



Quick Screen of Potential NAMAs Rwanda



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1. INTRODUCTION

This document discusses how the development of nationally appropriate mitigation actions (NAMAs) can contribute to the achievement of Rwanda's low-carbon growth and development objectives. The goal of this high-level country analysis is to present options for the identification and prioritization of NAMAs that meet Rwanda's specific needs, align with pre-existing policy frameworks, and have associated co-benefits, be they environmental, social, economic or with regard to adaptation to climate change.

NAMAs in this context refer to actions that developing countries can voluntarily implement and for which they may receive international support in the form of financing, technology, or capacity building. NAMAs are largely considered to be government interventions such as policies and programmes that result in emission reductions relative to business-as-usual levels. NAMAs can be of three main types: unilateral, supported, and creditable.

To ensure transparency of both the emission reductions resulting from NAMAs and the financial and technical support for NAMAs, Parties agreed at the United Nations Framework Convention for Climate Change (UNFCCC) meeting in Cancun (2010) on the need for measurement, report and verification (MRV). It is intended that the level and extent of MRV required will be clarified at the UNFCCC Eighteenth Conference of the Parties, to be held in Doha at the end of 2012.

With the forthcoming introduction of a NAMAs registry, it will be possible for developing countries to submit NAMAs to receive support for the preparation phase. As many NAMAs are conditional upon the provision of support, developing countries have also requested an assessment of support needs for these measures.

The process for prioritizing and selecting NAMA is one of the first of its kind and currently there is no standardized procedure. It is challenging by its very nature, as the details of NAMAs are being decided on in parallel with the development of the first pilot NAMAs.

In light of these challenges, this report presents a short list of potential NAMAs, describes the process and background against which the initial selection was made, and provides guidance on how to further prioritize and select actions for consideration. The report begins with an outline of the methodology used in NAMA identification. Next, a brief overview of the economic and emissions context in Rwanda and a discussion of current government priorities and policies are provided. The subsequent two sections provide a long list and screened short list of potential NAMAs by sector, followed by results and possible next steps.

2. QUICK SCREEN METHODOLOGY

The purpose of a quick screen exercise is to use a standardized, country-driven process to identify a short list of Nationally Appropriate Mitigation Action (NAMA) opportunities that meet a country's specific needs and align with pre-existing policy frameworks.

A quick screen produces a country report that provides context on the country and outlines a list of NAMAs that have been screened for:

- Having medium or high mitigation potential
- Alignment with government priorities
- Evidence of existing action
- Having non-negative co-benefits along the following dimensions:
 - Adaptation to climate change
 - Economic development
 - Environmental
 - Social

It involves a five-step process:

1. **Research and Categorization** – Collect, review and categorize relevant documents and data that provide country context, including a description of the socio-economic context, information on GHG emissions, government priorities and climate change-relevant actions.
2. **Long List** – Develop a comprehensive list of NAMA opportunities organized by the six UNFCCC mitigation sectors: Agriculture, Energy, Forestry and other land use, Industry, Transportation and Waste.
3. **Short List** – Screen the long list of potential NAMAs against a set of criteria to develop a short list of NAMAs with the greatest opportunity by UNFCCC sector.
4. **Review** – Evaluate the short list using an analytical grid that examines NAMAs in the context of mitigation potential, government priorities, current actions and co-benefits.
5. **Validation and Finalization** – Validate the short list of priority NAMA opportunities with government authorities and key stakeholders; and revise the short list and country report based on expert input.

2.1 STEP 1: RESEARCH AND CATEGORIZATION

OBJECTIVE

The first step is to collect, review and categorize the information that underlies the identification of NAMA opportunities. This includes relevant documents and data that provide country context, information on GHG emissions, government priorities, and on-going and planned actions in the six UNFCCC sectors.

PROCESS

COLLECTION

A desk review is undertaken to identify and access various information sources. The research will focus on assembling and categorizing information on the following topics:

- Economic growth and development (e.g. main economic sectors, growth trends)
- Social development (e.g., population and urbanization trends, percentage of rural population)
- GHG emissions inventory and forecast
- National government priorities and policies (e.g., from national development plans)
- Major government policies and priorities in the six mitigation sectors
- Sectoral context (e.g., trends, energy use and access to energy, modes of transport, forestry cover and rates of deforestation, main agricultural crops, technologies or interventions recommended for implementation)
- Major initiatives on the part of government, NGOs, private sector, multilateral institutions and donors in the six sectors.
- Any other information that is potentially relevant to NAMAs

This review can include Internet research, and if possible and desirable, in-country research. Documentation that is not accessible on the Internet may be available in country from bureaus of statistics and local experts. Government, donor, academic and multilateral organization publications may be useful. This information should be organized by the six UNFCCC mitigation sectors, in addition to one general climate change category (e.g., national development plans, national economic reports, etc.).

Researchers should note important documents that are not accessible at this stage, and major data and information gaps. There may be opportunity to locate the information at a later stage in the research (for example, through the validation process in Step 5), or through in-country consultations with experts.

