders. The actual emissions reduction potential is more difficult to determine, as this is dependent on the climatic condition, the baseline situation, waste management and the type and fractions of the waste. The potential in urban waste management in the least developed target countries is very low or nonexistent in this analysis. This does not mean that it cannot be realized; it only indicates that the present situation is not suitable for a project or that there is no existing data. The urban waste in these least developed countries is often a big problem in terms of health and pollution but the primary focus here should be on the establishment of waste management systems followed by the utilization of the waste for energy. Current emissions from unorganized waste sectors with no central collection or disposal may not be high due to aerobic decomposition by default.

Emissions reduction potential in waste utilization from sugar and maize production and processing has the biggest potential in the agricultural sector. While rice is not that predominant, this is more a result of the geographical location of the countries and not the lack of potential in rice waste.

The potential in agricultural wastes are based on available data and the emission reduction potential is primarily indirect in terms of the avoided emission from the energy displaced. The avoided methane emissions are more difficult to calculate as the potential greatly depends on the actual on-site situation, in terms of waste storage, type, fraction, climate and disposal practises. This is also the case when the potential emissions reduction is assessed from livestock, as the emission from manure is also very dependent on the climate, as well as the local breeds and treatment of the livestock.

Country	Sugar bagasse to power	Maize residues to power	Rice husk to power	Other agricultural residues	Sawmill/ forestry	Manure methane for cooking/lighting	Landfill methane capture and incineration	Wastewater methane capture	Industrial biogas	TOTAL (tCO_2e)
Angola	5,676	34,056				206,400	751,380	4,620		**1,002,132**
Belize	17,300		263			510	37,591		1,864	**57,528**
Burkina Faso						242,488	15,700			**258,188**
DRC	55,000					37,700	125,000			**217,700**
Fiji	60,000				15,000	22,500		10,000		**107,500**
Ghana		255,745		881,955	172,060	84,501	252,934			**1,647,195**
Haiti	16,416		30,780			70,000	63,000			**180,196**
Lesotho					55,000	29,200				**84,200**
Malawi	83,700	300,000			37,700	162,000	130,000	30,500	2,900	**746,800**
Mozambique	367,000			330,000		47,085				**744,085**
Myanmar	242,000		210,000			9,417	120,000	14,000		**595,417**
Rwanda		46,000		20,000	36,000	70,000	100,000			**272,000**
Sao Tome & Principe										-
Senegal	37,386	270,000		37,386		172,572	71,990	33,500		**622,834**
Trinidad & Tobago			6,650				583,580	192,000		**782,230**

Table 9 Waste sector emissions reduction

Due to these uncertainties, the accurate emission reduction potential is very difficult to determine. Therefore, the potential described in the waste sector, in almost all cases, is determined by using the average conservative assumptions from other CDM projects, using the same technology and with similar climatic, geographical and possible economic conditions.

The calculations made on the potential within municipal waste management systems, landfills and wastewater treatment plants are based on most recent available load and existing inflow numbers from local sources. In cases where not enough data is available for calculating the actual potential, examples are used from already registered CDM projects from similar climatic areas and from countries with the same type of waste management system and waste fractions. If the needed numbers are available, an internal calculation tool based on CDM methodologies is used for the more complex emission reduction calculations.

When the emission reduction potential, in terms of an indirect reduction from the displacement of other energy sources, is calculated, some assumptions are also made. In cases where the potential energy comes from bigger centralized sources, for example a landfill gas unit, a grid emission factor is used, if available. If the renewable energy is from smaller decentralized units, for example small household biogas systems, the emission reduction is calculated by using the emission from kerosene for cooking as a baseline. This is a simplified approach, which should be seen as a guide to where emission reductions can be identified, and not an exact calculation of the actual potential.

The size and number of identified sources for emission reduction potential in the different countries can also differ from the actual situation, as there can be some hidden and unidentified potentials. This is especially the case for small and medium sized agricultural processing units as well as municipal waste management systems in medium sized towns and cities. As the analysis is made from secondary sources and available data and information, there can be some cases where a landfill or a secondary agro-processing activity is overlooked. In such cases the assessment should be seen as a guide to identifying focus areas and not as a final assessment of the reduction potential.

Transport

Transport systems in the 15 countries are generally less organized, with large fleets of individual taxis or mini buses in the larger cities. Gross assessments of Bus Rapid Transit (BRT) system potentials have been undertaken in cities with more than 1 million inhabitants, but only through benchmarking based on registered CDM projects using the size of the cities as the relative basis. This disregards several parameters like traffic density, distances and types of vehicles, as such information is not available. Options in traffic mainly pertain to fuels. Ethanol and biodiesel are options in all countries assessed, and many assessments have existing biodiesel production as their point of departure. In CDM terms, however, the requirement of captive fleets have been taken into consideration, in many cases eliminating the CDM option, while maintaining a reduction potential outside the CDM.

The transport sector is a source of significant emissions in most countries. While individual transportation has yet to become a target area for emissions reductions, mass transportation systems have the potential to replace part of individual transport and reduce emissions. Moreover, efficiency improvements in existing mass transportation systems, such as more efficient operation and recovery of brake energy, can yield some benefits. Additional options exist in shifting from fossil fuel-based diesel to biodiesel.

