Finance Sector Working Paper

Appendix B

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Editor	Megan Cole *megan.cole@smithschool.ox.ac.uk*
Author	Ryan Hogarth *ryan.hogarth@smithschool.ox.ac.uk*
Government Counterpart	Ronald Nkusi *ronald.nkusi@minecofin.gov.rw*
Expert Advisor	Michele de Nevers

Photography by Megan Cole

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Smith School of Enterprise and the Environment
University of Oxford
Hayes House
75 George Street
Oxford OX1 2BQ
United Kingdom
www.smithschool.ox.ac.uk

Executive Summary

This paper is one of nine sector working papers, which inform the discussion in the development of a National Strategy on Climate Change and Low Carbon Development for Rwanda. It should be read in conjunction with the 'thinkpiece', which proposes a vision for 2050, objectives and guiding principles and strategic pillars for the national strategy.

Rwanda has yet to fully exploit climate finance opportunities that exist, and these opportunities will increase substantially over the next decade. The Copenhagen Accord established that developed countries will collectively commit USD 30 billion in new and additional 'fast start funding' (FSF) from 2010-2012 for adaptation and mitigation in LDCs, and will secure USD 100 billion per year by 2020 in long-term funding from a mix of public and private sources. Furthermore, the UNFCCC agreed to establish a new Green Climate Fund, which will rationalize the currently fragmented framework of climate finance, and will be central in mobilizing and channelling the committed funds. The Fund's 40-strong transitional committee, made up of 15 members from developed countries and 25 from developing countries, held its first meeting in April 2011 in Mexico City, and aims to propose an effective design for the fund in time for approval at the next Conference Of the Parties in Durban, December 2011.

Carbon Trading

Rwanda's carbon trading potential is limited by its "long-tail emissions profile": it has few large-scale sources of GHG emissions that can be abated through a single carbon project, and numerous small-scale sources such as automobiles, animal and human waste, dirty cooking techniques, and fragmented deforestation that require multiple interventions and must be appropriately aggregated to access the market. Though potentially high in volume, such small-scale emission reduction opportunities have proven difficult to implement under traditional Clean Development Mechanism (CDM) methodologies.

Most CDM projects constitute large-scale installations, located primarily in China and India. Less than 2 percent of traded CDM credits have originated from Africa. This trend may change. It is becoming increasingly likely that the UNFCCC will fail to come to a post-Kyoto agreement with binding emissions reductions. Failure will reduce demand for CDM credits. If an agreement is not reached, the EU has declared that it will meet its voluntary reduction commitments for 2020, but will only purchase CDM credits from projects hosted in least developed countries. If this scenario materializes, Rwanda, as a stable least developed country, will be well placed to capitalize on the resulting shift in carbon investment away from large developing countries.

Furthermore, long-tail emission reductions are becoming increasingly implementable due to the new programmatic approach to the CDM, which allows Rwanda to aggregate emission offsets from numerous small-scale sources that are widely diffused and negated over time. Programmatic CDM could be instrumental in promoting the diffusion of small-scale technologies such as organic composting stations, solar lanterns, solar

home systems, improved cook stoves, and biogas digesters.

Where the CDM remains too expensive, voluntary carbon markets may offer an alternative. Voluntary carbon markets may also be instrumental in obtaining carbon credits from Reducing Emissions from Deforestation and Degradation (REDD) projects, which are not yet eligible for CDM certification, and afforestation/reforestation projects, which are not tradable in Europe.

Currently, Rwanda has just one registered CDM project, to distribute efficient compact fluorescent lamps throughout the residential sector, and series of other proposed carbon projects at various stages in the pipeline. Potential carbon projects in Rwanda include renewable energy and energy efficiency projects, organic waste management, efficient transport systems, and forestry projects.

Bilateral and Multilateral Grants

Dozens of multilateral climate funds have been established in recent years. Thus far, Rwanda has received approximately USD 13.34 million from these funds and is due to receive a further USD 3 million. Each of the multilateral climate change funds has their own unique mandate, institutional requirements and application and monitoring procedures, which are outlined in a user friendly climate funds toolkit provided with the Strategy. The overt complexity of the process has led the executive chair of CDKN, Simon Maxwell to remark: "The institutional architecture seems to me like a herd of runaway horses without a rider. You need someone to simplify, simplify, simplify."

Beyond multilateral funds, a large portion the pledged USD 30 billion per year in “new and additional” Fast Start Funding (FSF) is flowing through traditional aid frameworks. Rwanda has one forthcoming FSF programme, sponsored by the Belgian government, Wallonie 2010, which is worth EUR 250,000. Other development partners, including Japan, United Kingdom, United States, Germany, Sweden, Norway, and the Netherlands, have made significant FSF pledges. Some of these donors may be willing to channel a portion of their FSF into a national climate change basket fund, giving the Government of Rwanda greater control over how the money is spent, and allowing it to plan long-term without uncertainties about funding.

National Climate Change Basket Fund

The international community is increasingly recognizing that a more coordinated approach to climate financing would best be achieved through ‘devolution’ of management to developing country governments. In this context, many developing country governments have created ‘national climate change basket funds,’ and have successfully attracted significant direct budgetary support.

Rwanda already has a draft law providing for a National Fund for the Environment (FONERWA). Such a fund could be the centrepiece of Rwanda’s climate financing strategy, and serve to streamline climate finance along the NSCCLCD plan. The forthcoming bill will initially place FONERWA within the Rwanda Environmental Management Authority (REMA) while it is being capitalized. During this incubational phase, FONERWA will be limited to providing adaptation and low carbon projects with grant financing. However, FONERWA could eventually become instrumental in leveraging private investment for low carbon initiatives by employing other public financing mechanisms. By extending lines of credit, loan guarantees, and public equity capital, FONERWA would enable green businesses and consumers to overcome initial investment costs of low carbon technologies, and would attract private finance by buying down the risk of low carbon investments. To facilitate the use of these more complex financial products, FONERWA should either be transferred to MINECOFIN once of a certain size, or a portion should be managed by a financial asset manager as a public private partnership (PPP) vehicle.

Most likely, FONERWA will initially be capitalized through bilateral grants. However, in the medium-term, the GoR may wish to access debt financing to scale-up financially viable low carbon activities. It would begin with highly concessional loans from

development partners, but could eventually issue "green bonds" to attract private institutional investors. FONERWA will also be capitalized through environmental fiscal reforms, which aim to shape private behaviour by making environmentally damaging activities more expensive. The revenues from environmental taxes could then recycled to invest in environmentally beneficial activities such as payments for ecosystem services (PES) to promote forest and wetland conservation, and feed-in tariffs to promote private production of renewable electricity. In this manner, Rwanda can guide its economic growth along a climate resilient and low carbon trajectory.

Contents

Executive Summary i
Acronyms and Abbreviations vii
1. Introduction 1
2. Economics of Climate Change in Rwanda 3
2.1 Macroeconomic of Low Carbon Growth 3
2.2 Macroeconomics of Adaptation 5
2.3 Microeconomics 7
3. Sources of Finance 11
3.1 Environmental Fiscal Reforms 11
3.2 Carbon Finance 11
3.3 Multilateral Climate Funds 17
3.4 Bilateral Development Partners 18
3.4 Concessional Loans and Green Bonds 20
4. Leveraging Private Capital 21
4.1 Public Financing Mechanisms for R&D Phase 21
4.2 Public Financing Mechanisms for Pre-Commercialisation Phase 21
4.2 Public Financing Mechanisms for Commercialisation Phase 22
4.3 Green Business Incubators and Green Investment Indices 26
4.4 Payment for Ecosystem Services Schemes 26
5. National Fund for Environment and Climate Change 29
5.1 FONERWA Draft Law 30
5.2 Opportunities and Challenges 30
5.3 Existing Climate Change Basket Funds 32
5.4 Potential Structures of a Basket Fund for Rwanda's Strategy 36
6. Roadmap 38
References 39

Appendices 41
Appendix 1. CDM Baseline Calculation for Hydro Electric Dams 41
Appendix 2. CDM Baseline Calculation for Efficient Cookstoves 42
Appendix 3. CDM Municipal Waste Compost Programme 45
Appendix 4. CDM Baseline Calculation for Geothermal 45

Acronyms and Abbreviations

BCCRF	Bangladesh Climate Change Resilience Fund
BCCTF	Bangladesh Climate Change Trust Fund
CDKN	Climate and Development Knowledge Network
CDM	Clean Development Mechanism
CDM EB	Clean Development Mechanism Executive Board
CER	Certified Emission Reduction
COMESA	Common Market for Eastern and Southern Africa
COP	Conference of Parties
DFID	Department for International Development
DNA	Designation National Authority
EAC	East African Community
EDPRS	Economic Development and Poverty Reduction Strategy
ETS	European Emissions Trading Scheme
EWSA	Energy, Water and Sanitation Authority
FNMC	Brazil's National Climate Change Fund
FONERWA	National Fund for the Environment in Rwanda
FSF	Fast Start Funding
GDP	Gross Domestic Product
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GoB	Government of Bangladesh
GoR	Government of Rwanda
ICCTF	Indonesia Climate Change Trust Fund
IEA	International Energy Agency
IGIF	Indonesia Green Investment Fund
IPCC	Inter-governmental Panel on Climate Change
IPP	Independent Power Producer
MIDIMAR	Ministry of Disaster Management and Refugee Affairs
MINAGRI	Ministry of Agriculture and Animal Resources
MINALOC	Ministry of Local Government and Social Affaires
MINECOFIN	Ministry of Finance and Economic Planning
MINICOM	Ministry of Commerce
MININFRA	Ministry of Infrastructure
MINIRENA	Ministry of Natural Resources
NCCLCD	National Climate Change and Low Carbon Development
NIE	National Implementing Entity
pCDM	Programmatic Approach to the Clean Development Mechanism
PES	Payment for Ecosystem Services
PFM	Public Financing Mechanism
PPP	Public Private Partnership
RDB	Rwanda Development Board
REDD	Reduced Emissions from Deforestation and Degradation
REMA	Rwanda Environment Management Authority
SEI	Stockholm Environment Institute
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change

Introduction

Two central purposes of Rwanda's National Climate Change and Low Carbon Development (NCCLCD) Strategy are to realise the economic gains from adapting to climate change and pursuing a low carbon growth path, and to tap into the increasing opportunities created by international climate change financing mechanisms. While the focus of this paper is on the latter, an introductory chapter on the economics of climate change in Rwanda is included in order to put the NCCLCD Strategy and international financing mechanisms in context.

A major issue with climate change is that those least responsible will suffer the most. While industrialised countries have produced most of the greenhouse gases (GHGs) that are causing climate change, developing countries bear more than nine-tenths of the human and economic burden[1]. This disconnect between those that have caused climate change and those that will bear most of the costs is the justification for the international community's mobilisation of large-scale funding for climate change adaptation in developing countries.

While the economic advantages to Rwanda adapting to climate change are self-evident, the advantages of pursuing a low carbon development path are less straightforward. Rwanda is a low emitting and unindustrialised country, and thus has no current obligations under international law to reduce its GHG emissions. However, even without international financing opportunities, low carbon growth is in Rwanda's self interest. Decoupling economic growth from consumption of imported fossil fuels through investment in alternative energy technology will make Rwanda more resilient to exogenous price shocks, and investing in low carbon industries such as ecotourism and organic agriculture will safeguard its ecosystem services and give it a comparative advantage. Because the benefits of Rwanda pursuing a low carbon growth path are global in nature, a number of international mitigation financing mechanisms have been established that can help Rwanda achieve these goals.

At the 15th Conference of the Parties (COP15) in Copenhagen, developed countries agreed to secure USD 30 billion from 2010 to 2012 in "new and additional" Fast Start Funding (FSF) for mitigation and adaptation initiatives in developing countries, and USD 100 billion per year by 2020 in long-term funding. The USD 100 per year will come from a mix of both public and private sources. In general, international support for adaptation will be in the form of multilateral and bilateral grants, while support for mitigation initiatives will take the form of both grants and innovative financing mechanisms, including carbon markets and green bonds. These financing mechanisms are described in detail in Chapter 1.

Although substantial, the public international climate funding flowing into Rwanda will not be sufficient to finance the NCCLCD Strategy. Thus, when designing a plan to finance the Strategy, it will be crucial to keep the role of private capital in mind. Chapter 4 discusses the use of public financing mechanisms (PFMs) to leverage private capital to for low carbon and adaptation activities.

As will become evident, the international climate finance landscape has become overly complex and fragmented, particularly due to an unnecessary proliferation of multilateral climate funds. There is a growing recognition that a more coordinated approach to climate financing is needed to respond to developing countries' adaptation and mitigation needs, and that such coordination would best be achieved through a 'devolution' of management to developing country governments. In order to streamline incoming climate finance, Rwanda is in the process of establishing a National Fund for Climate and the Environment (currently known as "FONERWA"), which is discussed in detail in Chapter 5. The next steps to launching FONERWA, as well as accessing and implementing other forms of climate finance, are outlined in an illustrative Roadmap in Chapter 6.

Economics of Climate Change in Rwanda

2.1 Macroeconomics of Low Carbon Growth

As a low emitting and unindustrialised country, Rwanda has no obligation under international law to reduce its emission levels. However, low carbon growth is strongly in its self-interest. For economic security, it is crucial that Rwanda decouple its economic growth from oil consumption. The Overseas Development Institute's Oil Vulnerable Index – measured according to the level of imports, the share of oil in the energy mix, and efficiency of energy production – ranks Rwanda amongst the countries at risk from the volatile and rising costs of oil[2]. As seen in Table 1, Rwanda's 2008 trade deficit stood at nearly USD 500 million. A large part of this deficit was the result of Rwanda's reliance oil, 100 percent of which is imported. In 2008, oil imports cost Rwanda's economy USD 210 million (2009 dollars), representing 6.1 percent of its GDP (USD 3,460 million) and over 23.2 percent of its net imports (USD 903 million).

Rwanda's demand for oil is relatively inelastic due to insufficient exploitation of its indigenous sources of energy. The 2008-2012 National Energy Policy and Strategy estimated that consumption of petroleum will need to increase 10.5 percent per annum in order to underpin the targeted 7 percent GDP growth rate outlined in Table 1. It states that this estimate could even prove too modest if the proposal to develop Rwanda as a regional transport hub is realised. As a result, Rwanda's economy is highly vulnerable to rising prices and exogenous shocks. Plainly put, "Higher average oil prices over the period [2008-2020] would leave too little foreign currency for other demands in the economy, and the likely consequence would be a fall in the level of investment and hence in the level of growth, making the scenario outlined in Table [1] unfeasible"[3].

Table 1: Annual average growth rates 2008-2020[3]

Item	Units	2008	Annual Average Growth	2020
Population	no.	9,886,767	2.30%	13,000,000
GDP (US$ m)	US$ m	3,460	7.00%	7,800
Exports (goods and services)	US$ m	405	10.50%	1,342
Imports (goods and services)	US$ m	903	6.00%	1,817
Households with electricity	no.	92,000	21.00%	1,011,111
Biomass (net)	toe	1,108,600	2.30%	1,453,700
Petroleum products	th m^3 / Ml	225	10.50%	768
Electricity - energy	GWh	225	17.10%	1,429
Electricity - capacity (incl. regional supplies	MW	55	17.40%	360
Primary energy (gross)	toe	1,652,500	4.30%	2,745,020

However, global oil prices increased 300 percent over the last decade due to rapidly increasing demand and diminishing supply, and are projected to continue to rise throughout the next decade. The International Energy Agency's World Energy Outlook 2010[3] has forecast future oil prices according to three scenarios (taken from EIA 2010[3]):

- Current Policies Scenario – fossil-fuel subsidies are completely phased out in countries that already have policies in place to do so.
- New Policies Scenario – fossil-fuel subsidies are completely phased out in all net-importing regions by 2020 (at the latest) and in net-exporting regions where specific policies have already been announced.
- The 450 Scenario – fossil-fuel subsidies are completely phased out in all net-importing regions by 2020 (at the latest) and in all net-exporting regions by 2035 (at the latest), except the Middle East where it is assumed that the average subsidisation rate declines to 20 percent by 2035.

As seen in Figure 1, the least ambitious Current Policies Scenario projects oil prices will rise to USD 120 per barrel by 2025, and the New Policy Scenario projects oil prices will rise to USD 105 per barrel the same year. In the overly optimistic 450 Scenario prices increase slowly, and level off at about USD 90 per barrel by 2020.

Rwanda's vulnerability to oil price rises was most evident during the oil price spike of 2008. As illustrated in Figure 2, the spike caused inflation to jump from 5 to 20 percent. Inflation subsided to 2007 levels once oil price crashed due to the onset of the global recession.

Owen & King[5] predict that a hypothetical price increase of 10 percent will result a 1.5 percent loss to Rwanda's GDP, and that the rising price of oil over the next two decades could cumulatively cost Rwanda at least 30 percent of its GDP.