The information collected during this stage will be used to develop the short list (Step 2), the long list (Step 3) and the Country Report (Step 4); and should be organized to allow researchers to find and access particular data, and identify sources. Mindjet’s MindManager software is one way to organize the documentation, but a range of other data management products or techniques could potentially be used. This library can be a useful deliverable for the developing country.

CATEGORIZATION

Categorization of information will be done concurrently with the document collection and review. To facilitate the identification of priority NAMAs, select information should be organized by the following categories:

- List of government priorities, overall and by sector (see Table 2 for an example of a list of government priorities identified in the NAMAs Quick Screen for Bangladesh)
- List of on-going initiatives and activities by UNFCCC mitigation sector – including government, donor-funded, NGOs and private sector
- List of planned or needed actions in the six sectors, as articulated in government documents

The initiatives and actions should be those that have the potential to reduce GHG emissions or enhance sinks – i.e., mitigation actions.

OUTPUTS

Step 1 results in a collection of relevant documents regarding the country’s economy, development priorities, national and sectoral policies and priorities, and major initiatives – organized by the six UNFCCC mitigation sectors. The collection and categorization process will also result in three lists of important information needed to identify potential NAMAs: government policies and priorities, current initiatives by sector, and actions recommended in government documents.

2.2 STEP 2: LONG LIST OF POTENTIAL NAMAS

OBJECTIVE

The objective is to develop a credible long list of possible NAMAs for the country. This long list is the basis for the short listing of NAMAs that occurs in Step 3.

Process

The lists of current initiatives and recommended actions developed in Step 1 are examined for actions that could be NAMAs – that is, they have to potential to lead to emission reductions or enhance the sequestration or removal of carbon from the atmosphere (sinks). The actions could be policies, programmes or projects. Examples of potential actions are listed below by sector:

- Energy supply – renewable energy (hydro, solar, wind, geothermal), clean coal, biofuels, electricity generation from landfill gas

- Energy Demand – improved cookstoves, renewable lamps replacing kerosene, energy efficient appliances, energy efficient lighting, solar water heating, improved buildings, energy efficiency improvements in industry, co-generation in agriculture
- Transport – bus rapid transit, light rail transit, improved vehicle stock efficiency, improved heavy-duty vehicle stock efficiency, biodiesel, shift of freight to rail, improved non-motorized transport
- Industry – improved cement processing, charcoal production
- Waste – methane avoidance from landfill gas
- Agriculture – conservation tillage, agroforestry, livestock management, reduced burning of grazing and cropland
- Forestry – reducing deforestation and forest degradation, tree planting, restoration of degraded forests

The lists above are not complete and other options may be identified. Expert opinion is used to draw out the options from the lists developed in Step 1. The degree of specificity is also dependent on expert opinion. For example, public transport policies can be grouped as a single NAMA, or can be separated into different NAMAs to cover various programs and initiatives. Source information's is indicated for each identified NAMA.

OUTPUTS

The output of Step 2 of the Quick Screen is a comprehensive long list of potential NAMAs for a given country.

2.3 STEP 3: SHORT LIST OF NAMAS

OBJECTIVE

The objective of Step 3 is to filter the long list to develop a short list of NAMAs that are potentially implementable in the developing country.

PROCESS

The NAMAs in the long list are analyzed against the following screening criteria:

- **Significant mitigation potential** – Defined as 0.1 percent of total 2010 emissions, or large enough to have a notable mitigation impact on sector emissions at the national level. The mitigation potential is estimated at this Quick Screen stage. Those actions with low mitigation potential are removed from the list.
- **Alignment with government priorities** – Actions must build on or contribute to the Government's national and/or sectoral priorities. Actions that are not in line with government priorities are removed from the list.

- **Evidence of existing action** – The NAMA should build upon and feed into existing initiatives to avoid duplication and demonstrate some in-country capacity to implement the action. Existing action could be enabling, planning or investment activities that directly relate to the NAMA. If there is no evidence of similar or complementary initiatives from either the government or major donors, the action is removed from the list.
- Sustainable development and climate resilience co-benefits – Recognizing that NAMAs are expected to contribute to sustainable development, and that development is a priority, all short listed NAMAs are expected to have at least one clear economic, social, environmental or climate resilience benefit.
 - Economic benefits can include economic growth, improved livelihoods, increased household income, improved energy security, negative impacts can be increases in prices of energy
 - Social benefits – enhanced food security, decreased time for fuelwood collection, improved indoor air quality; negative impacts can be displaced populations, lack of access to forest and grazing lands
 - Environmental benefits – improved local air quality, improved water quality, enhanced biodiversity; negative benefits can be flooding of land, mono-culture in tree plantations
 - Climate Resilience – e.g., improved water availability, reduced soil erosion, reduced deforestation and forest degradation; maladaptation can result from

The process screens out those actions that do not meet all of the above criteria. In other words, a short listed NAMA has significant mitigation potential, aligns with government priorities, has sustainable development benefits, and there is evidence of similar action in the country.