The results of analysis for emissions reduction potentials in the transport sector can be seen in the table below.

Country	Biodiesel for transport	Bus Rapid Transit	Biodiesel for diesel generators	Ethanol	TOTAL (tCO_2e)
Angola					-
Belize	6,400				6,400
Burkina Faso					-
DR Congo	16,000				16,000
Fiji	160,000				160,000
Ghana	139,000	100,000			239,000
Haiti	200,000		25,000		225,000
Lesotho	25,000				25,000
Malawi					-
Mozambique	170,000	1,500			171,500
Myanmar	500,000	25,000		100,000	625,000
Rwanda					-
Sao Tomé and Principe					-
Senegal	250,000			29,600	279,600
Trinidad & Tobago	62,500				62,500

Table 10 Transport sector emissions reduction

Myanmar and Mozambique hold the highest identified potential, while a number of countries do not have any viable options for emissions reductions in transport. Local circumstances translate into few practical opportunities for emissions reductions at present, even though transport remains a significant source of emissions in all of the countries. These include both lack of local biodiesel production capacity, as well as absence of captive fleets, which are a precondition for biodiesel use and claiming reductions within the CDM context.

Utilization of biodiesel from different sources is a relatively simple technology and most diesel vehicles may use biodiesel with little to no adjustments to the engine. Ethanol may also be added to both petrol and diesel. It is an important precondition that there be possibilities for sufficient supply of biodiesel, which would often entail careful weighing of available land for crops and ensuring that production of biodiesel does not compete with food production.

Opportunities for use of biodiesel for transport were identified as the most viable options for emission reductions, although not all would qualify as CDM project activities. In Kinshasa, DRC, converting to use of biodiesel in the bus fleet, can result in potential emission reductions of 11-16,000 tCO_2/y. In Fiji, where transport is the largest source of CO_2 emissions, some 150,000 tCO_2/y could be reduced through blending of fuels with locally produced biodiesel. It is, however, unlikely that such activities could qualify as CDM projects due to the methodological requirements of a captive fleet in order for a project to be eligible under CDM. The same is true for Ghana, where the theoretical emissions reduction potential of introducing biodiesel through a government-blending programme could reduce 139,000 tCO_2/y, but would also not qualify for CDM. In Angola, some future potential might exist in conversion of fuel to biodiesel or CNG for the public busses, however the practical potential for this is yet to be seen, and is largely dependent on the advancement of the national biofuel strategy and opportunities for local production of biodiesel.

In Haiti, local jatropha and sugar cane production could theoretically substitute enough diesel, in transport and generators, to yield up to 225,000 tCO_2/y in emissions reductions. Again, not all of this may qualify as a CDM project activity. In conditions where local biodiesel production is possible, Lesotho could achieve emissions reductions of 20,000-30,000 tCO_2/y. However, Lesotho's geographical conditions seem unfavourable for growing jatropha or other biofuel crops. In Mozambique, through a government mandate for blending -- and with local jatropha production, a general blending strategy would be the best platform for achieving real emissions reductions and reducing dependence on fossil fuels - making it possible to yield 170,000 tCO_2/y with a 10% blend.

In Malawi, while potential might exist, any significant emissions reduction initiative in the transport sector will have to address the unorganized traffic through a blending programme for liquid fuels. As mentioned earlier, usage of biofuel in captive fleets is a methodological requirement, but in many cases the captive fleets are only partly operational, working with considerable irregularities and lacking oversight, making it difficult for CDM monitoring. Nevertheless, Malawi introduced ethanol in mixing with petrol in 2006. The ethanol is produced in-country and the use has been increasing, as has been jatropha production, with prospective reductions in emissions from transport. In Myanmar locally grown jatropha for biodiesel blending and ethanol could potentially yield 500,000 and 100,000 tCO_2/y, respectively.

Senegal has also been embarking on national production and use of biofuels through a national program and local jatropha production. Emissions reductions though blending and biodiesel introduction in captive fleets could deliver savings of around 277,500 tCO_2/y. In Trinidad & Tobago, the government has made clear targets in emissions reductions in the transport sector. With transport being responsible for virtually all emissions from liquid fuel use, just a mere 10% reduction in petrol use would deliver emissions savings of 50-70,000 tCO_2/y.

Several technologies can be employed to increase efficiency and reduce emissions from public transportation. Bus Rapid Transit projects have great potential in both reducing congestion and avoiding CO_2 emissions. In Accra, Ghana, which has a rapidly growing fleet of private cars, BRT could reduce up to 100,000 tCO_2/y (an optimistic estimate). The capital city of Maputo, in Mozambique, could potentially be a target for a BRT system, although the savings are likely to be much lower – based on previously submitted CDM projects, savings could be only 1,500 tCO_2/y for a single BRT line. In Myanmar's largest city, Yangon, more than 80% of transport is undertaken by bus, and therefore public transportation would be an obvious target for reducing emissions in the transport sector. A superficial estimate for emissions reductions from BRT is 20-30,000 tCO_2/y. A more precise estimate would need to take into consideration the progress with ongoing conversion to CNG and mix of biodiesel in current transportation.