The 2008-2012 National Energy Policy and Strategy states three requirements for Rwanda to maintain high rates of economic growth:

- A significant increase in industries with minimal energy intensity, such as knowledge-based activities.
- Electricity needs must be increasingly met from indigenous resources (particularly hydropower and methane).
- Global oil prices must not rise again from present levels.

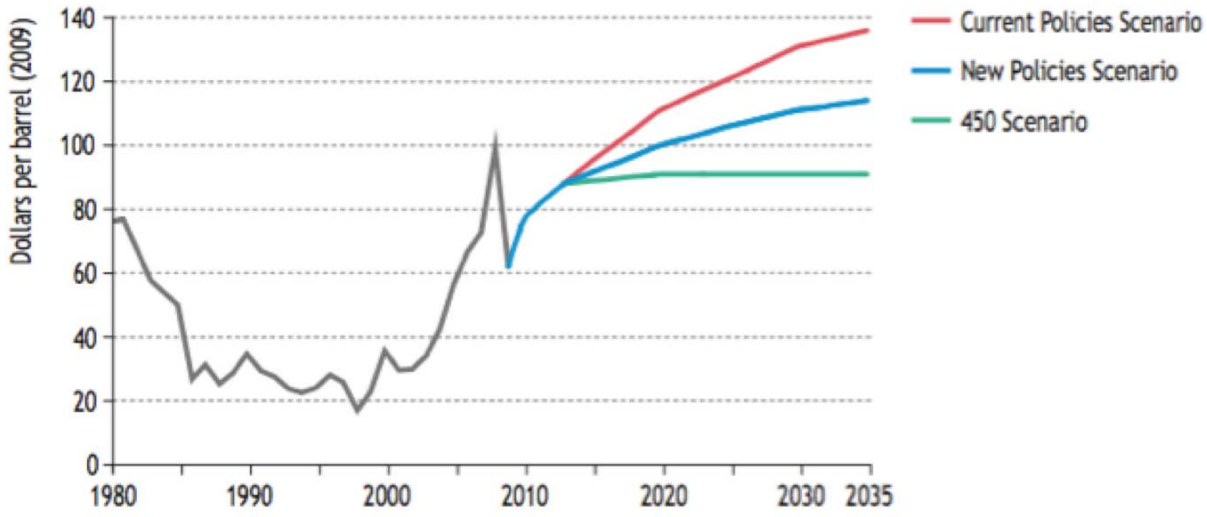

Figure 1: Average IEA crude oil import price by scenario
Source: IEA 2010[4]

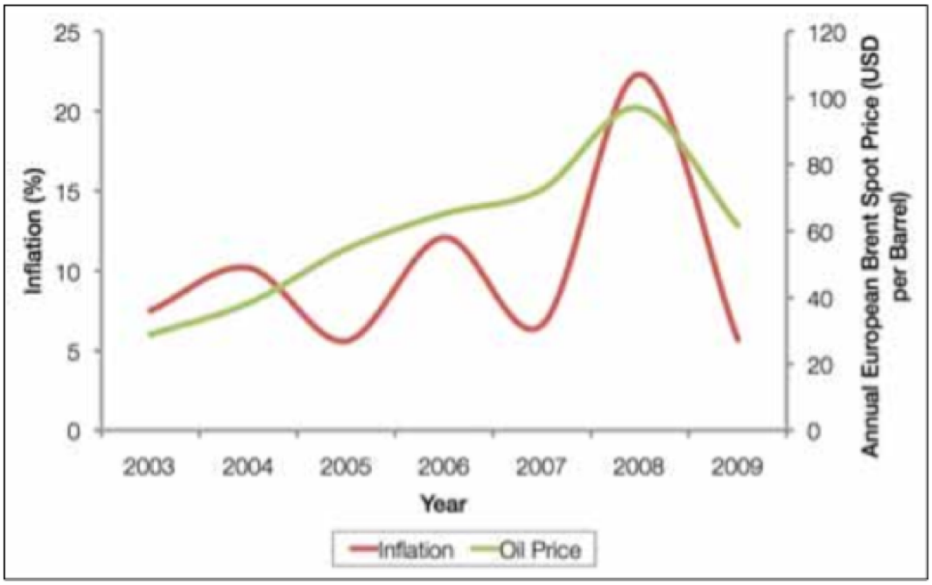

Figure 2: Oil Price and Inflation in Rwanda
Source: Owen & King [5]

As the final requirement is unlikely to occur, and is out of Rwanda's control, Rwanda should focus on the first two. Investing in indigenous energy sources, energy efficient technologies, and demand-side measures is the first step to both decoupling economic growth from oil consumption and transitioning Rwanda to a low carbon growth path. Opportunely, because low carbon growth offers global benefits in climate change mitigation, a wide and expanding range of financing mechanisms are being made available to developing countries to such an end.

Curbing deforestation also offers tangible economic benefits to Rwanda by protecting ecosystem services, sustaining affordable fuel wood, and driving the ecotourism industry. For example, the clearance of the Gishwati Forest for farming in the 1990s contributed directly to the Nyabihu flooding of 2006, which cost the economy an estimated USD 4.1 to 21 million. The resulting increase in erosion and sedimentation damaged the Gihira Hydro Power Plant to the point where the entire system needed to be replaced[6].

Tourism, driven largely by the country's rich biodiversity, is Rwanda's top foreign exchange earner and fastest growing industry, with revenues projected to double from USD 225 to 627 million per year over the coming decade (Rwanda's Tourism Master Plan 2008).

New international financing flows for reforestation, afforestation, and reducing emissions from deforestation and degradation (REDD) are also being debated at the international level, and could offer Rwanda an additional incentive to curb deforestation in the near future.

2.2 Macroeconomics of Adaptation

Floods, like that in Nyabihu, and other extreme weather events, such as droughts, will likely become more common in future years as a result of climate change. Without increased preparation, economic resilience and adaptive capacity, these events will have major economic costs, and could reverse past development gains.

Due to the overlaps between climate change adaptation and traditional development, isolating the costs of climate change is extremely difficult. In its study on the Economics of Climate Change in Rwanda, the Stockholm Environment Institute (SEI) estimated the potential costs of adaptation according to four categories (taken from SEI 2009[7]):

- Accelerating development to cope with existing impacts e.g. integrated water management, electricity sector diversity, natural resources and environmental management.
- Increasing social protection, e.g. cash transfers to the most vulnerable following disasters, safety nets for the most vulnerable.
- Building adaptive capacity and institutional strengthening, e.g. developing meteorological forecasting capability, information provision and education.
- Enhancing climate resilience, e.g. infrastructure design, flood protection measures.

Although the first two categories – social protection and accelerated development – encompass broader development goals, much of which are not directly attributable to climate change, they are necessary steps towards ensuring greater climate resilience. The second two categories are steps to tackle climate risks directly.

SEI[7] conservatively estimated Rwanda's urgent need for climate change adaptation to be USD 280-400 million per year by 2012 – a figure of similar magnitude to current levels of annual aid. By 2030, SEI estimated that Rwanda's costs for addressing climate change directly, through capacity building and enhancing climate resilience, will be in the range of USD 50-300 million per year. When the costs of social protection and accelerating development are taken into account, SEI argued the costs could be as high as USD 620 million per year. These costs are illustrated in Figure 3, and broken down in Table 2.

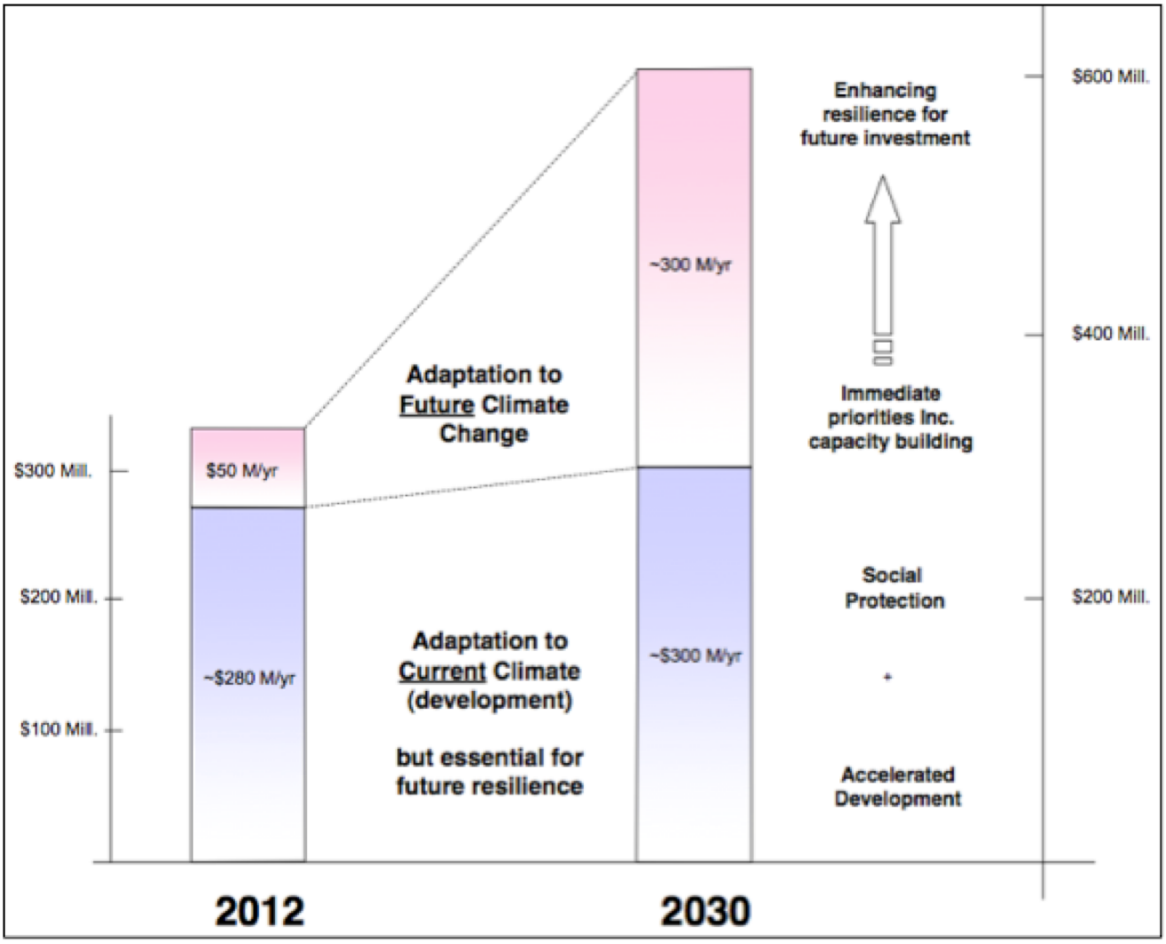

Figure 3: Rwanda's costs of adaptation
Source: SEI 2009 [7]

Table 2: Rwanda's urgent and long-term costs of adaptation[7]		
	Urgent needs for 2012	Benchmark Needs for 2030
Accelerating development	$100-200 mn / year (overcoming historic adaptation deficit)	$14 – 124 mn / year
Social protection	$120-170 mn / year	$120-170 mn / year
Adaptive capacity & institutional strengthening	Some early climate resilience (anticipatory adaptation)	$20–50 mn / year
Climate resilience	Minimum $13-21 mn / year for immediate priorities + $8 mn over many years for NAPA	Minimum $33-100 mn / year; Maximum $58-280 mn / year
Total	$280-400 mn / year	Minimum $50-300 mn / year; Maximum $620 mn / year

2.3 Microeconomics

As part of its study on the Economics of Climate Change in Rwanda, SEI prepared the Indicative Greenhouse Gas Cost Abatement Curve provided in Figure 4. The curve demonstrates that Rwanda has the potential to implement a number of "quick-win" measures that can deliver on both economic development and low carbon objectives. Each bar represents an opportunity for Rwanda to reduce its emissions below a business-as-usual level. The height of the bar shows the cost of avoiding one ton of GHG emissions through the initiative from a societal point of view (in US dollars), and the width of each bar shows the potential quantity of GHG that the initiative could negate (in gigagrams). In this context, emission reductions are a co-benefit of decisions made towards economic and development objectives, without consideration of the "price of carbon." Carbon financing could further increase each option's attractiveness relative to the business-as-usual scenario.

The graph is only meant to be illustrative of the approximate cost of GHG abatement opportunities, and the data used is out-of-date. For instance, since the SEI report was written, it has been found that wind potential in Rwanda is much lower than expected. Furthermore, other GHG abatement opportunities, such as reforestation, organic waste management, solar LED lanterns, and geothermal and methane electricity production, have come to the forefront of policy debates in the country. These, and other GHG abatement opportunities, should be added to the cost-curve during the implementation phase of the NCCLCD Strategy. Despite these shortcomings, the message of the abatement cost-curve is clear: there are numerous opportunities to promote low carbon growth in Rwanda, which, from a societal point of view, would save money.

It must be noted that GHG abatement costs should not be the only factor guiding policy. Social impacts must be considered as well. For example, the cost-curve shows that a bus transit system would be a relatively expensive way to abate GHG emissions. However, urban transport has many social advantages as well, in that it increases the mobility of low-income individuals. Moreover, the cheapest GHG abatement opportunity suggested in the cost-curve would be to ban older vehicles. However, banning older vehicles will have large impact on the ability of middle-income households to afford vehicles and on the price of doing business. Kigali City Council recently announced a ban on imports of second hand public transport cars more than five years old. While the Kigali City Council's motives were driven as much by safety as by environmental motives, an import duty on older vehicles may be a more appropriate policy option as described in Chapter 3.1.

Considering the cost-saving GHG abatement opportunities that exist, the logical follow-on questions must be raised:

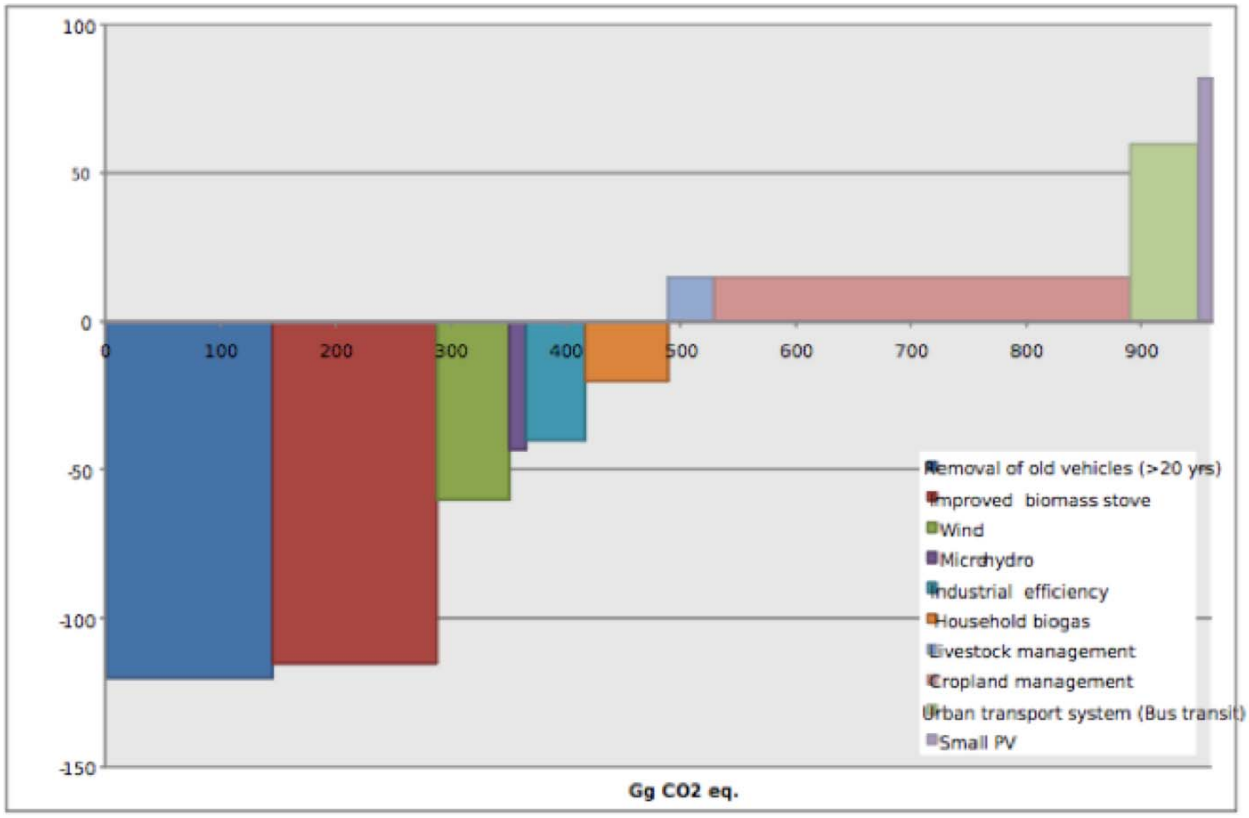

Figure 4: Indicative Greenhouse Gas Cost Abatement Curve for Rwanda
Source: SEI 2009 [7]

- Without government intervention, why would the private sector not drive Rwanda along a low carbon development path?
- Why should the government spend public money to promote activities that could potentially be profitable to private individuals and businesses?
- Likewise, given that adaptation to climate change is clearly in an individual's best interest, why is it necessary for the government to intervene?