This is a high-level screen, where evidence of the above screening criteria is noted in the literature or understood through expert opinion. Analysts are not expected to undertake extensive additional research at this stage, but to use the understanding and knowledge gained in Step 1.

OUTPUTS

The output of Step 3 is a short list of NAMA opportunities that have medium to high mitigation potential, sustainable development benefits, align with government priorities, and likely are feasible to implement because of existing initiatives.

2.4 STEP 4: REVIEW AND DEVELOPMENT OF DRAFT COUNTRY REPORT

OBJECTIVE

To evaluate the short list using an analytical grid that examines NAMAs in the context of mitigation potential, government priorities, current actions and co-benefits.

To prepare a report for country stakeholders that outlines the results of the analysis, including the short list of NAMAs.

PROCESS

The country report can be developed concurrently with the collection and organization of information (Step 1) and the development of the lists of NAMAs (Steps 2 and 3). The report brings together information and context about the country that is relevant to NAMAs. The outline of the country report is set out below:

1. Introduction
2. Quick Screen Methodology
3. Country Overview
 - a. National Socioeconomic Overview
 - b. National GHG Emission Overview
 - c. Overview of Vulnerability to the Adverse Effects of Climate Change
 - d. National Government Priorities
 - e. Identification of Existing National Policies
4. List of Potential NAMAs
 - a. Agriculture
 - b. Energy
 - c. Forestry and Other Land Use
 - d. Industry
 - e. Transport
 - f. Waste
5. NAMAs Evaluation Grid
6. Results
7. References

This report of approximately 15-20 pages in length is an overview of the NAMAs in the developing country, providing context on the economy, government priorities and sectoral actions that inform the selection of priority NAMAs.

OUTPUTS

The country report is the output of Step 4.

2.5 STEP 5: VALIDATION AND FINALIZATION

OBJECTIVE

The objective of this step is to validate the selection of potential priority NAMAs, including the analysis and assumptions, with country experts.

PROCESS

There are various options for validating the NAMAs lists (Steps 2 and 3) and the country report (Step 4). The desired approach is through an in-country stakeholder meeting that includes experts from government, the private sector and civil society. Alternatives are review by a select number of country experts, or review by representatives from the climate change unit. A simple option is to discuss the

results with representatives from select ministries or the climate change unit. The method of validation should be noted in the Country Report.

Discussions with country experts through the validation process will help to determine if actions align with government priorities, if there is sufficient “readiness” to prepare and implement the NAMA, if there are barriers that impact the feasibility of NAMA implementation, and if additional actions should be considered in the analysis. Country experts will identify potential priority NAMAs. The NAMA lists and the country report will be revised after local validation and the final lists and report developed.

OUTPUTS

The final report, which is informed and improved by expert input, is the output of Step 5. The report can also be used for a variety of purposes, including: to form the basis for factsheets on high-priority NAMAs to attract funding; to form the basis of information of a preparation proposal to submit to the UNFCCC’s prototype registry, and to raise awareness of NAMAs and NAMA opportunities.

3. COUNTRY OVERVIEW

3.1 NATIONAL SOCIOECONOMIC OVERVIEW

Rwanda's growth performance has been remarkably strong over the past 2 years. Despite the global and regional economic uncertainties, Rwanda has remained on a strong growth path with real gross domestic product (GDP) accelerating to approximately 7.2% in 2010 and 8.6 percent in 2011 from 4.1 percent in 2009 (AfDB; OECD; UNDP; UNECA, 2012). Although a slowdown is projected in 2012 and 2013 on account of the government's fiscal consolidation efforts and the uncertainties of the global outlook, real GDP is projected to remain within the 6.9-7.6% band thanks to projected strong capital spending, increased agriculture productivity, and a rebound in the services sector (AfDB; OECD; UNDP; UNECA, 2012)

Agriculture is at the heart of Rwanda's economy. The sector occupies 79.5% of the labor force, contributes one third of GDP and generates more than 45 percent of the country's export revenues. Agriculture is also important for national food self-sufficiency, accounting for well over 90 percent of all food consumed in the country. (World Bank, 2011) Lastly, basic food crop production is projected to rise by 15 percent over the Government's Economic and Development and Poverty Reduction Strategy (EDPRS) period (World Bank, 2011).

Difficult macroeconomic structural challenges are expected. Rwanda's economic outlook for 2012 is positive, but with increasing medium-term risks, including:

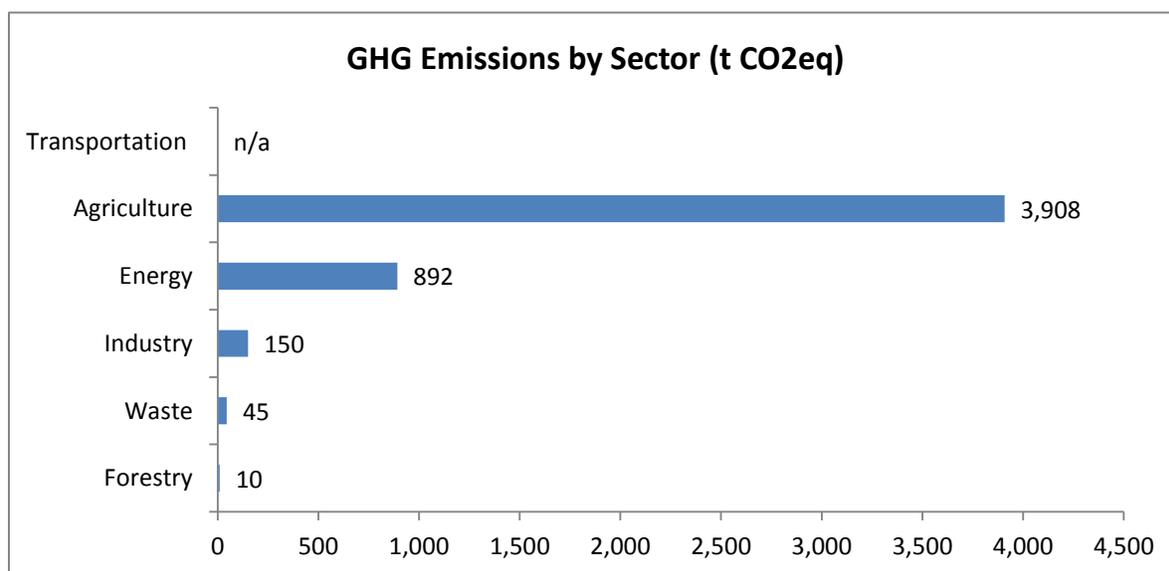
- Rwanda's growth outlook is tied to a recovery in the global economy. Therefore, downside risks to Rwanda's economy due to uncertainty and potential recession in Europe and North America are expected through the following channels: reduction in export demand, slowdown in foreign direct investment¹, deceleration in tourism receipts, reduction in remittances, etc.
- Any shock in international commodity prices would severely hamper Rwanda's balance of payments and growth outlook and could increase domestic inflationary pressures.
- Poor physical infrastructure and the lack of electricity access and generation are major constraints to increasing and diversifying exports of goods and services and further enhancing competitiveness.
- Significant capacity and skills gaps in the private sector and across Government agencies hinder establishing the policy environment for private sector development.

¹ Rwanda remains highly dependent on grants from its Development Partners. About 40 percent of the budget is financed by grants, adding up to 11.0 percent of GDP in 2010/2011 (World Bank, 2011).

3.2 NATIONAL GHG EMISSION OVERVIEW

Rwanda has one of the lowest GHG emissions per capita in the world estimated in 2005 at 0.6 tCO₂e/person compared to a global average of 6.7 tCO₂e/person including land use change (GOR, 2011). Rwanda's GHG emission baseline was set in 2005 in preparation for the Second National Communication (SNC) to the UNFCC and has continued to grow over recent years. In 2009 a Rapid Assessment of a National Energy and Low Carbon path reported GHG emissions have shown an upward trend from 2003 to 2006 and will likely to continue to rise. Further, according to the assessment, the figure below indicates that Rwanda's emissions will increase by 50% by 2020 and it will become a net emitter in 2012 (SEI, 2009).

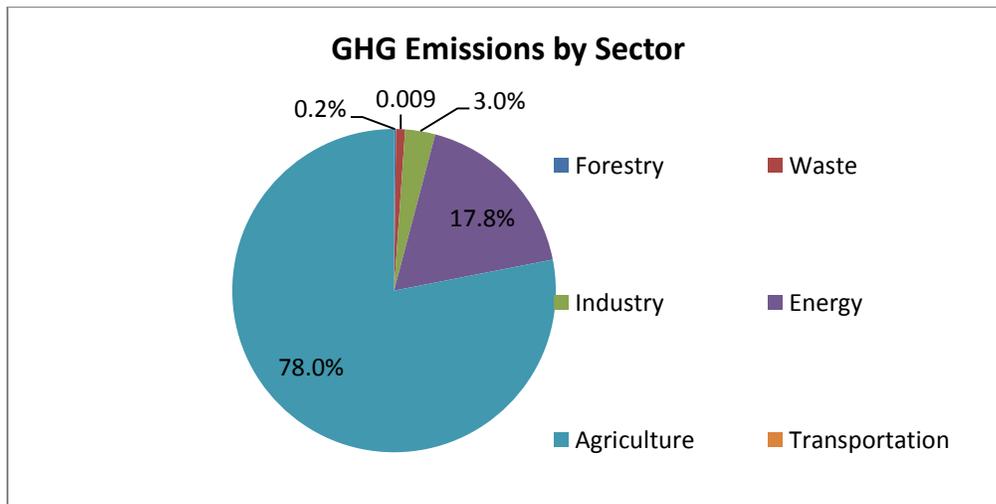
FIGURE1. RWANDA GHG EMISSIONS



Source: GOR, 2011.