No considerable potential for emissions reductions programmes within transport was identified in Rwanda and São Tomé. In Belize, the size of the country is not favourable for implementation of new mass transit systems. The same is true for Haiti, where the population density is not high enough for investments in public transportation to be feasible.

Although transport remains one of the major sources of emissions across the world, implementation of transport projects within CDM is complex and not always feasible. General blending strategies, mandated by the government, are better platforms for increasing emissions reduction and reducing dependence on fossil fuels – as opposed to captive usage, as required in CDM methodologies.

Data quality

The availability of data in the 15 countries analysed is very limited. This is a challenge in itself when developing a single country report, but it also becomes a challenge when comparing or accumulating the emissions reduction options across countries. There is not one single sector throughout these country reports for which one source has been able to provide information for all countries. Information has had to be pieced together from different sources -- if any sources are available at all. In cases where sources have not been available, indirect and very generic pieces of information, e.g. the number of cars in a country, have been used. In this regard, many elements are established, for which no official records exist – specifically, not on the World Wide Web.

Conversely, coping with these constraints has required some creativity in putting together sources that in many – or even most – cases would not be acceptable in a scientific context. Only very few peer reviews or official sources have been used, simply because they do not exist. Instead, newspaper articles, Wikipedia, blogs and other web-accessible information have been used. On this basis, a general reservation on the validity of the sources has to be made, but in the absence of alternatives there have been no other options than to not produce the country reports at all. A more positive consequence of the scarcity of information is that the necessary creativity in constructing data has provided ballpark figures for reduction potentials that have not been developed in other contexts.

Conclusion

The overall assessments of the potential emissions reduction in the 15 countries was initially presented in Table 1. Sector details have been presented throughout the text, allowing an accumulation of overviews of the potentials in the 15 countries distributed across the 7 sectors of the economy around which the country reports have been structured, as seen in Table 10. In Table 1, as well as in Table 10, it is evident that the emissions reduction potential by far exceeds the current emissions reported by the UN, following calculations from the United States Department of Energy's Carbon Dioxide Information Analysis Center (CDIAC). The reason for this is that these figures do not include the indirect emissions caused by current deforestation levels, as presented in the agro and forestry sections of the country reports.

The intention behind including these figures is to illustrate that compared to these indirect emissions, almost any emissions reduction initiative, whether CDM or not - even those that may yield hundreds of thousands of tons of CO_2 equivalents - are dwarfed by the main cause of emissions in these countries: deforestation. This source of emissions should be addressed with priority.

While it is not the purpose of these country reports to provide specific recommendations regarding the most obvious areas of activity for emissions reduction, it should be evident that any reduction initiative that targets the current use of wood for fuel or other purposes has far reaching prospects.

We hope that these studies will help inform decisions on policy making and project development to reduce emissions of greenhouse gases in the assessed countries and beyond.

Country	Agriculture/forests (tCO_2e)	Waste (tCO_2e)	Conventional power (tCO_2e)	Renewable energy (tCO_2e)	Energy consumption (tCO_2e)	Industry (tCO_2e)	Transport (tCO_2e)	Total ($000/tCO_2e$)	National Emissions ($000/tCO_2e$)
Angola	319,465,196	1,002,132	52,500	1,008,000	3,120,000	54,828,000	-	**379,476**	24,371
Belize	17,771,923	57,528	-	72,243	20,000	25,500	6,400	**17,954**	425
Burkina Faso	106,858,297	258,188	-	290,250	1,000,000	108,900	-	**108,516**	1,856
DRC	2,082,490,957	217,700	-	9,957,000	2,960,000	-	16,000	**2,095,642**	2,816
Fiji	17,651,000	107,500	-	322,420	80,000	-	160,000	**18,321**	1,254
Ghana	352,656,852	1,647,195	587,417	2,258,785	1,500,000	65,000	239,000	**358,954**	8,592
Haiti	2,198,967	180,196	45,000	-	1,025,000	-	225,000	**3,674**	2,435
Lesotho	113,984	84,200	-	36,200	203,000	-	25,000	**462**	-
Malawi	11,920,972	746,800	-	544,005	1,500,000	1,005,500	-	**15,717**	1,228
Mozambique	37,639,834	744,085	485,198	18,662,178	8,516,000	950,000	171,500	**67,169**	2,314
Myanmar	553,374,910	595,417	1,706,353	703,651	6,650,000	500,000	625,000	**564,155**	12,776
Rwanda	109,835,296	272,000	100,000	670,000	5,100,000	152,500	-	**116,130**	704
Sao Tome & Principe	6,866	-	-	86,764	18,000	-	-	**111**	128
Senegal	77,918,133	622,834	109,901	666,354	1,247,000	553,000	279,600	**81,397**	4,976
Trinidad & Tobago	2,015,820	782,230	-	258,332	233,000	2,128,800	62,500	**5,481**	49,772

Table 11 Summary Table

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