In order to answer these questions, and to identify and justify the appropriate public financial interventions to execute the NCCLCD strategy, we must examine the economic forces governing decision-making in Rwanda. These economic forces are complex, but can be summarised in the categories of weak and perverse incentives, high upfront costs and discount rates, and information gaps.

2.3.1 Weak Incentives

Although the benefits of Rwanda following a low carbon development path will accrue to globally, and will outweigh the net costs, those deciding on whether to make low carbon investments will generally not realise the full net benefits. Instead they will typically be faced with high private costs, and low returns. The inverse is true for those deciding on whether to make carbon-intensive investments, which will have an overall negative impact on society, but will have more private benefits than costs.

Consider a private landowner deciding on whether or not to log and develop their land. While the ecosystem services provided by the standing forest will be enjoyed on a wide-scale, without intervention, the costs of maintaining those services will fall solely on the landowner. Thus, from the perspective of the landowner, the net benefit from logging and developing a forest will outweigh the

net benefit from preserving or reforesting it. In contrast, from society's point of view, preservation may be optimal.

Another investment barrier often faced by investments in low carbon technology, such as energy efficient buildings, is "split incentives": although the investments may be quite profitable over the lifetime of the technology, those who pay the costs (such as a landlord or building contactor) are not the ones reaping the benefits (the building buyer or tenant), and thus have the incentive to choose a cheaper carbon-intensive alternative.

To overcome these incentive problems, the challenge for the Government of Rwanda (GoR) is to align private costs and benefits with those faced by society. Broadly speaking, this can be done using two approaches:

- Penalising carbon-intensive behaviour through taxation or regulatory restrictions
- Rewarding low carbon and adaptive behaviour through the use of subsidies or minimum quantitative quotas

From an economics perspective, the most efficient option to align private and social costs and benefits is to penalise carbon-intensive behaviour through environmental taxes that make carbon-intensive behaviour more expensive. Environmental taxes that the GoR may consider are discussed in Chapter 3.1. However, the purpose of environmental taxation is to reduce consumption, which can have negative social consequences.

Hence, the second option to align private and social costs and benefits – rewarding low carbon and adaptive behaviour – will be a more applicable option to Rwanda's National Climate Change and Low Carbon Development Strategy in the short term. Chapter 4 discusses different public financing mechanisms available to alter private behaviour.

As mentioned, regulation can also be instrumental in aligning private costs and benefits with those faced by society. Examples include building codes or vehicle fuel efficiency and emission standards. Such regulations are covered primarily in the sector working papers.

2.3.2 High Upfront Costs and Discount Rates

Many investments in adaptation or low carbon initiatives entail significant upfront costs, but the benefits only accrue in the long-term, over generations. While most decision-makers apply a positive discount rate in that they favour near-term profit and savings at the expense of long-term gains, the high upfront costs of low carbon and adaptation investments are particularly inhibiting to those living on very low incomes. Either they simply do not have the money to pay the upfront costs of products such as renewable energy technology or drought resistant seeds, or they consider the upfront costs to be worth more to them today than benefits would be in the future.

A number of public financing mechanisms are available to overcome these barriers. Price subsidies can reduce the upfront costs, and loans can allow consumers and investors to spread the upfront costs over a prolonged period of time. These mechanisms are discussed in more detail in Chapter 4.

2.3.3 Information Gaps

The local impacts of climate change are not well understood in Rwanda, and decision-makers are often unaware of how their actions, or lack of action, could have an impact on climate vulnerability and low carbon growth. Even when decision-makers are aware of these issues and want to direct money to low carbon and adaptation initiatives, they will often face serious hurdles in determining which investments would be most effective in promoting adaptation and mitigation, choosing the appropriate financial mechanisms to invest through, and ensuring that their investment has the desired result. Compounding the issue, many low carbon technologies are in an early stage of development, rendering investment highly risky; and the lack of experience in assessing the risk causes banks to be hesitant to provide capital on favourable terms. These barriers make investing in low carbon and adaptation initiatives an effort intensive process beset with uncertainties.

Public interventions can help overcome each of these barriers. Public loans, loan guarantees, and venture capital can relieve capital constraints; environmental certification and green investment indices can reduce information barriers; and green bonds can facilitate private investment in climate change adaptation and mitigation initiatives, while providing the government with a potential source of commercial debt capital. Each of these tools will be addressed in the following chapters.

Sources of Finance

3.1 Environmental Fiscal Reforms

Environmental taxes aim to shape private behaviour by making environmentally damaging activities more expensive. Likewise, tax exemptions can shape private behaviour by making environmentally beneficial behaviour cheaper. Although tax exemptions for low carbon activities are important, such as import duty exemptions for renewable energy technologies, they will be discussed in other Sector Working Papers. This section will focus on environmental taxes as a source of revenue.

One of the most common types of environmental taxes is a carbon tax levied on the price of fossil fuels to force private actors to take into account the social cost of burning fossil fuel and releasing greenhouse gas emissions. The GoR already levies a consumption tax on gasoil at a rate of 283 RWF (USD 0.47) per litre and 250 RWF (USD 0.42) for premium fuel. The revenues from this tax are earmarked for the Road Maintenance Fund. MINECOFIN recently announced that each of these levies will be reduced to RWF 100 (USD 0.17) per litre in order to curb inflation from rising oil prices. Fossil fuel is expensive in Rwanda, and transport costs are approximately 2.5 times those of neighbouring countries[8]. Although transport costs will decline with the impending tax cuts, Rwanda should not consider levying environmental fuel taxes in the near future, because fuel consumption is so entwined with economic growth and stability. Carbon taxes, however, should seriously be considered as a medium- to long-term option.

One environmental tax that Rwanda might consider in the short-term is an import duty older vehicles, which tend to be inefficient and highly polluting. For example, in 2004 the government of Uganda introduced a 10 percent levy on motor vehicles aged eight years and above in an attempt to discourage "environmentally hazardous used goods." Other goods in the category included old fridges, television sets, cookers, radios, and other household appliances. In 2007, Uganda's 10 percent tax was extended to include vehicle parts and used motorcycles (and, oddly enough, bicycles). Because the cost of old vehicles are only on average one-fifth the cost of new vehicles, the number of imported vehicles over 8 years old continued to rise. However, the import duty on old vehicles yielded substantial revenue for the government – USD 8.6 million in the first two years alone[8]. If the GoR were to implement a similar levy, it could yield a significant source of funds for the GoR to invest in low-carbon transport initiatives.

The revenues of environmental taxes could be used in the general budget; recycled to invest in environmentally beneficial activities, such Payments for Environmental Services (PES) schemes, feed-in tariffs, and other public financing mechanisms discussed in Chapter 4; or used to capitalise the forthcoming fund for climate and the environment (FONERWA), discussed in Chapter 5.

3.2 Carbon Finance

A number of international carbon markets have been created for trading certificates – called carbon credits – that denote a reduction in greenhouse gas (GHG) emissions. One carbon credit represents a

reduction of one tonne of CO2 emissions, or a reduction of a specific quantity of another greenhouse gas (methane, nitrous oxide, or chlorofluorocarbons) that has an equivalent global warming potential as one tonne of CO2 emissions. Carbon markets offer a potential source of finance for both public and private GHG emission reduction initiatives.

Each carbon market has different rules and prices. They can be divided into two broad categories: mandatory cap-and-trade markets, and voluntary markets. The difference between the two lay in whether those purchasing carbon credits have legally binding emissions reduction commitments. Mandatory markets make up 99 percent of the total carbon market volume.

Of particular interest is the Clean Development Mechanism (CDM), which was established as a mandatory cap-and-trade scheme between countries party to the Kyoto Protocol. It has two aims:

- Assist Annex 1 (predominantly 'industrialised') countries achieve compliance with their quantified emission reduction commitments by purchasing carbon credits from offset projects in Non-Annex 1 countries
- Promote sustainable development in non-Annex 1 countries

As seen in Figure 5, most of CDM projects constitute large-scale installations, located primarily in China and India. Less than 2 percent of traded CDM credits – called certified emission reductions (CERs) – have originated from Africa.

However, this trend will likely change after the emission reduction targets of the Kyoto Protocol expire in 2012, which could paradoxically work in Rwanda's favour. It is becoming increasingly likely that world leaders will fail to come to a succeeding agreement with binding emissions reductions, which will result in reduced demand for CERs. The largest market for CDM CERs is the European Emissions Trading Scheme (ETS), the mandatory cap-and-trade system set up for European industries. According to the European Union's current position, CDM CERs will continue to be traded via the ETS, but only from projects hosted in least developed countries. If this scenario materialises, Rwanda, as a relatively stable least developed country, will be well placed to capitalise on the resulting shift in carbon investment away from large developing countries.

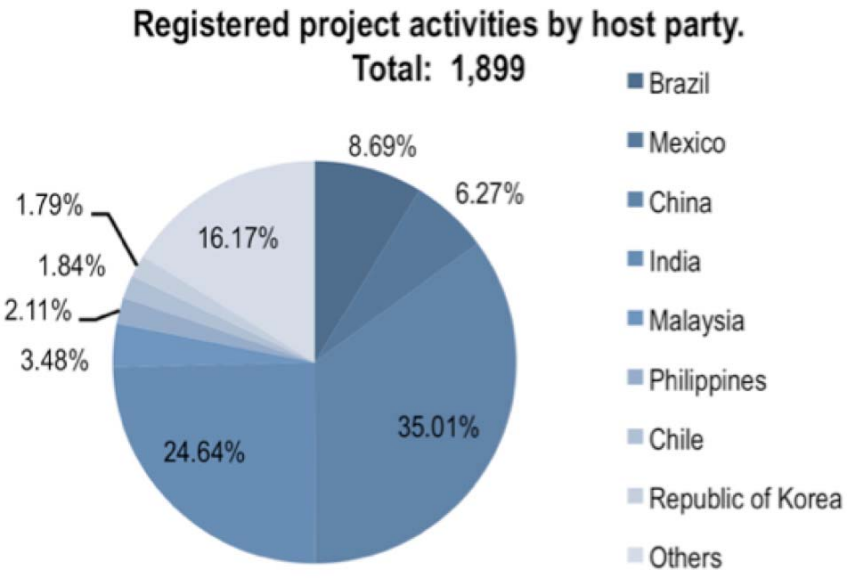

Figure 5: CDM Project Statistics
Source: CDM EB 2009[9]

Table 3: Potential Carbon Projects in Rwanda					
Energy	Built Environment	Forestry	Transport	Water	Agriculture
Hydro power	Solar water heaters	Reforestation	Biodiesel buses	Energy Efficient Water Purification	Composting
Biogas digesters	Waste-to-energy	Afforestation	Cash for clunkers		Biomass/ Biogas
Geothermal	Energy efficient building design	Reduced Emissions from Deforestation & Degradation	Bus Rapid Transit		
Solar home systems		Improved cook stoves			
Solar LED lanterns					
Lake Kivu methane					

As described below, the costs of establishing a CDM project are high and are one of the primary barriers to least developed countries. Where CDM projects are not a viable option due to the high costs associated with its strict requirements, voluntary markets may offer a viable solution. Voluntary markets generally have less strict requirements than the CDM, but also have lower prices.

Voluntary markets could also be instrumental in obtaining carbon credits from land-use management initiatives, such as Reduced Emissions from Deforestation and Degradation (REDD), which are not yet eligible for CDM certification, and afforestation/reforestation projects, which are not permissible in the ETS.

Currently, Rwanda has just one registered CDM project, to distribute highly efficient compact fluorescent lamps throughout the residential sector, and series of other proposed carbon projects at various stages in the pipeline. Table 3 provides a list of potential carbon projects in Rwanda. These opportunities are discussed in more depth in their respective Sector Working Papers. The first step to determining the viability of a carbon project is to calculate baseline: an estimation of the amount of emissions that would have been produced in the absence of that project. The methodology used to calculate the baseline varies according to the scenario. A list of approved CDM methodologies can be found at http://cdm.unfccc.int/. Baseline calculations of high potential projects are included in the Appendices and the Sector Working Papers.

To ensure accurate calculation of GHG emission reductions and to prevent fraud, each carbon project must adhere to a series of steps for quality insurance. Figure 6 outlines the CDM project cycle. Steps include approval by the Designated National Authority (DNA), which in Rwanda is housed in REMA; validation of the project design by a third party called a Designated Operational Entity (DOE); registration of the project with the CDM Executive Board (EB); monitoring to ensure offsets are achieved; and verification by a DOE. Like the CDM, voluntary carbon projects must also adhere to standards and be verified by a third party for quality assurance. A few of the standards voluntary carbon projects can choose from include Plan Vivo, the Gold Standard, and the Voluntary Carbon Standard.

CDM procedures are disproportionally burdensome for single projects on a household or small industry scale, which are required to pay similar validation, monitoring, and verification costs as projects on a much larger scale[11]. Figure 7

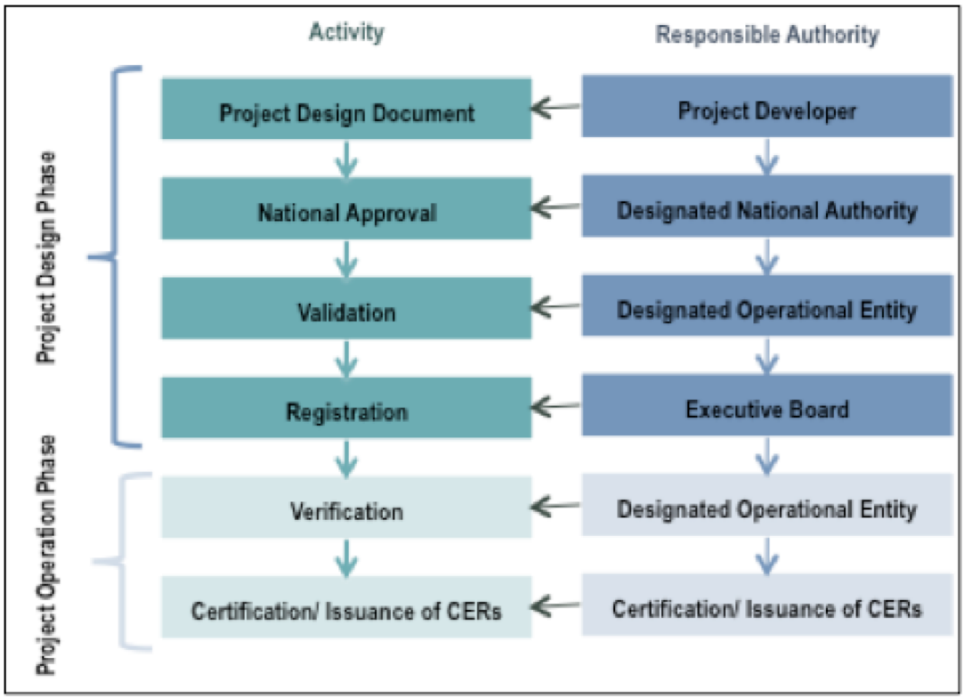

Figure 6: CDM Project Cycle
Source: Adapted from UNFCCC 2010[10]

provides estimates of the average transaction costs paid by small- to medium-sized CDM projects.

To deal with high upfront costs, the government could extend concessional loans for private project developers, potentially through its new climate and environment fund FONERWA; or it could secure affordable loans for project developers through loan guarantees. Carbon credits can also be forward sold, generally at a reduced rate. Potential buyers of forward purchasing agreements include international climate funds such as the European Investment Bank (EIB) Post-2012 Carbon Credit Fund, EIB-KfW Carbon Programme II, and the various World Bank Carbon Funds.