The main source of CO₂ GHGs emissions in 2005 were: agriculture (which contributed 78%), and energy (17.8%), industrial processes (3%), wastes (0.9%) and land use, and land use change and forestry (.2%) (GOR, 2011). In terms of aggregated emissions nitrous oxide (N₂O) and methane (CH₄) are the most potent greenhouse gases contributing 62% and 26% of aggregated emissions in Rwanda (Byamukama, B.; Carey, C.; Cole, M.; Dyszynski, J; Warnest, M, 2010). The four key sources which contributed 91% of aggregate emissions were: Nitrous oxide (N₂O) from agricultural soils (57%), methane (CH₄) from enteric fermentation in domestic livestock (19%), methane (CH₄) from residential energy from fuel combustion (8%), and carbon dioxide (CO₂) from road vehicles (5%).(Byamukama, B.; Carey, C.; Cole, M.; Dyszynski, J; Warnest, M, 2010)

FIGURE 2. CO2 GHG EMISSIONS BY SECTOR



Source: GOR, MOI, 2009.

Although the SNC recognized that there were uncertainties in the GHG emissions due to inadequate representation, lack of basic data, and application of emission factors for different conditions the GoR has recognized the need, going forward, for the National Institute of Statistics to include climate change and low carbon-related questions in the data collection process to improve confidence in the figures.

3.3 OVERVIEW OF VULNERABILITY TO THE ADVERSE EFFECTS OF CLIMATE CHANGE

MAJOR CLIMATE CHANGE EFFECTS

Climate model scenarios show future increases in mean annual temperatures of up to 3.25 C for the region by the end of the century (GOR, 2011). Records of annual mean temperature show a significant increasing trend between 1971 and 2010 of .25 C per decade for four stations across Rwanda (GOR, 2011).

Changes in rainfall are more uncertain, due to data availability, although most models suggest that there will be reductions and increased variability in annual rainfall (Byamukama, B.; Carey, C.; Cole, M.; Dyszynski, J; Warnest, M, 2010). An analysis of climate data undertaken during the NAPA preparation shows that the period between 1991 and 2000 was recorded as the driest since 1961 and 1992, 1993, 1996, 1999 and 2000 have all shown a marketed rainfall deficit. Contrarily, excessive rainfall patterns were observed in 1998 and 2001 resulting in cyclical droughts and floods. The overall analysis shows a progressive tendency for shorter rainy seasons.

VULNERABILITY ASSESSMENT OF MAJOR CLIMATE CHANGE EFFECTS

Agriculture, the source of employment for 80% of the population, is most at risk (GOR, 2011). Rwanda is vulnerable to the impacts of climate change as its economy is largely dependent on rain fed agriculture. Prolonged droughts as well as irregular and unpredictable rainfall associated with increased floods and landslides all have very negative impacts on the agriculture production, export earnings, and livelihoods of local communities living in these regions. According to the MINECOFIN's department of

statistics, the low performance of food production from 2002 is the result of irregular rainfalls and a dislocation of rainy seasons which took place (GOR, 2006). The weakening of agriculture production linked to climate hazards are to be seriously considered knowing that the food needs in Rwanda are growing.

Rwanda will be a hotspot for food insecurity due to climate change. In the tropics it takes only 1 C of average temperature change to alter the suitability of some crops. For example, Maize is particularly vulnerable to heat changes and to water stress. The suitability of maize as a crop is forecasted to drop by 15% or more by 2020 in much of sub-Saharan Africa (GOR, 2011). Rice yields are also known to rapidly decline due to temperature change. Further bananas, tubers, fruits and vegetable production may experience fluctuations as a result of climate change (GOR, 2011).

Rwanda is currently dependent on hydropower for 50% of its electricity, making it vulnerable to changes in rainfall (Byamukama, B.; Carey, C.; Cole, M.; Dyszynski, J; Warnest, M, 2010). Droughts reduce generating capacity of hydroelectric dams, and floods increase soil erosion and siltation which can damage dams. In 2004, a drought reduced hydropower capacity so much the government was forced to rent diesel power plants to meet domestic demand.

Increased temperatures lead to new parasites, pests and diseases. As temperatures rise, diseases will spread posing health risks to farm animals and humans. Out of the main livestock diseases, ticks, are the most likely to be sensitive to climate change. On the other hand there are seven vector-borne diseases in Rwanda that affect human health with malaria, tick bite fever and bilharzia or schistosomosis most likely to be affected by climate change (GOR, 2011). Further crops may be negatively affected by new parasites and pests which thrive in new climate.

Existing climate variability has significant economic costs associated with it. Major floods occurred in 1997, 2006, 2007, 2008, and 2009 when heavy rainfall resulted in infrastructure damage, fatalities and injuries, landslides, loss and damage to agriculture crops, soil erosion and environmental degradation. Damages can also have a knock-on effect on the economy as a whole, particularly in critical services such as power and transport. The FUND national model for Rwanda estimates annual economic costs from climate change to be around 1% of GDP (GOR, 2011)

SUMMARY OF NAMA CONTEXT

Although Rwanda has seen significant economic development in recent years its future socio-economic development is uncertain as its climate changes and causes pressure on land, water, food and energy sources. Rwanda is currently highly vulnerable to climate change and climate change could result in annual economic costs of approximately 1% of GDP by 2030.