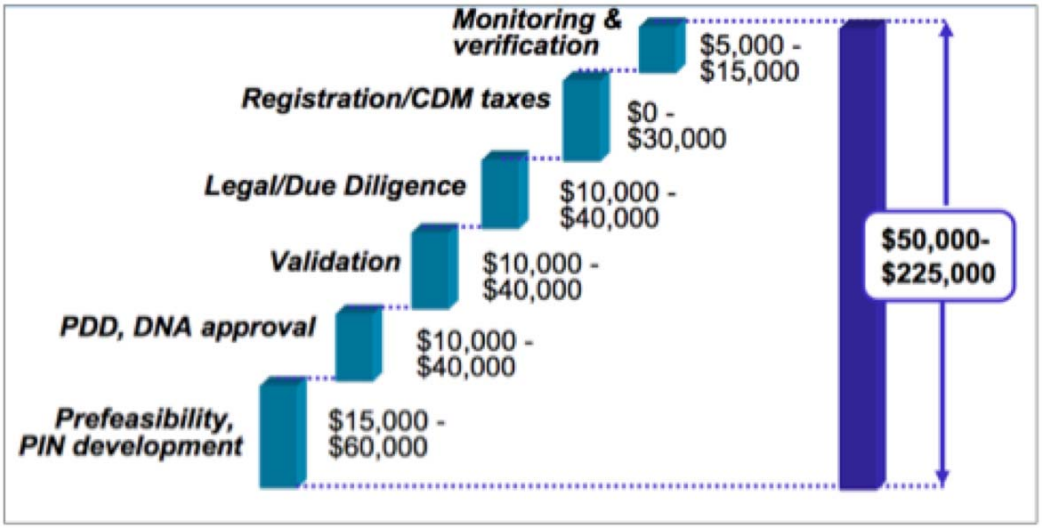

Figure 7: CDM Project Cycle
Source: Hodes 2004[12]

High transaction costs are particularly inhibiting to Rwanda due to its "long-tail" emission reduction potential illustrated in Figure 8. Rwanda's GHG emissions are made up primarily of small geographically dispersed sources such as fragmented deforestation for wood fuel and agricultural land, fossil fuel combustion in electricity production, animal and human waste, cooking, automobiles, and kerosene lanterns. There are relatively few large sources like industry smoke stacks. Though potentially high in volume, these small-scale reduction opportunities are difficult to implement under traditional CDM methodologies. Small-scale projects must be appropriately aggregated to overcome these costs and reach a volume significant enough to access the market[13]. Within the CDM, two strategies exist to aggregate small-scale projects: the Bundling Approach and the Programmatic Approach (pCDM). These strategies are outlined in Table 4.

"Bundling" involves combining several small-scale projects together for registration purposes. The procedures are relatively well established. Bundling however involves rigid restrictions. For instance, each project must be submitted at the time of registration, and the composition of the bundle may not change over time with the exit or entry of activities. The location of each project must be known ex-ante, and their timing must be specified. Similarly, the verification methodology needs to be approved at the start. Finally, the combined size of the emissions reductions achieved by the bundled projects must be below the "small-scale threshold" as defined by the CDM EB. Such restrictions by design inhibit the entrance of scalable business models, in which activities are unpredictably distributed over space and time.

The CDM EB introduced the Programmatic Approach (pCDM) in 2007 in an effort to permit scalable projects that can tap into the long-tail emissions reduction potential of developing nations. Under the pCDM "an unlimited number of project activities, over a wide area and starting at different times, can be administered under a single administrative umbrella, thus reducing transaction cost and contributing to the scaling up of the CDM"[9]. Programmes can be developed over a period of 28 years, with specific "Project Activities" (CPAs) added at any point. Sampling methodologies can be used to confirm the emissions reductions. Finally, the size of emissions reductions achieved by each individual activity must be under the "small-scale threshold", but the size of the programme as a whole is unlimited[11].

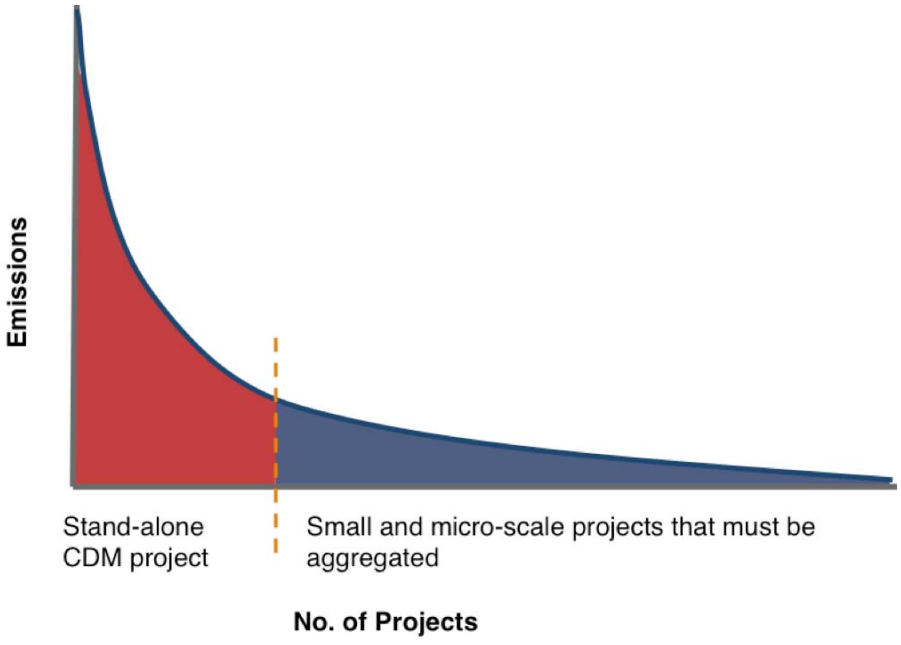

Figure 8: Long-Tail Emissions Profile of Rwanda

Table 4: Bundling vs. Programmatic Approach to CDM (Adapted from Blank et al. 2009[11])		
	Bundle	Programme
Sites	Ex-ante identification of exact sites	GHG reductions must be estimated ex-ante. Exact sites may not be known, but type and maximum potential volume is known.
Project participants	Each single activity is represented by a CDM project participant	Only the entity implementing the program represents the project activity as a CDM project participant.
	Project participants are identical to entities achieving reductions.	The project participant does not necessarily achieve the GHG-reducing activities, but rather promotes others to do so.
Project activities	Each activity in the bundle is an individual CDM project activity	The sum of all individual activities under the programme is the CDM project activity.
	Composition does not change over time.	No pre-fixed composition (uptake of an incentive such as a feed-in tariff could be unknown).
	All projects in a bundle must be submitted and start at the same time.	Programme is validated and registered based on identification of targeted activities. Actual reductions are not confirmed until verification, and that can be done by sampling.
Size	The size of the bundled small-scale activities has to be under the standard small-scale threshold.	The size of the individual activities has to be below the small-scale threshold, allowing the overall programme of activities size to be unlimited.

Programmatic CDM offers a number of advantages relevant to Rwanda. Given that many of its emissions are dispersed in communities located in rural areas, it is hard to predict ex-ante how many interventions will need to be implemented. With established methodologies, pCDM could limit costs of project development, as similar projects do not need to be approved on a project-by-project basis.

For each project, an important decision that the GoR must make is whether it should act as the implementing entity itself, or support private companies or NGOs as implementing entities. If the government were to take on the role, significant risks must be taken into account. The implementing entity is a hands-on role with monitoring obligations throughout the duration of the project. If carbon credits are sold that are found to be "erroneously included" there could be financial liabilities. However, the government has advantages over other organisations in that it can more easily achieve the scale necessary to access markets, and it has the financial capacity to pay the upfront costs. Furthermore, implementing public demonstration CDM projects could serve to boost confidence in their financial performance and create technical know-how within partner organisations.

The appropriate action will vary from project to project, and will depend largely on how involved the GoR wishes to be throughout the projects lifecycle. For those potential projects that the government will not implement on its own, it should ensure that adequate technical assistance is in place, and public financing to allow the implementing entities to overcome the initial investment barriers.

3.3 Multilateral Climate Funds

Dozens of multilateral climate funds have been established in recent years to promote both adaptation and low carbon projects in developing countries. Table 5 offers a list of these funds, and shows the sectors that each of them support. Each fund has its own unique mandate, institutional requirements, and application and monitoring procedures, which are outlined in a user friendly Climate Fund Toolkit complementing the NCCLCD Strategy. Thus far, Rwanda has received approximately USD 13.34 million from these funds and is due to receive a further USD 3 million, as outlined in Table 6.

Table 5: Multilateral climate funds available to each sector

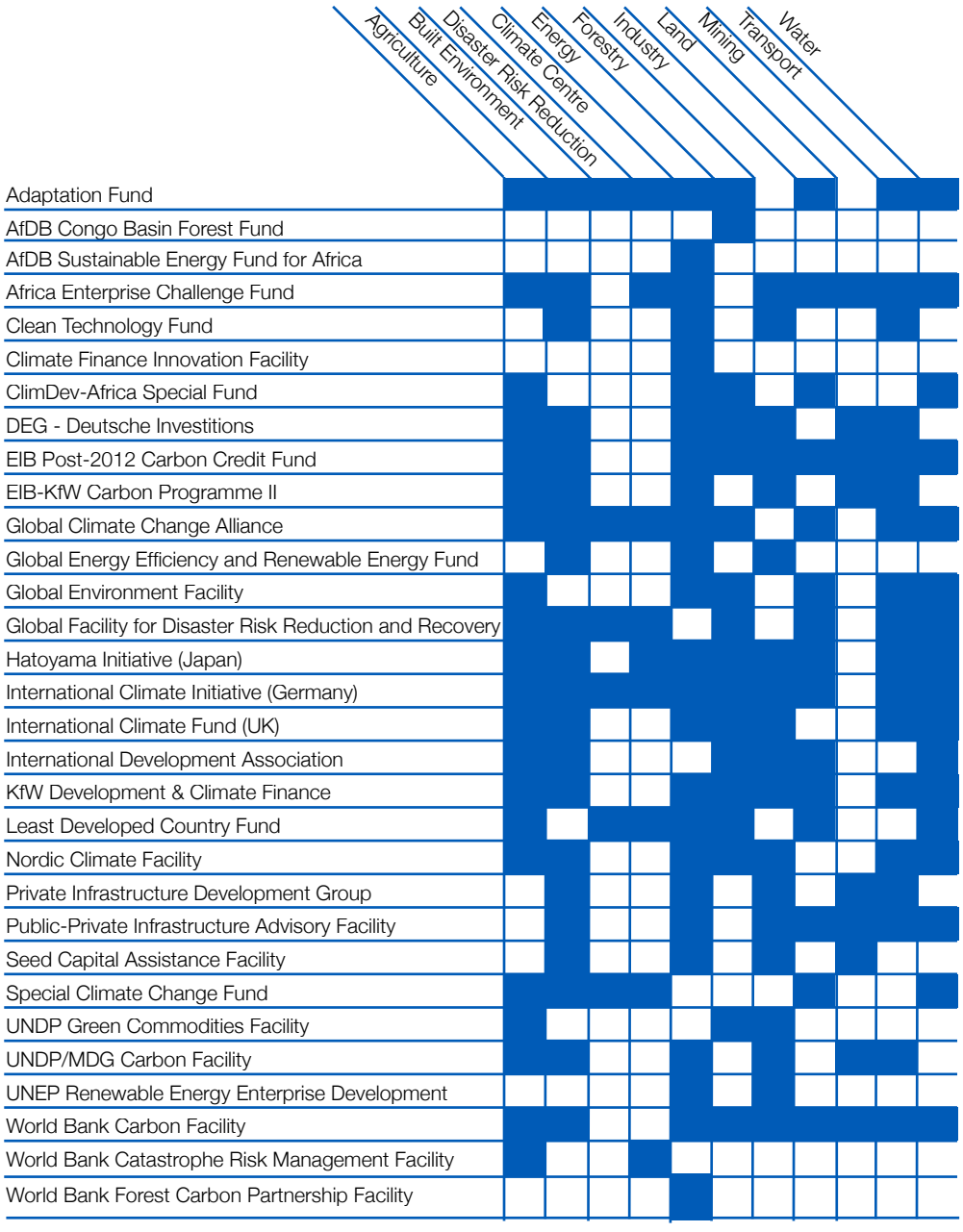

Table 6: Multilateral Funding for Climate Change Projects in Rwanda

Project	Fund	Year	Approved (USD)	Received (USD)
Budget Support for Environment and Natural Resources in Rwanda: Ensuring food security through a land tenure reform	Global Climate Change Alliance	2010	$6.05 mn	$3.06 mn
Preparation of a National Adaptation Plan of Action (NAPA)	Least Developed Country Fund	2010	$0.20 mn	$0.20 mn
Preserving Biodiversity in the Nyungwe Forest	International Climate Initiative	2009	$2.42 mn	$2.42 mn
Establishing Early Warning and Disaster Preparedness Systems and Support for Integrated Watershed Management in Flood Prone Areas	Least Developed Country Fund	2009	$3.16 mn	$3.16 mn
Sustainable Energy Development Project	GEF Trust Fund	2009	$4.50 mn	$4.50 mn
Total			$16.33 mn	$13.34 mn

One particular fund of note is the Adaptation Fund, which is unique in that it allows direct access to funds by developing countries for concrete adaptation projects through accredited National Implementing Entities (NIE). Rwanda is in the process of establishing MINIRENA as its NIE. The Adaptation Fund, which capitalised primarily by a 2 percent tax on CDM CERs, currently has over USD 200 million of which only USD 34.4 million has been allocated.

In December 2010, at the 16th Conference of the Parties (COP16) in Cancun, Mexico, the UNFCCC agreed to establish a new Green Climate Fund. The Fund's 40-strong transitional committee, made up of 15 members from developed countries and 25 from developing countries, has been charged with rationalising the currently fragmented framework of climate finance, and will be central in mobilising and channeling the agreed USD 100 billion in additional climate finance per year by 2020 from a mix of public and private sources. The transitional committee held its first meeting in April 2011 in Mexico City, and aims to propose an effective design for the new fund in time for approval COP 17 in Durban in December 2011.

3.4 Bilateral Development Partners

At the 15th Conference of the Parties (COP15) in Copenhagen, developed countries pledged USD 30 billion in "new and additional" Fast Start Funding (FSF) from 2010 to 2012 for mitigation and adaptation initiatives in developing countries. A large portion of this FSF is flowing through traditional aid frameworks. Rwanda has one forthcoming FSF programme, sponsored by the Belgian government, Wallonie 2010, which is worth EUR 250,000.

The GoR's comprehensive aid policy, which regulates the utilisation of aid flows, ranks its preferred aid modalities as un-earmarked budget support, followed by sector budget support, and then stand alone projects. This order reflects the Paris Declaration for Aid Effectiveness, adopted internationally in 2005, which stressed five core principles:

- Ownership: Developing countries set their own strategies for poverty reduction, improve their institutions and tackle corruption.
- Alignment: Donor countries align behind these objectives and use local systems.
- Harmonisation: Donor countries coordinate, simplify procedures and share information to avoid duplication.

- Results: Developing countries and donors shift focus to development results and results get measured.
- Mutual accountability: Donors and partners are accountable for development results.

To secure and align budgetary support for climate change adaptation and mitigation initiatives with the NCCLCD strategy, Rwanda intends to establish a basket fund for climate and environment, FONERWA, discussed in more detail in Chapter 5. Figure 9 gives two indicators of which development partners are likely to provide support for this fund. The most likely supporters are the development partners shown in the left graph to already be providing significant budget support (United Kingdom, European Union, Germany, Belgium, and Norway); and the development partners shown in the right graph to have already pledged substantial FSF (Japan, United Kingdom, United States, Germany, France, Sweden, Norway, and the Netherlands).

As observed in the left graph, a number of development partners do not provide budgetary support as a matter of practice. The GoR should work closely with these development partners to align their support with the NCCLCD strategy. To fulfill the Paris Principle of 'harmonisation' and prevent duplication, development partners' climate finance should target specific sectors, complying with the agreed division of labour for traditional official development assistance.

Figure 9: Development Partner Budget Support and Project Support for Rwanda for Fiscal Year 2009/2010 (left)[14]; and Global Fast Start Finance Pledges as of May 2011 (right)[15] in Millions of US Dollars

3.5 Concessional Debt and Green Bonds

In the near-term, public sources of funding for Rwanda's NCCLCD Strategy will be limited to fiscal mechanisms, carbon finance, and grants from multilateral funds and development partners as described above. In the medium-term, it is likely that the GoR will also wish to seek debt financing to scale up its financially viable low carbon activities. Classified as a Highly Indebted Poor Country, which recently received debt relief, Rwanda's debt financing for low carbon activities would initially be in the form of highly concessional loans with at least a 35 percent grant element and fixed interest rates as stipulated in the 2008 Public Debt Policy. These concessional loans could likely come from development partners, the World Bank's International Development Association, the European Investment Bank's EU-Africa Infrastructure Trust Fund, and the African Development Bank Infrastructure Consortium for Africa.

In the longer-term, when the GoR's Debt Sustainability Analysis deems commercial borrowing a viable option without risking another debt trap, it might consider issuing "green bonds". Green bonds are an innovative debt instrument used to attract investment for low carbon initiatives. Like traditional sovereign bonds, the issuer offers a fixed return for a fixed duration investment. Repayment of the bonds is not associated with the performance of the projects funded, so investors do not assume the project risk. As such, green bonds are attractive to institutional investors such as pension funds, mutual funds, sovereign wealth funds, and insurance companies, which have inherently long-term investment horizons and allocate large amounts to fixed income products. With long maturities, green bonds are a particularly appropriate fundraising tool for low carbon technology and infrastructure projects that have high upfront costs and generate returns over the long-term. For example, World Bank Green Bonds are used to fund renewable energy and low carbon technology installations, fuel switching and mass transit systems, waste management, energy efficient building, reforestation, avoided deforestation, watershed management, flood protection, and climate resilient agricultural systems in developing countries (World Bank 2010). In line with Rwanda's 2010 External Resource Mobilisation Strategy, "commercial borrowing should only be accessed to finance projects that provide high rate of return so that income generated by them is sufficient to service the debt payments."

If the GoR chose to issue green bonds, it could seek loan guarantees to secure more favourable terms from the African Development Bank, the World Bank's Multilateral Investment Guarantee Agency, or the International Development Agency. Learning from the World Bank's experience shaping green bonds, Rwandan green bonds should have minimum financial characteristics such as size, rating and structure; standardised criteria for project eligibility; and rigorous due diligence in project evaluation.

Leveraging Private Capital

When designing the plan to finance the NCCLCD Strategy, it is crucial to keep the role of private capital in mind. A recent study commissioned by the UNFCC posited that near 90 percent of the funds required to meet the climate challenge globally must come from the private sector[16]. Herein lies the problem. Although low carbon and adaptation investments have a high social return, they general have a small, long-term, or even negative financial return resulting from the perverse incentives, high upfront costs and discount rates, and information gaps discussed in Chapter 2.3.

Public financing mechanisms (PFMs), such as performance-based grants, demonstration projects, publically backed loan guarantees, public venture capital, and public procurement mechanisms, can address several of these investments hurdles by creating attractive investment environment for low-carbon activities. The process by which public financial instruments are used to mobilise private capital is referred to as leveraging[17]. PFMs leverage private capital through risk sharing, creating niche markets, building track records for new products, and lowering the cost of capital for mitigation and adaptation initiatives. A list of common PFMs is provided in Table 7.

Designing PFMs is a delicate matter. Policies must be predictable and long-term to bolster the confidence of the private sector, yet at the same time nimble and adaptable to changing conditions. Adaptation and low carbon activities and technologies vary by risk profile and level of maturity, and PFMs should be customised accordingly as illustrated in Figure 10.

4.1 Public Financing Mechanisms for Research and Development Phase

The appropriate PFM or combination of PFMs will depend on which financial barriers need to be addressed. Generally, the higher the risk of the activity, the more capital intensive the public support must be. During the technology and project development phase, the risk profile is often too high for traditional investors and funding is dependent on public support through grant financing. Other PFMs effective at this stage are contingent grants, which are loaned to project developers without interest or repayment until business is viable, and innovation prizes, in which payments are made to project developers after they achieve a pre-determined goal.

4.2 Public Financing Mechanisms for Pre-Commercialisation Phase

PFMs that address investors' perceived risk are most effective at the deployment stage. Demonstration projects can promote new products by demonstrating their value. In doing so, demonstration projects help new products build a track record to more easily access loans and risk capital. Public procurement schemes, such as Rwanda's programme to purchase solar panels for rural schools and hospitals, can further build a product's track record and can create a niche market for technologies that are not yet commercially viable while market infrastructure and distribution outlets are established.

Table 7: Public Financing Mechanisms (Adapted from Gomez-Echeverri 2010[18])

PFM	Description	Financial Barrier Addressed
Grants	Grants are provided without any repayment	(i) Lack of sufficient capital; (ii) costly development process
Contingent grants	Grants are loaned without interest or repayment until business is viable	(i) Lack of capital for upfront costs
Innovation prizes	Ex-Ante prizes to stimulate R&D	(i) High and risky development costs
Performance-based grants	Grants are awarded based on stipulated achievement (eg. grants-per-unit-sold or grant-per-unit financed)	(i) Insufficient incentives for low carbon or adaptation activity
Soft loans	Provides debt capital at concessional interest rates	(i) Financing gap during project development stage
Loan guarantees	Government buys down risk to unlock debt financing	(i) High credit risks, particularly perceived risks; (ii) lack of consumers with enough purchasing power for products
Demonstration projects	Governments, often in partnership with a private company or NGO, will finance initial demonstration of a new product in order to demonstrate its viability	(i) Lack of track-record and knowledge of viable technology prevents marketability and access to capital
Public procurement	Government purchases products to provide a guaranteed market for entrepreneurs and demonstrate viability of product	(i) Lack of track-record and knowledge of viable technology prevents marketability and access to capital. Does not address consumer' lack of purchasing power
Subordinated equity	Subordinated equity is repaid and claims profits only after other equity investors have first claim on rewards.	(i) Aims to attract other equity investors
Public venture capital	Equity Investment in nascent business	(i) Lack of private risk capital
Feed-in Tariffs	Government guarantees long-term procurement of privately produced electricity fed onto the grid at a fixed-rate	(i) Natural monopoly of electricity grid prevents private production

Loan guarantees and public equity financing can attract private loans and private risk capital. The main source of private equity for early stage technologies is venture capital, which specialises in high-risk investments against a high internal rate of return. With the right PFMs in place, equity investors may be encouraged to get on board at this pre-commercialisation stage. These green investment opportunities should be advertised through the Rwanda Development Board, possibly via a Climate Bazaar or Green Investment Index as is discussed in Chapter 4.5.

4.3 Public Financing Mechanisms for Commercialisation Phase

4.3.1 Large-scale infrastructure investments

Private capital can be more easily leveraged at the commercialisation stage, and is instrumental in catalysing the diffusion of financially viable green products and services. For large-scale projects, such as large energy infrastructure or energy efficient buildings, which have high upfront costs and a long delay before reaching operation, access to long term funding is critical. Although large-scale

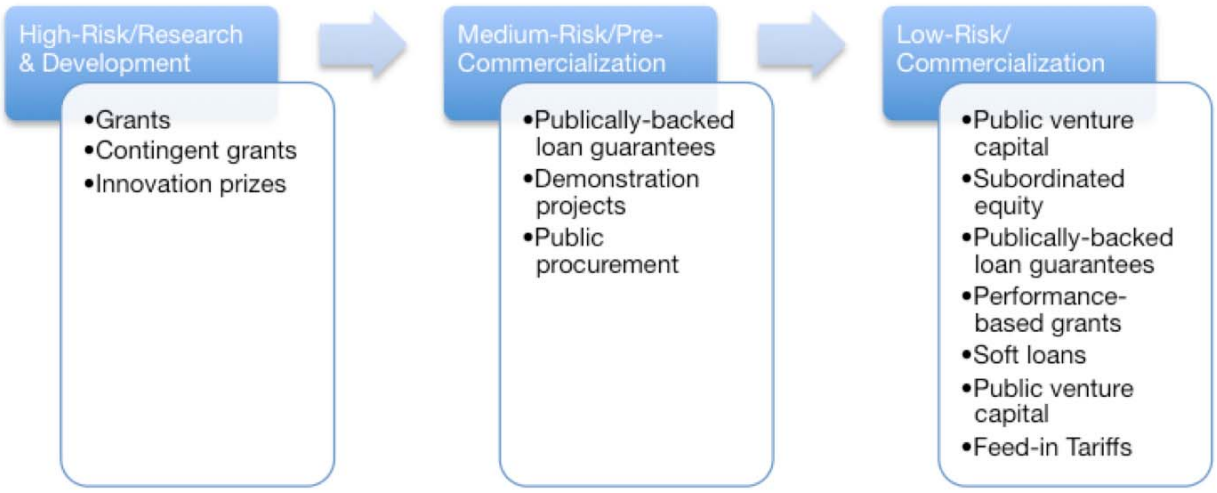

Figure 10: Public support for different stages of development and risk-profiles

projects can generally attract loans based on an expected revenue stream, given the size of investment required and the high-risk involved, sufficient capital is often not available at an affordable rate. Publically backed loan guarantees and public venture capital could overcome this problem by buying down the risk.

4.3.2 Household and Small-and-Medium Enterprise Investments

In contrast to large-scale renewable energy projects, small-scale technologies and energy efficiency measures must generally be implemented by households and small and medium-size enterprises. These include investments that are cost-effective such fuel-efficient automobiles, solar water heaters, solar home systems, efficient cookstoves, and biogas digesters, but in which small-scale investors lack the will or the purchasing power to bear the high upfront costs. Compounding the issue, financial institutions are often perceive small investors as risky and are reluctant to provide the necessary capital.

Consumer finance is vital at this stage, because the primary barrier is not the overall cost of the product, but the ability of the consumer to afford the initial investment. Grants-per-unit-financed or a loan guarantee scheme can be effective in encourage private financial institutions such as microfinance institutions, savings and credit cooperatives (SACCOs), and banks to extend consumer loans. One example comes from Bangladesh, where the government provided a grant-per-unit-financed scheme for solar home systems. The grant began at USD 20 per system, and was gradually reduced to USD 7 per system as the industry took off. Another example is the Chinese IFC loan guarantee scheme. By guaranteeing up to 75 percent of the loans from Chinese banks, the guarantee scheme developed a pipeline of energy efficiency projects worth over USD 650 million[19]. The GoR may also have to extend or secure lines of credit for the financial institution so that it has sufficient liquidity to deal with increased demand.

Unlocking consumer finance for these products will be difficult as Rwanda's microfinance industry is relatively nascent. However, there are a number of financial institutions operating in rural areas such as Union des Banques Populaires du Rwanda, Urwego Opportunity Bank, Centre Financier Aux Entrepreneurs, COOPEDU-Kigali, Duterimbere, Rwanda Microfinance Limited, and Union Des Coopecs Umutanguha. The GoR should work closely with these institutions to secure consumer finance, as well as the Access to Finance

programme, which provides loans and technical support to develop the microfinance industry.

Beyond consumer finance, it is critical that the government use PFMs to enable and incentivise entrepreneurs to take on risk and start green businesses. Enabling PFMs include public loans, loan guarantees and equity investments. An incentivising PFM is performance-based grants, such as grants-per-unit-sold. This PFM has been the most effective policy in other developing countries to kick-start a solar industry. Grants-per-unit-sold could also be provided to the company that invoices the sale of green technologies such as fuel-efficient automobiles, solar water heaters, efficient cookstoves, and biogas digesters. The company can choose how much of the subsidy to pass on to the consumer, and how much to keep for itself. The appropriate level seems to be about 20 percent of the product cost – so for a USD 500 system, USD 100. These subsidies could be paid out of FONERWA, or concessional loans or grants could be sought from the multilateral funds discussed in Chapter 3.3.

DFID is currently launching a pilot project that will provide grants-per-unit-sold to businesses selling LED lanterns. It would provide a grant-per-unit-sold, which will begin at USD 8 and decline to USD 4 over three years, with a cap of 25,000 per year. The GoR should follow the development of this pilot project closely, and if necessary supplement or carry on the grant programme.

The DFID pilot project will also provide performance-based grants to the operators of six micro hydro plants and mini-grids. Upfront grants will be given for each new household connected to the mini-grid, and a monthly payment will be provided for ongoing connections contingent on successful management. Such schemes could be instrumental in incentivising off-grid private electricity production. To incentivise on-grid private electricity production, a feed-in tariff is necessary.

4.3.3 Feed-in Tariffs

Feed-in tariffs have proven to be the most successful policy mechanism to promote private investment in renewable energy such as micro and pico hydro, solar home systems, and wind power. Feed-in tariffs provide a secure investment environment for independent power producers (IPPs) by guaranteeing long-term procurement of the energy at a fixed-rate for typically 15 to 20 years. According to Deutsche Bank feed-in tariffs are responsible for 75 percent of global solar photovoltaic power deployment and almost half of global wind deployment. They are championed by twelve American states, China, Germany and Spain – first, second, third and fifth in renewable energy world rankings (India ranks fourth)[20].

It is important that Rwanda not only implement a feed-in tariff to incentivise private production of electricity, but also a law stating that once the grid is expanded to include an area with private electricity producers, the utility will either purchase the technology outright, or it will begin procuring the electricity via the feed-in tariff. IPPs will be hesitant to invest in a renewable energy unit if they feel there is a chance that the electricity grid will expand to their region. This law will remove the danger facing IPPs that grid extension could undermine their business.

A recent tariff study, commissioned by the Rwanda Revenue Authority, explored the potential for Rwanda to implement a feed-in tariff. The study proposed that the tariff could be set at the rate equivalent to the costs avoided by the utility by purchasing the electricity from IPPs rather than other sources. It proposed the tariff be set at RWF 69 (USD 0.115) per kWh for individual electricity producers selling exclusively to RECO, and RWF 49 (USD 0.0817) per kWh for electricity producers selling only their surplus, taking into account that those selling their surplus will likely be providing electricity to the grid predominantly during off-peak hours. Furthermore, many IPPs will be selling to the grid from a region that is a net exporter of electricity, and thus the utility will also need to pay for transmission costs[21].

Another study, prepared by the consulting company Nexant, examined the feed-in tariff rates necessary to make different renewable energy

Table 8: Feed-in Tariff Rates necessary to make different renewable energy technologies financially viable	
Renewable Energy Technology	Viable Feed-in Tariff Rate (USD/kwh)
Micro-hydro larger than 2MW	$0.06 - 0.08
Micro-hydro between 250kw and 2MW	$0.09 - 0.12
Geothermal above 2MW	$0.08 - 0.10
Wind above 2MW	$0.10 - 0.13
Wind less than 2MW but above 250kw	0
Micro-hydro less than 250kw	$0.13-0.17
Solar PV	$0.31-0.51

technologies financially viable in Rwanda. These rates are listed in Table 8. The study found that a tariff set at the avoided rate of electricity, RWF 69 (USD 0.115) would be high enough for geothermal and most hydro sites above 250 kilowatts. The potential for wind is quite low in Rwanda, however USD 0.115 should be high enough to make wind power above 250 kw viable as well[22].

There is substantial potential in Rwanda for power generation from micro-hydro below 250 kw and solar PV, neither of which would be viable with a feed-in tariff rate of USD 0.115. Taking into account the environmental benefits provided by renewable energy, and the economic benefits of domestic production, the government might consider setting the rate for renewable energy higher than that of carbon intensive energy. Doing so would create long-term costs, and it is important to consider who will be responsible to bear them. There are five separate possibilities:

- Regulatory tariff model (eg. Germany) – The government could mandate that the utility (RECO) purchase the power at a rate set higher than the utilities avoided costs. The higher costs would then be passed on to consumers via higher electricity prices. This model is advantageous in developed countries, because the higher prices promote demand management. However, in Rwanda where electricity prices are already high and increased energy consumption is vital to economic growth, this model will likely not be Rwanda's first choice.
- Subsidised tariff model (eg. Spain) – The government could subsidise the marginal increase in cost from the national budget. The costs would then be passed on to the taxpayer. Again, this model would likely not be Rwanda's first choice. As occurred in Spain, in which the government reneged on its feed-in tariff commitments, the costs could create a large burden on the national budget. Furthermore, with so much of the population living without electricity, it would be inequitable to pass the costs on to the taxpayer.
- Tax-exemption model – By making renewable electricity tax exempt, the government could increase the avoided costs for RECO, enabling it to offer a higher rate to IPPs. Note that a tax-exemption is a form of subsidy from the taxpayer to the IPP, thus this model is a watered-down variation of the "Spanish-model."
- FONERWA/Bilateral Model – Either bilateral development partners, or the new environment fund, FONERWA, which would be partly capitalised by development partners, could be used to pay the additional cost of the renewable feed-in tariff. Considering the global benefits provided by Rwanda following a low carbon growth path, this model may be the most appropriate. It has also been suggested that the Belgian government would be willing

to supplement the feed-in tariff with a "top-up" for renewable energy.

- CDM Model – An innovative alternative might be possible through a CDM Programme of Activities. In this case the higher price of the feed-in tariff for renewable electricity would be paid by those purchasing the carbon credits in Annex 1 developed countries. Using the emissions factor and baseline calculation discussed in the Energy Sector Working Paper, such a programme could add an extra USD 0.007 (RWF 4.2) per kWh minus transaction costs to the feed-in tariff rate. The advantage of such a CDM programme would be that monitoring costs would be reduced, because the energy fed in to the grid would guarantee that the technology is working.

4.4 Green Business Incubator & Green Investment Index

PFMs, while necessary, are often not enough to leverage the necessary private capital to green investments. Even with public financial support, technical experts, such as hydro engineers or research organisations, often lack the business knowhow to attract investors and bring good ideas to the market. To assist these potential entrepreneurs, "business incubators" can combine PFMs with business support services. For example, the UK Carbon Trust Incubator Programme assists businesses to refine their business plans and address issues concerning investors. Since it was introduced in 2003, it has helped 90 companies to raise approximately GBP 86 million in private funding.

A similar business incubator could be established in RDB to connect entrepreneurs with potential investors. It could be combined with a green investment index that would highlight companies' environmental performance as well as their financial performance. Such a mechanism could be instrumental in attracting green foreign investment from institutional investors that have long-term investment horizons, and often a social or environmental motive, but lack on-the-ground knowledge in Rwanda.

4.5 Payments for Ecosystem Services Schemes

As discussed in Chapter 2, a primary driver of deforestation in Rwanda is that of missing markets for the public services provided by ecosystems. Plants photosynthesise the oxygen we breathe, and insects and animals provide pollination and pest-control services. Forests perform watershed maintenance services: first, by acting as a natural purification system taking up nitrogen; second, by retaining water, which serves to lessen soil erosion and regulate the water supply to minimise the threat of floods and droughts. Finally, and most importantly from a climate financing perspective, forests sequester carbon dioxide, which acts to mitigate climate change.