By setting up on the ground actions such as NAMAs to assist Rwanda's sectors that are directly affected by climate change pressures such as increasing temperatures and decreasing rainfall Rwanda can position the country to increase ecosystem resilience against climate shocks.

3.4 NATIONAL GOVERNMENT PRIORITIES

The government of Rwanda has a number of planning documents that take proactive steps toward building a more prosperous, ecologically sustainable country. Its Vision 2020 document provides an overarching vision for the country, and is complemented by its Economic Development and Poverty Reduction Strategy (EDPRS), National Employment Policy (NEP), National Export Strategy (NES), and various sector-specific strategy documents in providing guidance for economic development and poverty reduction. It is also conducting substantive planning on the environmental front, having made Environmental Impact Assessments mandatory for all projects, and mainstreaming environmental indicators into its budgeting and planning functions. And it is also trying to ensure that natural resources are managed sustainably, as exemplified by its National Land Use and Development Master Plan, the National Land Tenure Regularisation Programme, the Kigali City Master Plan, the rehabilitation of degraded ecosystems such as Rugezi and Gishwati, the implementation of nationwide crop intensification based on land consolidation and soils and water control, and efforts to increase the supply of domestic renewable energy.

The following government priorities were gathered using the methodology described below. They are a consolidation of the stated priorities found in government planning documents and referred to in third party documents and publications. They do not necessarily reflect all the declared priorities of the government, just those that could be found in publicly available documents for this quick screen assessment. The fact that specific sectors may not contain government priorities means only that none could be found at this stage of analysis.

TABLE 1. RWANDA GOVERNMENT PRIORITIES

SECTOR	PRIORITY
Forestry and other land use (F)	1. Increase forest cover
	2. Protect forests
	3. Make forest use sustainable
Energy (E)	1. Increase domestic energy production from several sources
	2. Promote small-scale energy solutions for remote areas
	3. Promote energy security
	4. Make energy value chain sustainable
	5. Increase efficiency and conservation
	6. Rational utilization of wood energy
Transport (T)	1. Reduce transport costs
Agriculture (AG)	1. Raise productivity
	2. Intensification of (sustainable) production
	3. Promote food security
	4. Promote value addition
	5. Promote and increase use of sustainable agricultural practices
	6. Promote and increase use of sustainable livestock management practices
	7. Promote agroforestry
Economic (EC)	1. Pursue low-carbon development strategy
	2. Accelerate growth
	3. Decrease unemployment
Development (D)	1. Build, strengthen and protect household and community assets and livelihoods
	2. Build, strengthen and protect household and community assets and livelihoods
	3. Build, strengthen and protect household and community assets and livelihoods
Environmental (EN)	1. Improve natural resource management and environmental quality
	2. Preserve biodiversity and ecosystem services
	3. Rehabilitation of degraded areas
	4. Promote sustainable and integrated water resources management

Sources : GOR, MOI, SEI, Huggins, 2009; Abbott & Rwirahira, 2010; Siegel, Gatsinzi & Kettlewell, 2011

TABLE 2. MILLENNIUM DEVELOPMENT GOALS

PRIORITY	PRIORITY #	REFERENCE
Eradicate Hunger and Extreme Poverty	A	Abbott & Rwirahira, 2010
Education for All	B	Abbott & Rwirahira, 2010
Promote Gender Equality and Empower Women	C	Abbott & Rwirahira, 2010
Reduce Child Mortality	D	Abbott & Rwirahira, 2010
Improve Maternal Health	E	Abbott & Rwirahira, 2010
Combat HIV/AIDS, Malaria and Other Diseases	F	Abbott & Rwirahira, 2010
Ensure Environmental Sustainability	G	Abbott & Rwirahira, 2010
Global Partnership for Development	H	Abbott & Rwirahira, 2010

3.5 IDENTIFICATION OF EXISTING NATIONAL POLICIES

There are currently no NAMA projects ongoing in Rwanda. However, there are three CDM projects, described in the following table.

TABLE 3. MAJOR EXISTING NATIONAL POLICIES IN RWANDA

MEASURE	TYPE	GHG REDUCTION
Rwanda Electrogaz Compact Fluorescent Lamp (CFL) distribution project	Affects energy demand	23.9 KT of CO ₂ e/year
Rwanda Natural Energy Project: Water Treatment Systems for Rural Rwanda (Shyira and Fawe)	Affects energy industries	2.7 KT of CO ₂ e/year
Rwanda Natural Energy Project: Water Treatment Systems for Rural Rwanda (Mugonero Esepan, Rwesero, Nyagasambu)	Affects energy industries	3.1 KT of CO ₂ e/year

4. LIST OF POTENTIAL NAMAS

This section lists the potential NAMAs for each sector, which will then be analyzed using the evaluation grid in Section 5.