In order to incentivise landowners to maintain these services, payment-for-ecosystem-services (PES) strategies aim to directly compensate landowners for public services that their forests provide. For PES to function properly, two requirements must be fulfilled: payments to the landowner must exceed the opportunity costs of developing the land, and property rights must be well defined and enforced.

There are numerous variations of PES, but they generally fit into three models: private deals between environmental service beneficiaries and private landowners; direct payments from governments or organisations to landowners; and carbon trading systems.

4.5.1 Private Payments-for-Ecosystem-Services Scheme

A private PES deal could be as simple as downstream users of a watershed paying upstream landowners for the conservation of their forests. Often, downstream businesses reliant on the water supply are willing to pay for a quality and well-regulated water supply. A commonly cited example is that of the bottled water company, Perrier, paying French landowners to maintain the forests surrounding their water sources. The GoR can actively engage beneficiaries and landowners to facilitate bargains, but once the market is

Box 1. Payments for ecosystem services by electricity consumers

Tangible economic benefits of ecosystem services can be observed in Rwanda's history. The clearing of the Gishwati Forest for subsistence farming in the 1990s was a direct cause of the Nyabihu flooding in 2006. The estimated economic costs of the flood were between USD 4.1 and 21 million. Furthermore, the forest clearing caused increased erosion and sedimentation, which damaged the Gihira Hydro Power Plant to the point where the entire system needed to be replaced. Likewise, the degradation Rugezi Marshland resulted in a shortage of hydroelectric power, which had significant knock-on effects on people's livelihoods and the entire Rwandan economy. Subsequent restoration of the Rugezi marshland increased RECO's capacity to generate power[6].

A private PES scheme could prevent such costly degradation of ecosystem services. Downstream organisations that are reliant on a well-regulated and quality water supply, such as RECO, could pay upstream landowners to conserve and/or reforest their land. In designing such a scheme is important to take into account that any additional costs to RECO would be passed on to its consumers in the form of higher prices for electricity and water services, which may not be desirable.

REMA held a workshop on PES in December 2010. The workshop resulted in the establishment of a PES Task Force. The core team is made up representatives from REMA, RDB, the Private Sector Federation, RECO/EWSA and has the mandate to commission further research into potential PES transactions and leverage interest in the private sector[6].

established, it can be relatively hands off. An example of how a private payment-for-ecosystem service scheme might work in Rwanda is provided in Box 1.

Both the advantage and the limitation of local schemes is that they capture the market value of environmental services exclusively on a local level. To demonstrate, whereas watershed maintenance has a high economic value for downstream users, it has a low or non-existent value for people on the other side of the planet. Thus the international climate finance available for such schemes will be limited.

4.5.2 Direct payments

Direct payment schemes involve payments from an implementing government or organisation to landowners, contingent on conservation. One success story is that of Costa Rica's Pago por Servicios Ambientales, which is described in Box 2.

Despite this success, direct payment mechanisms have drawbacks. They are fiscally burdensome. Direct payments involve generating donor funds or levying taxes, each of which have issues with sustainability. Unlike less centrally-controlled schemes, which would likely survive as long as the forest is providing a service for which beneficiaries are willing or required to pay, the survival of a direct payment mechanism depends largely on the whim of donors or the government de jour.

If the GoR were to pursue a direct payment scheme, it could fund it through environmental fiscal reforms. FONERWA, discussed in Chapter 5, could act as the main implementing body. Taxes could be levied on beneficiaries, such as consumers of electricity and water services, and the revenues could be earmarked for use in incentivising private landowners to conserve and reforest their land. In setting up a direct payments scheme, the GoR could also seek grants from bilateral and multilateral donors, such as the AfDB Congo Basin Forest Fund.

Box 2. Costa Rica's *Pago por Servicios Ambientales*

Begun in 1978 as a tax incentive for reforestation in efforts to maintain the lumber stock, Costa Rica's direct payment scheme has evolved to direct subsidies in efforts to maintain carbon sequestration, biodiversity, watershed services and scenic beauty. Over the last 10 years Costa Rica has invested USD 200 million in contracts to subsidise 8000 landowners 25 percent of their land-value annually. The PES scheme protects 8 percent of the country's landmass, which is on top of a further 12 percent protected by national parks. The scheme is financed 50 percent by a 3.5 percent carbon tax on fuels (unique within in the developing world), and 50 percent by World Bank loans, Global Environmental Facility grants, and a carbon-purchase by the Norwegian government. To date, Costa Rica is the only developing country to turn around forest loss[23] – a feat, which experts partially attribute to its direct payments scheme, and partially to a thriving ecotourism industry and substantial protected areas.

4.5.3 Carbon trading schemes

Carbon trading offers a potentially innovative approach for Rwanda to finance its forest conservation and reforestation efforts by harnessing global demand for the carbon sequestration services provided by its ecosystems. Because climate change is a systemic problem, in that mitigation involves a reduction in the aggregate level of human greenhouse gas emissions, a ton of carbon produced in London, can theoretically be offset by a ton of carbon sequestered in Rwanda.

Currently, REDD projects are not eligible in the CDM. While afforestation and reforestation projects are eligible, credits from these projects are not allowed to be sold in the ETS. The GoR's best approach to accessing external finance will likely be to put itself in a position to access the CDM with forestry credits once it becomes more open, and for the time being support forestry projects that aim to access voluntary carbon markets. One of the most important steps that the government will need to take to enable such projects on public land would be to guarantee their permanence. To be eligible for carbon credits, planted trees will need to be standing for decades.reforms. FONERWA, discussed in Chapter 5, could act as the main implementing body. Taxes could be levied on beneficiaries, such as consumers of electricity and water services, and the revenues could be earmarked for use in incentivising private landowners to conserve and reforest their land. In setting up a direct payments scheme, the GoR could also seek grants from bilateral and multilateral donors, such as the AfDB Congo Basin Forest Fund.

National Fund for Environment and Climate Change

There is a growing recognition among the international community that a more coordinated approach to climate financing is needed to respond to developing countries' adaptation and mitigation needs, and that such coordination would best be achieved through a 'devolution' of management to developing country governments (See for example Gomez-Echeverri 2010[18]; Muller 2009[24]; Ballasteros et al. 2010[25]; and Brown & Peskett 2011[26]). In efforts to streamline incoming climate finance, coupled with a desire to exercise leadership over development agendas as specified in the Paris Declaration on Aid Effectiveness, a few developing countries have established national climate change basket funds to align direct budgetary support with national climate change strategies. These include those of Bangladesh, Indonesia, and Brazil, each of which are discussed as case studies below.

Rwanda already has a law providing for a National Fund for the Environment, which is currently known as 'FONERWA.' Such a fund could be the centerpiece of Rwanda's climate financing strategy. It could streamline climate finance along the NCCLCD plan, and, as seen in Figure 11, it could be instrumental in leveraging private investment, consumer finance, and carbon finance for low carbon initiatives. A portion of FONERWA could act as a Public Private Partnership Vehicle and employ public financing mechanisms such as grants, lines of credit, loan guarantees, public venture capital, and equity capital as discussed in Chapter 4. Such mechanisms would enable green businesses and consumers to overcome initial investment costs of low carbon technologies, and would attract private finance by buying down the risk of low carbon investments.

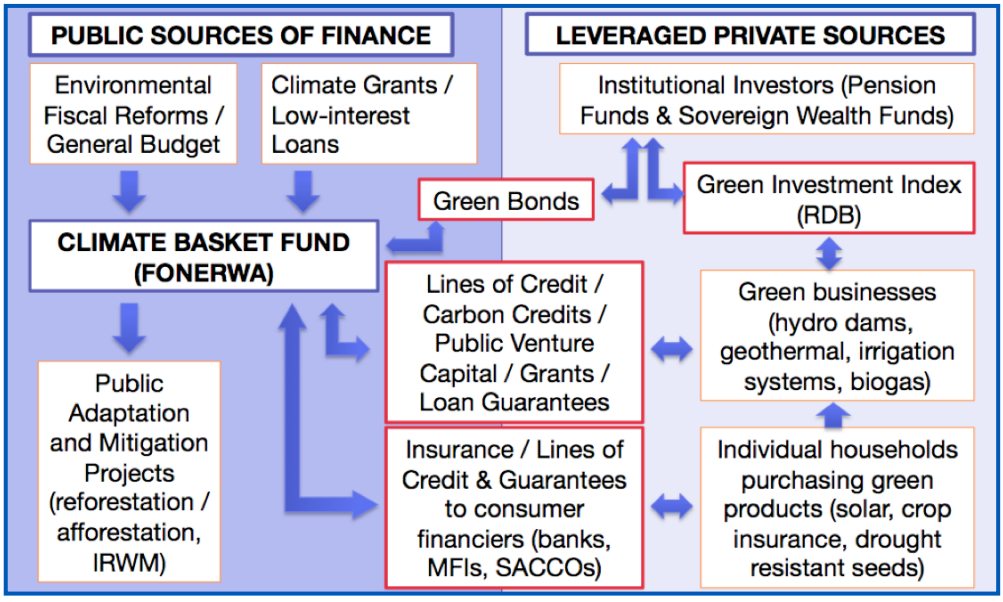

Figure 11: Using Public Funds to Leverage Private Investment

5.1 FONERWA Draft Law

In 2005, the Government of Rwanda passed Organic Law No.04/2005[27], which provided for the establishment of two new institutions:

- The Rwandan Environmental Management Authority (REMA)
- National Fund for the Environment (FONERWA)

While REMA was established in 2006, FONERWA has yet to be established. A draft bill is currently making its way through parliament, which would house the fund under REMA. The fund would have a rather large mandate:

- Provide grants and any other support for activities aimed at conserving and protecting the environment, water, forestry, mines and quarries as well as managing climate change;
- Support training, research and communication aimed at promoting prudent management and rational utilisation of environmental, water, forestry, mining and quarry resources;
- Award prizes to individuals, associations or model institutions involved in environmental, water, forestry, mines and quarry conservation as well as in climate change adaptation and mitigation;
- Support to repair and rehabilitate areas whereby the environment and natural resources have been degraded or damaged when the culprit is unknown or has no means to rehabilitate the degraded area.

According to the draft bill, the Management Committee would consist of Permanent Secretaries from the Ministries of Environment and Lands (MINELA), Forestry and MINES (MINIFOM), Finance and Economic Planning (MINECOFIN), Commerce (MINICOM), Agriculture and Animal Resources (MINAGRI), Local Governments (MINILOC), Infrastructure (MININFRA), Natural Disasters and Refugee Affairs; Director Generals from REMA, and the Natural Resource Board (RNRB); a representative of the Rwandan private sector federation; and four representatives of nongovernmental organisations operating in environment, water and forests protection and climate change adaptation and mitigation fields[27].

FONERWA would be financed through bilateral and multilateral grants; fines for breaking laws regarding environmental, water and forestry protection and mining and quarry exploitation; 0.1 percent of the cost of a project whose environmental impact assessment has been carried out minus the operating costs; and the national budget[27]. Originally, FONERWA was to also be capitalised through the interest accumulated on administered loans. However, at the meeting to finalise the draft bill in March 2011, it was determined that FONERWA should not be able to engage in debt financing because “it is not a bank.”

5.2 Opportunities and Challenges

It is important to consider potential opportunities and challenges to FONERWA being the central source of public funding for implementation of the NCCLCD Strategy. Its provision under organic law gives it a national character that can achieve buy-in from both national stakeholders and development partners for the government’s NCCLCD strategy[28]. Furthermore, having a combined environment and climate change basket fund would simply administrative procedures.

FONERWA’s position in REMA could help ensure that there is consistency and clarity in the institutional management and modalities in support of climate activities in Rwanda. REMA also houses a Climate Change Unit and DNA for the Clean Development Mechanism, and thus has internal capacity and institutional knowledge regarding the external climate finance landscape. Rwanda is also applying to establish a National Implementing Entity (NIE) to access the UNFCCC Adaptation Fund in MINIRENA, the ministry overarching REMA, which could allow for easy coordination. Clarifying and improving coordination between these diverse mechanisms, in line with the proposed mandate of FONERWA, will be a critical task of any financing framework to support a mainstreamed NCCLCD Strategy.

However, as structured, there are also drawbacks to using FONERWA as the central source of public climate finance. For one, there is a danger that housing FONERWA within REMA may perpetuate the relegation of perceptions of climate change as exclusively an environmental issue. An important outcome of the NCCLCD Strategy is to "mainstream" climate change considerations into decision-making in all sectors, and alter perceptions that climate change is just about environment. Adaptation to climate change is a crosscutting issue involving crucial actions within each ministry. For example, it will involve changing building codes, crops grown, and the training of medical practitioners. Likewise, launching Rwanda on a low carbon growth trajectory will involve fundamental changes spanning sectors from energy, to transportation, to industry, to agriculture, to forestry, to the built environment. If FONERWA is housed in REMA, it may institutionally prevent the "non-environment ministries" responsible for these activities from accessing funds. On the other hand, the cross-sectoral structure of the Management Committee may negate this issue.

Second, "ring-fencing" a portion of the budget for FONERWA will be an important step in providing a sustainable source of finance and legitimacy to the NCCLCD Strategy. However, the drawback of ring-fencing must be acknowledged: inputs into the fund will rarely match the necessary expenditures in size or timing. Hence, the fund will either be over-capitalised, and will have money sitting idle that could be used for productive purposes; or, more likely, it will be undercapitalised, leaving important projects unfunded. This might not be a problem, as long as funds can be transferred from the national budget to meet shortfalls. With the fund operating at REMA, it will be acting in parallel to the national budget. The two will simultaneously be funding activities in energy, agriculture, forestry, water, etc, and it will be important that lines of communication between REMA and MINECOFIN are in place to coordinate budget allocations and to enable shortfalls to be met.

Third, when dispersing the funds, it will be necessary to leverage private capital: first, because it is unlikely that the size of FONERWA will be sufficient to fulfill its mandate without private capital; and second, because incentivising private investment into low carbon industries will be fundamental in Rwanda's transition to low carbon economy. However, FONERWA's capacity to leverage private capital will be severely restricted if it is only able to engage in grant financing. Grants can be used to provide seed capital, and performance-based incentives, but in many cases it would be more appropriate for the fund to provide other public financing mechanisms such as lines of credit, public venture capital, and mezzanine finance to low carbon projects as described in Chapter 4. FONERWA's potentially restricted capacity to leverage private capital may also have implications for its ability to attract grants from international donors, which are increasingly considering leverage ratios in their investment activities.

Fourth, in the medium-term, the GoR may wish to access debt financing to scale-up financially viable low carbon activities. As discussed in Chapter 3.4, it would begin with highly concessional loans from development partners, but could eventually issue "green bonds" to attract institutional investors. However, as stated in the Public Debt Policy, for obvious coordination reasons, "MINECOFIN shall be the principle debt managing entity"[29]. Thus, housing FONERWA at REMA may pose a barrier to debt financing.

Finally, the amount of international funding available for climate change adaptation and mitigation dwarfs that for non-climate environmental issues. FONERWA was initially envisioned as an environmental fund, and climate change has since been added on to its mandate. With climate change subordinated within a broader "environmental fund", FONERWA might have a difficult time attracting international climate finance.

Table 9: National Climate Change Basket Funds	
Country	Name of Fund
Indonesia	Climate Change Trust Fund, and Green Investment Fund
Brazil	Amazon Fund, and National Fund on Climate Change
Bangladesh	Climate Change Trust Fund, and Climate Change Resilience Fund
China	Fund for the Environment, and CDM Fund
Ecuador	Yasuni National Trust Fund
Maldives	Climate Change Trust Fund
Thailand	Energy Efficiency Revolving Fund
India	Clean Energy Fund
Philippines	National Survival Fund

5.3 Existing Climate Change Basket Funds

Numerous countries have established national climate change basket funds, and have successfully attracted significant direct budget support. Some of these are listed in Table 9. This section will examine the experience of three countries in particular: Bangladesh, Indonesia, and Brazil.

It must be stressed that these three countries represent three different contexts from Rwanda, and that the amount of climate finance received by these countries should not be considered indicative of the amount that Rwanda can expect to receive. As another least developed country, the Bangladesh example may be considered the most applicable to Rwanda. However, its extremely high population density (970 people per square kilometer), low lying land (60 percent is less than five meters above sea level), and frequent cyclones and floods make it one of the most vulnerable countries to climate change in the world. Indonesia and Brazil, on the other hand, are the fourth and fifth most populated countries, and the third and fourth largest emitters when deforestation is taken into account. They, therefore, are much more important players than Rwanda in global efforts to mitigate climate change.

It also must be noted that it is too soon to determine whether the institutions and strategies established by Brazil, Indonesia and Brazil represent "best practice" in achieving their purpose. Nonetheless, these countries' experiences can provide important insights as Rwanda establishes its NCCLCD Strategy and mechanisms to finance it.

5.3.1 Bangladesh

The case of Bangladesh offers a tangible example of the battle for control of climate finance that has been playing out at the international level, with developed countries and the World Bank on one side, and NGOs and developing country governments on the other. In Bangladesh, this contested issue has been manifested in the creation of two separate trust funds to finance its Bangladesh Climate Change Strategy and Action Plan: the USD 100 million Bangladesh Climate Change Trust Fund (BCCTF), capitalised and managed by the government; and the USD 110 million Bangladesh Climate Change Resilience Fund (BCCRF), capitalised by development partners and initially managed by the World Bank. Each of these funds is discussed below.

Bangladesh Climate Change Trust Fund

In 2009, Bangladesh became the first developing country to establish a domestically capitalised climate change trust, BCCTF, with the goal of funding the Bangladesh Climate Change Strategy Action Plan. In fiscal year 2009-2010 it budgeted about USD 100 million for the fund, and it will likely allocate a similar amount for fiscal year 2010-2011 as well. Thus far, the BCCTF has received about 5000 applications, of which it approved 66 for grants (38 from the Government of Bangladesh (GoB) and 28 from NGOs). Many of the applications were of poor quality, and decision-makers reported political pressure from MPs during the selection process highlighting the importance of appropriate due diligence and monitoring, reporting, and verification procedures[30].

The Bangladesh Climate Change Resilience Fund

The USD 110 million BCCRF was recently established to enable development partners to directly support the Bangladesh Climate Change Strategy and Action Plan (BCCSAP). It has been capitalised by DFID (USD 87 million), Denmark (USD 1.6 million), Sweden (USD 11.5 million), the EU (USD 10.4 million) and Switzerland. There are two windows: an on-budget window for funding public sector projects, and an off-budget window for funding projects from civil society. Like the BCCTF, the BCCRF is limited to grant financing[30].

The fund will have a two-tiered governance structure made up of a governing council and a management committee supported by a secretariat. The Governing Council, which will oversee the fund, will include government ministries and development partners and the WB Country Director will act as an observer. The Management Committee will select the proposals to fund, and the secretariat will oversee project preparation to grant agreement and implementation[31].

When the multi donor trust fund was first proposed in 2008, the development partners suggested that the World Bank act as the collector, disburser, and administrator of the funds due to concerns about financial management and fiduciary responsibility. The GoB and NGOs objected, raising concerns about lack of government control, the World Bank's long and complex procedures, and its poor environmental record. In the end, it was agreed that the World Bank would act as the secretariat for the first three years while government capacity is built up[30].

Although those involved perceive the BCCRF and the BCCTF to be complementary, it is not clear how the two will coordinate with one another. The BCCRF fulfills the Paris Principles in that it provides donor harmonisation and coordination. However, the proliferation of funding mechanisms obviously runs contrary to the Paris Principle of alignment with, and use of, local systems. There is expectation that two funds will be merged by 2020[30].

5.3.2 Indonesia

In 2008, Indonesia created the National Council on Climate Change, the primary body for formulating climate change policy, strategy and programmes. In recognition that climate change is a crosscutting issue that affects all ministries, NCCC is positioned at the very upper echelon of government, above all of the ministries and directly below the President's office (see Figure 12). It is chaired by the President, with Coordinating Ministers for Economic Affairs and People's Welfare serving as vice chairs, and sixteen cabinet ministers and the head of Meteorology, Climatology & Geophysics sitting as council members. In addition to the NCCC, the Government of Indonesia created a REDD Commission under the Ministry of Forestry, for the purpose of managing the implementation of REDD+.

In 2009, Indonesia gained widespread applause when it declared a voluntary commitment to cut its GHG emissions by 26 percent by 2020 unilaterally, and 41 percent with support from the international community. This target represents the largest yet from a non-Annex I country. In support of Indonesia's efforts, Norway signed a Letter of Intent in 2010 to provide USD 1 billion towards sustainable management of its forests and peat lands, USD 800 million of which is to be performance-based, contingent on emissions reductions. The large pledge spurred the creation of the 'superagency' REDD+ Working Group within the President's office to place REDD higher on the national agenda[26].

Indonesia has also received a USD 2.2 billion concessional loan from the World Bank, Japan, and France disbursed directly to the Ministry of Finance in support of its climate change policies, as well as significant project and programme support as outlined at the bottom of Figure 12.

In an effort to gain greater ownership over incoming climate finance through direct budgetary support, the government established two climate change basket funds: the Indonesia Climate Change Trust Fund (ICCTF) and the Indonesia Green Investment Fund (IGIF).

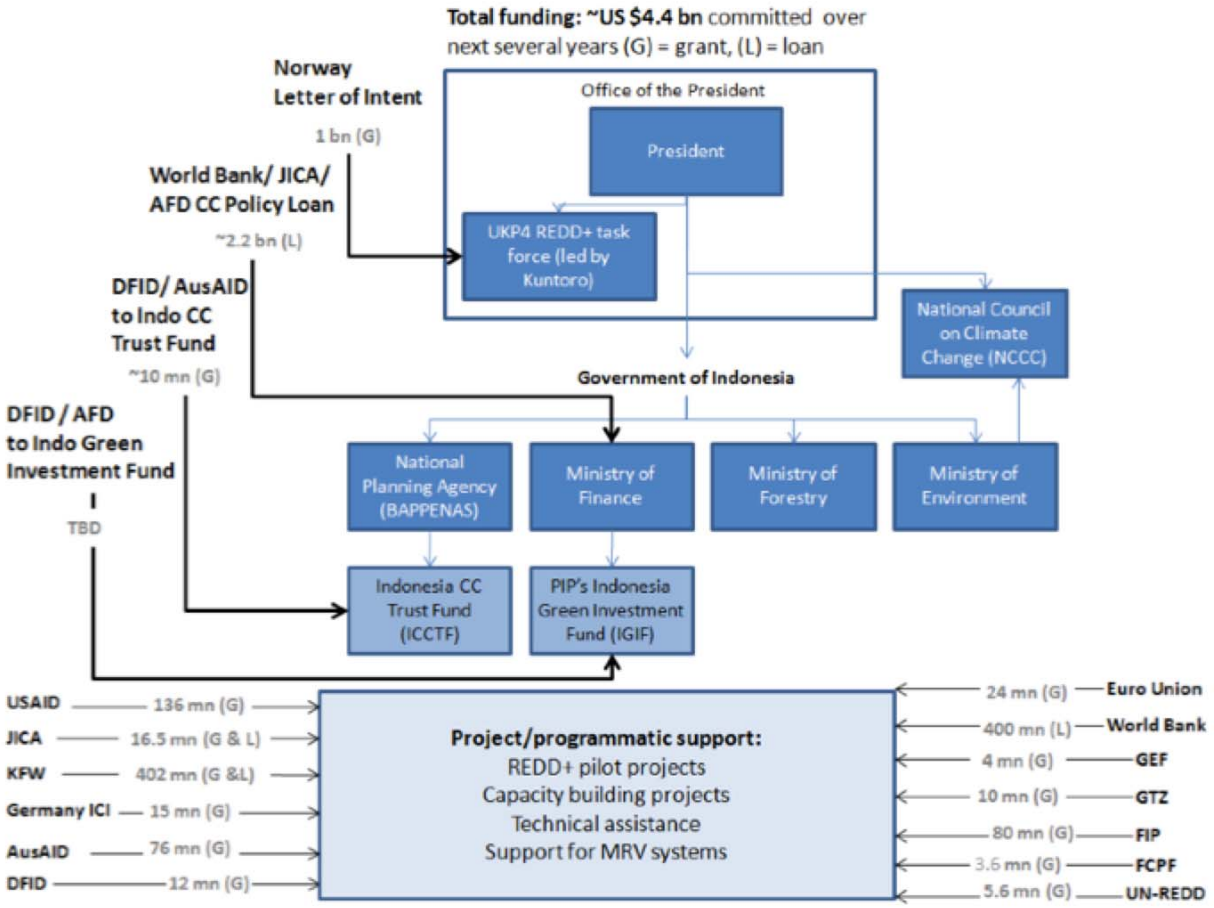

Figure 12: Landscape of climate finance in Indonesia
Source: Brown & Peskett 2011[26]

Indonesia Climate Change Trust Fund

ICCTF gained significant international attention as the first internationally capitalised climate change basket fund to be managed solely by the government, and not in partnership with a donor agency. Its core aim is to mainstream climate change into the national development agenda. ICCTF is housed in the National Planning Agency, which leads the Steering Committee that makes policy decisions and provides oversight of the fund. Project proposals are evaluated by a Technical Committee made up of members from the Ministry of Finance and the National Planning Agency. UNDP has been designated as an interim fund manager.

Initially the ICCTF was to be divided into two: an Innovation Fund, which provides grants to climate change projects within ministries; and a Transformation Fund, a "revenue generating revolving investment fund"[26]. However, the IGIF, described below, was established in the Ministry of Finance to replace the Transformation Fund, presumably due the incapacity of the National Planning Agency to manage more complex financial products. The ICCTF has received over 100 project applications to date, but has only provided grants to three:

- "Implementation of Energy Conservation and CO2 Emission Reduction in Industrial" under the Ministry of Industry
- "Research and Technology Development of Sustainable Peat Management" under the Ministry of Agriculture

- "Public Awareness, Training, and Education Program on Climate Change Issues for All Level of Societies in Mitigation and Adaptation" under the Agency for Meteorology, Climatology and Geophysics

The Innovation Fund component of the ICCTF could be considered analogous to the current design of FONERWA, as it is not housed centrally in the Ministry of Finance and is limited to grant finance. ICCTF has been supported by DFID with a USD 7.5 million grant and AusAID with a USD 2 million grant. Although significant, these funds are quite small compared to the other streams of climate finance coming into the country, and donors have complained that a more sustainable source of funding is needed. There are also concerns that grant financing may not be effective in leveraging private investment and incentivising a long term transformation to a low carbon economy[26].

Indonesia Green Investment Fund

The IGIF, housed in the Ministry of Finance under the Governance Investment Unit, operates like a public venture capital enterprise that invests in a variety of asset classes with the aim to leverage private sources of finance for low carbon projects at a lower cost than would otherwise be available. IGIF provides blended grants, concessional loans, loan guarantees, venture capital, and equity capital to create low carbon public-private partnerships (PPP) as illustrated in Figure 13[26].

As a profit making entity, IGIF is much more capitalised than ICCTF. The government allocated USD 400 million to the fund, and plans to allocate a further USD 100 million this fiscal year through its Special Purpose Vehicle (SPV). France intends to extend EUR 300-500 million in concessional loans per year over the next three years, and DFID plans to provide a small grant as seed capital. Japan, Korea, and the Islamic Development Bank have also made commitments to co-invest with the IGIF in low carbon projects. IGIF investments will range from USD 20-80 million, and returns on its portfolio through dividends, sales, and initial public offerings should provide a sustainable source of finance[26].

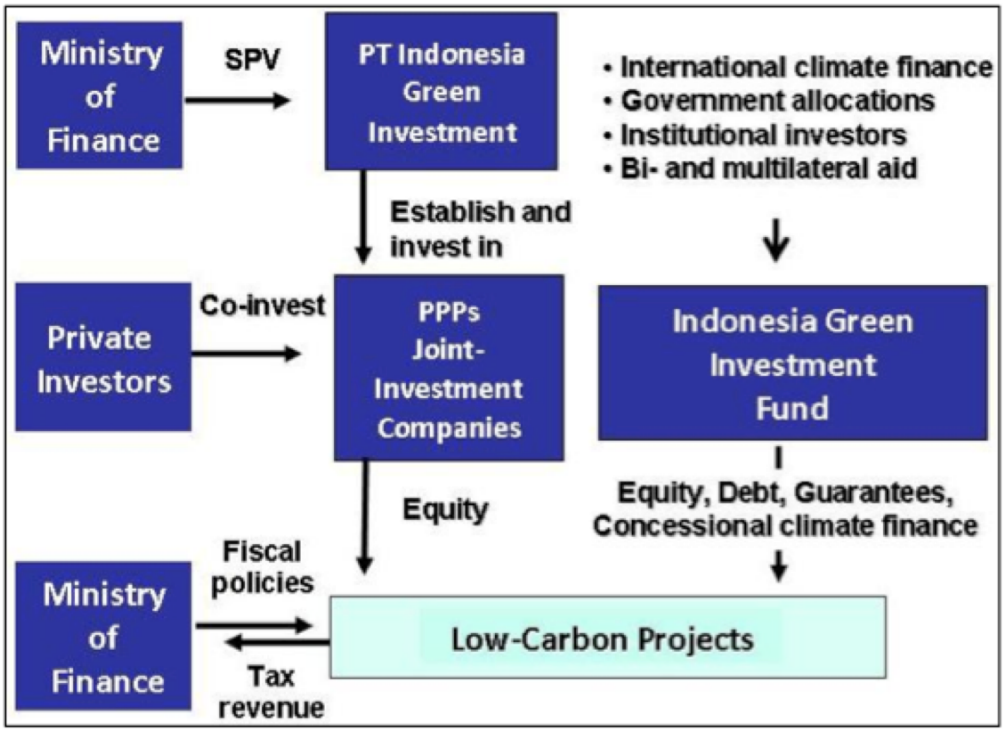

Figure 13: Structure of the Indonesian Green Investment Fund
Source: Brown & Peskett 2011[26]

5.3.3 Brazil

Brazil's National Climate Change Fund (FNMC) offers an alternative model. It was established in December 2009 under Brazil's Climate Change Law (No. 12,187), which stated principles, policies, and objectives to promote low carbon development. The law includes a voluntary commitment to reduce GHG emissions between 36.1 percent and 38.9 percent below projected 2020 levels.

FNMC is capitalised through both climate grants and a 60 percent cut of the royalties paid to the government by companies working the country's oil fields. 2011 will be its first year of disbursal, and it is set to distribute USD 142.6 million. Although it is housed in the Ministry of Environment, 86 percent of the funding (USD 122.3 million) will be transferred to Brazil's National Development Bank to extend lines of credit to financially viable adaptation and mitigation projects including the development of irrigation reservoirs, REDD schemes, and low carbon technologies. The Ministry of Environment will disperse the remaining 14 percent (USD 20.6 million) to public sector climate change initiatives including training and education, research and development, environmental conservation, and a USD 6 million dollar prevention and early warning system for drought, floods and landslides (Kepp 2011).

5.4 Potential Structures of a Basket Fund for Rwanda's Strategy

Despite the nascence of Bangladesh, Indonesia and Brazil's climate change basket funds, we can draw lessons from their design. First, in each of the national climate change basket funds, the primary purpose is adaptation and/or mitigation. FONERWA might have an easier time attracting international climate finance, if climate change is included in the title of the fund than if is subordinated within a broader environmental fund.

Second, the national climate change funds range in complexity from simple grant-in/grant-out structures, to revolving loan funds, to public venture capital funds that take on debt as well. The wider the range of public financing mechanisms available, the greater the fund's leveraging capacity as described in Chapter 4. Funds that provide loans and equity can target a larger portion of the economy, because the appropriate mechanisms will vary a great deal between sectors, project scales, and the specific investment barriers being addressed. Furthermore, the non-grant portion of the portfolio creates a sustainable source of income for the fund that is not contingent on tax dollars and continued development partner support.

However, due to their complexity, non-grant public financing mechanisms require much more due diligence and thus should be managed by a finance ministry or a financial institution. The ability of a basket fund to attract support from development partners will depend on both the strength of its monitoring, reporting, and verification procedures, and on its capacity to leverage private capital.

Two structures seem appropriate for the future transformation of FONERWA:

- Option 1: FONERWA could operate as the climate change fund under its current design, with a portion of the funds transferred to the management of a financial institution such as the National Bank of Rwanda to extend lines of credit, equity investments, etc to viable adaptation and mitigation projects. The advantage of this option would be that the climate change fund would be operating within an already existing law.
- Option 2: Once established and capitalised, FONERWA could be transferred to MINECOFIN. The advantage of this option would be that it would facilitate coordination between the general budget and the climate change fund, because both would be managed by the same entity. Furthermore, housed centrally in MINECOFIN, the fund might be more capable of mainstreaming climate change issues into decision-making in all sectors than if housed in REMA. At a later date, FONERWA could begin extending non-grant financing mechanisms to leverage private capital, and could begin operating like a public

private partnership vehicle similar to Indonesia's Green Investment Fund. Housed in MINECOFIN, it would also have an easier time accessing debt finance and issuing green bonds if the GoR chooses to do so.

Considering the advantages, Option 2 is likely preferable. Whichever is chosen, FONERWA should begin simple grant-in/grant-out basket fund, and should fostered in REMA, where most of the momentum to establish the fund has been generated and which possesses organisational knowledge regarding the external funding landscape. Once the fund is capitalised, it can progress to one of the more complex options listed above. Beginning simple will allow for easy implementation, and will ensure that the bill is passed through parliament in time for a seamless transition to the implementation phase of the NCCLCD strategy.