4.1 AGRICULTURE

Rwanda's high population density has led to a growing land scarcity problem, which has itself over time led to a deterioration in soil quality over time (GOR, MOAAR, 2009). Soil erosion is also a concern since many smallholders are on land with steep slopes and have increasingly spread onto land with marginal productivity that is not suitable in the long term to agricultural production. Fertilizer use, both organic and inorganic, is relatively low, and Rwandan agriculture is characterized by low input levels in general. Labour is the country's most abundant resource endowment, and the prevalence of this input is witnessed in the agricultural sector. Food crops are dominant in the sector, but there has been an increasing shift to high value crops such as fruit and vegetables, rice, sorghum, maize, groundnuts and soybeans (GOR, MOAAR, 2009). And although livestock is an important source of income in the country, livestock numbers remain relatively low compared to similar countries.

The following table identifies the complete list of potential NAMAs that were generated at Step 3 of the methodology described above.

TABLE 4. LONG LISTED NAMA OPPORTUNITIES FOR THE AGRICULTURAL SECTOR

NAMA	Source(s)
Agroforestry	GOR, MONR, 2011; GOR, 2011a
Low or zero tillage	SEI, 2009; GOR, n.d.
Soil erosion control (terracing, etc.)	World Bank, 2008; GOR, n.d.; GOR, MOAAR, 2004; SEI, 2009
Soil fertility and nutrient management	World Bank, 2008; GOR, 2011a; GOR, n.d.; GOR, MOAAR, 2004; SEI, 2009
New and improved crop varieties	GOR, n.d.
Water management techniques	SEI, 2009; GOR, n.d.; World Bank, 2008; GOR, MOAAR, 2004; GOR, 2011a
Livestock management techniques	GOR, n.d.

4.2 ENERGY

Energy is a crucial ingredient for economic growth and development and is an enabler for achieving the Millennium Development Goals (GOR, 2011). Rwanda's main energy source is biomass, sourced mainly from on-farm trees and plantations of fast growing eucalyptus trees. Petroleum products account for 11%, used mainly in transportation, and energy for electricity contributes a mere 3% (95 MW) of the energy balance (GOR, 2011). Of the 3% of electricity generation, 50% is generated from hydropower and 45% is generated from oil-fuelled power (GOR, 2011).

Rwanda has the second lowest electricity consumption per capita in East and Central Africa, at 44kWh per person per year (GOR, 2011). Currently only 10.5% of the population has access to electricity, with the majority relying on wood fuel (GOR, 2011). Rapid population growth has put pressure on resources, and as a result power demand is expected to increase to 600 MW in 2017. Because the GoR aims to strike a balance between energy for economic growth and energy to further social objectives and poverty reduction the plan to increase the capacity to 1000 MW through geothermal, methane, hydropower, and peat.

According to the Second National Communication, energy from fuel burning contributed 17% of GHG emissions, oil-fuelled power plants emitted 8.5% of total Co₂, while residential use of biomass produced 28% of methane emissions (GOR, 2011).

The following table identifies the complete list of potential NAMAs that were generated at Step 3 of the methodology described above.

TABLE 5. LONG LISTED NAMA OPPORTUNITIES FOR THE ENERGY SECTOR

NAMA	Source(s)
More efficient lighting, solar lighting	Mutabazi, 2010; Byamukama et al., 2010
High efficiency furnaces and stoves	GOR, MONR, 2011; GOR, MOI, 2009
Substituting other fuels for wood	GOR, MONR, 2011; GOR, MOI, 2009
Hydroelectricity	GOR, MONR, 2011; GOR, MOI, 2009;
Solar PV	GOR, MONR, 2011; SEI, 2009; GOR, MOI, 2009
Wind energy	GOR, MOI, 2009; SEI, 2009; GOR, 2011a
Geothermal energy	GOR, MONR, 2011; GOR, 2011a; GOR, MOI, 2009
Biogas	GOR, MONR, 2011; GOR, MOI, 2009;
Methane capture	GOR, MONR, 2011; GOR, MOI, 2009;

4.3 FORESTRY AND OTHER LAND USE

Humid natural forests form 33% of Rwanda’s forest cover, with the rest coming from Eucalyptus plantations and degraded forests (GOR, MONR, 2011). Forest cover has shrunk dramatically in the last 50 years in Rwanda, going from 659,000 ha in 1960 to 240,746 ha in 2007, a decline of 64% (REMA & UNEP, 2009). As stated above, wood fuel is a major source of energy for Rwandans and as such is a major driver of deforestation in the country. The use of forests for biomass energy is very high—“the value of firewood and charcoal in 2007 was on the order of US\$122 million, or 5% of GDP” (EU EIPD, 2009). Other threats to existing forest cover include illegal tree cutting (some of which is for fuel wood), livestock grazing and farming activity. The GHG inventory of forests is quite positive, as forest sequestration made Rwanda a net carbon sink in 2005 (GOR, 2011a).

The following table identifies the complete list of potential NAMAs that were generated at Step 3 of the methodology described above.

TABLE 6. LONG LISTED NAMA OPPORTUNITIES FOR THE FORESTRY AND OTHER LAND USE SECTOR

NAMA	Source(s)
Afforestation and reforestation	GOR, MONR, 2011; EU EIPD, 2009; Byamukama et al., 2010; SEI, 2009
Protection	SEI, 2009; GOR, n.d.

4.4 INDUSTRY

Industry in Rwanda is mainly comprised of mining, quarrying and manufacturing. The sector has made up a declining share of GDP in recent years because of limited growth in the manufacturing sector (AfDB, OECD, UNDP, & UNECA, 2012). Cement and lime production are the main source of GHG emissions in the country (GOR, MONR, 2011).

The following table identifies the complete list of potential NAMAs that were generated at Step 3 of the methodology described above.

TABLE 7. LONG LISTED NAMA OPPORTUNITIES FOR THE INDUSTRY SECTOR

NAMA	Source(s)
Industry efficiency improvements	SEI, 2009

4.5 TRANSPORT

The transport sector in Rwanda is dominated by road transport. Rwanda does not have a terribly high number of road transport vehicles, but the number is growing quickly because of the growing urbanization in the country. Transport is Rwanda's fastest growing source of GHG emissions (GOR, MONR, 2011), and Vision 2020 expects fuel imports to rise by 10% a year going forward (SEI, 2009).

The following table identifies the complete list of potential NAMAs that were generated at Step 3 of the methodology described above.

TABLE 8. LONG LISTED NAMA OPPORTUNITIES FOR THE TRANSPORT SECTOR

NAMA Opportunity	Source(s)
Transport management policies	Mutabazi, 2010; SEI, 2009; GOR, MONR, 2011
Public transport	GOR, MONR, 2011; Mutabazi, 2010; SEI, 2009

4.6 WASTE

Waste heaps in Kigali and in Rwandan towns are largely uncontrolled and have been growing substantially in recent years, with one dump site in Kigali doubling in size between 2003 and 2007 (GOR, MONR, 2011). Burning of waste is prohibited in Rwanda and while not widespread, it is nonetheless practiced in some parts in the country. Like solid wastes, wastewater is largely uncontrolled in rapidly growing part of the country, in many cases flowing directly into nature untreated. Wastewater treatment is improving however, and wastewater lagoons and septic systems are not uncommon (GOR, MONR, 2011).

No NAMA opportunities were identified for the waste sector in this quick screen.

5. NAMAs EVALUATION GRID

The following NAMAs met the screening criteria and were therefore short listed.

Measure	Sector	Reduction potential (L/M/H)	Government priorities (see Table 1)	Evidence of existing action	Co-benefits (-/neutral/+)			
					Adaptation to CC	Economic development	Environmental	Social
Agroforestry	Agriculture	M	EN2, AG2, AG5, AG7	Yes	+	+	+	neutral
Low or zero tillage	Agriculture	M	EN1, AG3, AG5, AG7	Yes	+	neutral	+	neutral
Soil erosion control (terracing, etc.)	Agriculture	M	EN1, EN2, AG3, AG5, AG7	Yes	+	neutral	+	neutral
Soil fertility and nutrient management	Agriculture	M	EN1, EN4, AG1, AG3, AG5, AG7	Yes	+	+	+	neutral
Livestock management techniques	Agriculture	M	AG6	Yes	+	+	neutral	neutral
High efficiency furnaces and stoves	Energy	H	E4, E5, E6	Yes	+	+	+	+
Substituting other fuels for wood	Energy	M	E4, E5, E6	Yes	+	neutral	neutral	neutral
Hydroelectricity	Energy	H	EC1, E1, E3	Yes	neutral	neutral	+	neutral

Measure	Sector	Reduction potential (L/M/H)	Government priorities (see Table 1)	Evidence of existing action	Co-benefits (-/neutral/+)			
					Adaptation to CC	Economic development	Environmental	Social
Wind energy	Energy	M	EC1, E1, E3	Yes	neutral	neutral	+	neutral
Geothermal energy	Energy	M	EC1, E1, E3	Yes	neutral	neutral	+	neutral
Biogas	Energy	M	EC1, E1, E2, E3	Yes	+	neutral	+	neutral
Methane capture	Energy	M	EC1, E1, E3	Yes	neutral	+	neutral	neutral
Afforestation and reforestation	Forestry	H	EN2, EN3, F1	Yes	+	neutral	+	neutral
Forest Protection	Forestry	H	EN1, EN2, F2	Yes	+	neutral	+	neutral
Industry efficiency improvements	Industry	M	EC1, E6	Yes	neutral	+	+	neutral
Measures to improve fuel economy	Transport	M	EC1, T1	Yes	neutral	+	+	neutral
Public transport	Transport	M	EC1, T1	Yes	neutral	neutral	+	+

6. RESULTS

18 NAMAs opportunities were identified in this Quick Screen for Rwanda, 5 for the agricultural sector, 7 for the energy sector, 2 for the forestry sector, 1 for the industry sector, 2 for the transport sector, and 0 for the waste sector. Because of the high emissions of the sectors, agricultural and energy sector options likely offer the greatest opportunity in terms of emissions reductions and sustainable development.

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