Roadmap

The following roadmap gives a rough outline of the timing and order in which the Government of Rwanda could implement some of the climate financing policies discussed in this paper. It is meant to be only a guide, with the most urgently needed and simplest policies located at the beginning, and the more complex and riskier policies towards the end. The timing and order of actual implementation will most likely differ from the dates seen here.

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Appendices

Appendix 1. CDM Baseline Calculation for Hydro Electric Dams

The methodology used to calculate the baseline will depend on the size of the dam, and whether it is connected to the central grid or not. Methodology AMS.I.D is used for small-scale hydro dams (or any other renewable energy source) that will feed into the central electricity grid, thus offsetting more carbon intensive sources of electricity. Small-scale hydro dams that supply a mini-grid with total capacity not exceeding 15MW would use AMS.I.F, and standalone off-the-grid hydro dams would use methodology AMS.I.A. The latter methodology will be discussed in the section on solar PV. Large-scale dams fall under ACM0002. In each, dams are only eligible in the following conditions:

- The dam is implemented in an existing reservoir with no change in the volume of the reservoir;
- The dam is implemented in an existing reservoir, where the volume of reservoir is increased and the power density is greater than 4W/m2;
- The dam results in new reservoirs and the power density of the power density is greater than 4W/m2.

To illustrate, let us consider a 100 kW dam that will feed-in to the electricity grid. Equation 1 provides the baseline calculation for methodology AMS.1.D.

A 100 kW hydro dam operating at a realistic 80 percent efficiency for 8760 hours per year will produce 700.8 MWh per year, resulting in a carbon offset of 490.56 tonnes each year. Valued at USD 10 per tonne, this represents a potential subsidy of USD 4905.60 per year minus transaction costs. For mini-grid systems using methodology AMS.I.F the baseline equation is exactly the same as above, except that the emissions factor is a default value for a modern diesel generating unit, which will result in an even higher offset.

The cost of developing a hydro dam is site specific. Although size-cost is generally not a linear relationship, the cost generally ranges from USD 1200 to USD 6000 per kW. Using this price range, a 100 kW hydro dam would cost between USD 120,000 to USD 600,000 to build. Carbon finance could be generated for either seven years and renewed twice, or ten years and renewed once. Twenty years of carbon finance at USD 4905.60 per year would amount to USD 98,112 minus transaction costs. Of the population connected to the grid in Rwanda, the average electricity consumption per person is 720kWh/person. A 100 kW dam, producing 700,800 kWh per year, could thus serve almost one thousand people.

Equation 1: Baseline calculation for 100 kw hydro dam using CDM methodology AMS.1.D.

$$BE_y = EG_{BL,y} * EF_{CO2|,grid,y}$$

Variable	Definition	Value
BE_y	Baseline emissions in year 'y' (tCO2)	490.56 tCO2 / yr
$E_{GBL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)	700.8 MWh / yr
$EF_{CO2\|,grid,y}$	CO2 emission factor of the grid in year y (tCO2/MWh)	0.7tCO2/MW

Appendix 2. CDM Baseline Calculation for Efficient Cookstoves

Efficient charcoal and wood cook stoves are conservatively estimated to reduce consumption of fuel by 36 percent from a traditional stove by insulating the combustion chamber and regulating air intake[32]. As such, improved cook stoves can have a serious impact on rates of deforestation. The first step to developing a carbon trading programme for efficient cook stoves is to calculate the greenhouse gas emissions offset per stove. The appropriate CDM methodology for this calculation is AMS.II.G. – "Energy efficiency measures in thermal applications of non-renewable biomass".

The first step in the baseline calculation is to determine the quantity of biomass that would be saved by each stove. Equation 2 is used.

Rwanda has a relatively high percentage of improved cook stoves compared to other African countries. This is the result of an aggressive government program to bring improved stoves to rural households. From Table 1 we can discern that roughly 58 percent of the population that cooks with firewood or charcoal stoves already uses improved models. A default efficiency rating of 20 percent efficiency is permissible for these stoves. The remaining 42 percent is made up of three stone fire cooking techniques and stoves that lack improved combustion chambers and air supply mechanisms. These are assigned a default efficiency rating of 10 percent. Using these figures to calculate the parameter n_{old}, the efficiency of the baseline system being replaced, we arrive at a weighted average of 15.8 percent.

The value of n_{new}, the efficiency of the system being deployed, will vary depending on the particular improved cook stove implemented. The approved Nigerian CDM project, implemented by atmosfair, used very efficient cook stoves implemented from Germany called SAVE80. SAVE80 systems have an efficiency rating of 35.15 percent. Atmosfair is currently in the process of developing a similar project in Rwanda, however the SAVE80 stove costs USD 100. We will also calculate the offset of the efficient Jiko stove, which costs in the range of USD 10 and is manufactured in Rwanda. According to Winrock 2009[34], the Jiko stove has an efficiency rating of 28.97 percent.

Finally, the parameter By is given by Rwanda's Biomass Energy Strategy[33], which states that the average household fuelwood consumption, including firewood and wood used to produce charcoal, is 900 kg per year.

Equation 2: Quantity of biomass saved per improved cookstove deployed

$$B_{y,savings} = B_y * (1 - n_{old} / n_{new})$$

Parameter	Definition	Source	Value
$B_{y,savings}$	Quantity of woody biomass that is saved in tons	Final product	
B_y	Quantity of woody biomass used in the absence of the project activity in tonnes	BEST, 2009[33]	0.9 tonnes / year
n_{old}	Efficiency of the baseline system being replaced, measured using representative sampling methods or based on referenced literature values (fraction), use weighted average values if more than one type of systems are encountered	BEST 2009[33] & Fixed default values	0.158
n_{new}	Efficiency of the system being deployed as part of the project activity	Winrock, 2007[34]; atmosfair, 2009[35]	SAVE80 = 0.3515; Jiko = 0.2897

Table 10: Proportion of firewood and charcoal stoves that are "Improved Cookstoves"[33]				
Land owned	Firewood stove	% Improved	Charcoal stove	% Improved
no land	450	54%	58	36%
0.1 - 0.5 ha	870	59%	45	29%
0.5 - 1 ha	427	67%	29	34%
> 1 ha	113	69%	16	38%
Total	1860	60%	148	34%

Using Equation 2, the quantity of woody biomass that is saved per SAVE80 cook stove deployed can be calculated as follows:

$$B_{y,savings} = B_y * (1 - n_{old} / n_{new})$$
$$= 0.9 * (1 - 0.158 / 0.3515)$$
$$= 0.495 \text{ tonnes per year}$$

The next step calculating the carbon offset of each improved cook stove deployed is measuring the fraction of currently used biomass that is non-renewable– i.e. that is not replaced through natural forest growth or reforestation. According to CDM methodologies, carbon credits are only granted for avoided combustion of fuelwood from sources that are non-renewable. To determine this non-renewable fraction, CDM methodology AMS.I.G. permits the use of nationally approved surveys, national or local statistics, studies, maps, or remote-sensing data that demonstrates that carbon stocks are depleting. Table 2, from Rwanda's 2011 National Forest Policy, shows Rwanda's needs and sustained yield of wood during 1960-2009. From the decline in forest cover, it is clear that non-renewable biomass has been used for the last 50 years.

To measure the precise proportion that is beyond the regeneration capacity of plantations and natural forests, the approved Nigerian cook stove programme used Equation 3.

Table 11: Needs and sustained yield of wood from 1960-2009											
	1960	1970	1980	1990	1996	1999	2000	2002	2007	2008	2009
Natural forest areas (ha)X1000	634	591.8	513.6	451.2	383.66	221.2	221.2	221.2	221.2	221.2	221.2
Total population	2.7 mn	3.8 mn	4.8 mn	7.2 mn	6.2 mn	7.2 mn	7.5 mn	8.2 mn	9.2 mn	9.5 mn	9.8 mn
Pop. growth rate (%)		3.8	3.8	3.1	3.1	3.1	3.1	3.0	3.0	3.0	3.0
Man-made forests (ha)X1000	25.5	27.16	80	247.5	232.5	252	282.56	112.73	125.27	144.85	153.5
Sustained Yield ($1000m^3$)	368	407	1,200	3,313	2,790	2,268	2,261	902	1,021	1,159	1,228
Needs (1000^3)	2,695	3,763	4,832	7,158	6,784	7,882	8,247	8,979	9,900	10,467	10,781
Balance (1000^3)	-2,327	-3,356	-3,632	-3,445	-3,994	-5,614	-5,987	-6,719	-7,879	-9,308	-9,552

Sustained Yield - Based on average sustained harvest per hectare that varies from 15m3 (before 1996) to 8m3 (after 1996)

Needs - According to a survey carried out by the MINAGRI in 1981/1982, a medium Rwandan consumer uses 1 m3 of wood per year.

Equation 3: Proportion of fuelwood from non-renewable sources

$$F_{NRB,y} = (H - MAI) / H$$

Parameter	Definition	Source	Value
$F_{NRB,y}$	Fraction of woody biomass saved by the project activity in the year y that can be established as non-renewable biomass	Final product	
H	The annual harvest of fuel wood (i.e. annual demand in m3)	National Forest Policy, 2010	10,781
MAI	Sum of mean annual increments (i.e. annual production in m3)	National Forest Policy, 2010	1,228

The fraction of woody biomass saved that is from non-renewable sources can be calculated as follows:

$$F_{NRB,y} = (H - MAI) / H$$
$$= 10,781 * (1 - 1,228 / 10,781)$$
$$= 0.886$$

Finally, using the parameters FNRB,y and By,savings, the carbon offset per improved cook stove deployed can be measured using the baseline calculation in Equation 4.

The carbon offset per SAVE80 deployed can be calculated as follows:

$$ER_y = B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}$$
$$= 0.495 * 0.886 * 0.015 * 71.5$$
$$= 0.47 \text{ tonnes per cook stove per year}$$

The carbon offset per Jiko stove can be calculated as follows:

$$ER_y = B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}$$
$$= 0.421 * 0.886 * 0.015 * 71.5$$
$$= 0.47 \text{ tonnes per cook stove per year}$$

Priced at USD 10 per tCO2e, 0.47 tCO2e per SAVE80 is worth USD 4.70 per year, and 0.4 tCO2e tonnes per Jiko is worth USD 4 per year – a small difference considering the substantially higher costs

Equation 4: Baseline Calculation to determine the carbon offset per cook stove

$$ER_y = B_{y,savings} * f_{NRB,y} * NCV_{biomass} * EF_{projected\_fossilfuel}$$

Parameter	Definition	Source	Value
ER_y	Emission reductions during the year y in tCO2e	Final product	
$B_{y,savings}$	Quantity of woody biomass that is saved in tonnes	Calculated in Equation 1	SAVE80 = 0.495 Jiko = 0.421
$f_{NRB,y}$	Fraction of woody biomass saved by the project activity in the year y that can be established as non-renewable biomass	Calculated in Equation 2	0.886
$NCV_{biomass}$	Net calorific value of the non-renewable woody biomass that is substituted (IPCC default for wood fuel, 0.015 TJ/ton for wood)	Fixed default value	0.015 TJ/tonne
$EF_{projected\_fossilfuel}$	Emission factor for the substitute of non-renewable woody biomass by similar consumers. The default emission factor for kerosene is 71.5 tCO2/TJ	Fixed	71.5 tCO2/TJ

Table 12: Comparison of the CO2e offset of two improved cookstoves, SAVE80 and Jiko					
Improved Cook Stove	Cost (USD)	Offset (tCO2e/year)	Life Expectancy	Lifetime Offset (tCO2e)	Value at USD 10/tCO2e
SAVE80	100	0.47	10 years	4.7	Can$47.00
Jiko	10	0.4	4 years	1.6	Can$16.00

of the SAVE80. However, as seen in Table 3, the average life expectancy of a SAVE80 is much longer, at 10 years compared 4 years for the Jiko. Whereas the lifetime carbon offset of a SAVE80 could be worth USD 47.00 at a price of USD 10 per tonne, the offset of a Jiko would only be worth USD 16.00. It is important to note that this revenue is before CDM transaction costs and fuel efficiency savings are taken into account.

The calculated offset of these two stoves is much lower than that of the Nigerian and Ugandan programmes. One of the main reasons is the relatively low value for the parameter, B_y, the quantity of biomass currently used per household, at 0.9 tonnes per year. This low value may be the result of the already high rate of efficient cook stoves in use in the country. Or it may be an inaccurate calculation. A new survey should be conducted to determine the value on a regional basis to see if higher carbon offsets can be obtained in different locations.

Appendix 3. CDM Municipal Waste Compost Programme

In Uganda, 80 percent of the waste sent to the landfill is organic resulting in significant methane emissions. In 2010, the Uganda's Municipal Waste Compost Programme was set up as a countrywide CDM programme of activities to eliminate these methane emissions by recovering and composting the organic matter. The resulting compost is sold to farmers to enhance plant growth. Municipalities either set up and operate the composting facilities on their own, or contract the service out to the private sector. The implementing entity, the National Environment Management Authority (NEMA), provides financial and technical assistance during implementation of the composting facilities, and then monitors their operation.

To finance the initial costs of the project, the Government of Uganda has taken a loan from the World Bank. The municipalities then transfer their CER rights to the NEMA in repayment for the initial investment. NEMA, in turn, sells the CERs directly to the Community Development Carbon Fund (CDCF) of the World Bank.

On average, each municipality handles 70 tonnes of waste per day (between 50 and 200 tonnes), and 25,550 tons per annum. The average yield of compost for each municipality is about 5000 tonnes, which at the predicted price of USD 13 per tonne, is worth USD 65 thousand. The predicted emission offset for the whole programme during the first seven-year crediting period is 8370 tonnes of CO2 equivalent per year from 2010 to 2017[36]. Priced at USD 10 per offset, this offset is worth USD 83,700 annually.

Appendix 4. CDM Baseline Calculation for Geothermal

The methodology to calculation the emission reductions from geothermal is similar to that of hydro, except that the "fugitive GHG emissions" produced during the operation of the geothermal plant must be taken into account. Fugitive GHG emissions from geothermal include carbon dioxide and methane released from produced steam. The quantity of fugitive emissions must be multiplied by their respective emissions factor and subtracted from the baseline in order to determine the total emission reductions of the CDM project.

As exploratory drilling for geothermal has not yet begun in Rwanda, it is not yet known how much electricity and fugitive emissions will be produced. However, an expert at MININFRA predicted each

Equation 5: Baseline Calculation for 4 MW Geothermal Plant

$$BE_y = EG_{BL,y} * EF_{CO2|,grid,y}$$

Variable	Definition	Value
BE_y	Baseline emissions in year 'y' (tCO2)	24,192 tCO2e / yr
$E_{GBL,y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)	4 MW * 360 days * 24 hours/day = 34,560 MWh / yr
$EF_{CO2\|,grid,y}$	CO2 emission factor of the grid in year y (tCO2/MWh)	0.7tCO2/MW

plant will produce at least 4 MW of power, and a similar CDM programme has been registered in Kenya which can be used to predict fugitive emissions.

If each of the geothermal plants being registered has an output of less than 15 MW, the project will be eligible as a small-scale CDM Programme of Activities (PoA) using the baseline methodology AMS.I.D. "Grid Connected Renewable Electricity Generation." If any of plants has an output of over 15 MW, the appropriate methodology is ACM0002. The baseline formula for geothermal, given in Equation 5, is the same, regardless of the methodology being used, however small-scale PoAs have reduced transaction costs, simplified monitoring procedures, etc.

The fugitive emissions from the Kenyan 34.4 MW Olkaria III Phase 2 CDM project totalled 6255 tCO2e per year. If we assume that the relationship between size and emission produced is linear (big assumption), fugitive emissions would equal 181.8 tCO2e per MW. A 4 MW plant would thus produce 727.2 tCO2e per year in fugitive GHG emissions. To calculate the emissions reduced by a 4 MW geothermal plant, these must be subtracted from the baseline as follows.

A 4 MW Geothermal CDM plant should be eligible for a roughly estimated 23,464 tCO2e in carbon credits through the Clean Development Mechanism. This estimate is comparable to the 34.4 MW Olkaria III Phase 2 CDM project, which generates 5162.8 tCO2e per year per MW. Sold at USD 10 per tonne, the carbon revenues from a 4 MW Geothermal CDM plant could be worth USD 235 thousand minus transaction costs.

Equation 6: Emission Reductions from 4 MW Geothermal Plant

$$ER_y = BE_y - PE_y$$

Variable	Definition	Value
ER_y	Emission Reductions in year 'y' (tCO2e)	23,464.8 tCO2e / yr
BE_y	Baseline emissions in year 'y' (tCO2)	24,192 tCO2e / yr
PE_y	Project emissions in year 'y' (tCO2e)	727.2 tCO2e / yr

Rwanda aims to develop 310 MW of geothermal electricity. Using the above calculations, a 310 MW Geothermal CDM programme could offset an estimated 1.8 million tCO2e. At USD 10 per tonne, this would be worth USD 18 million per year, minus transaction costs.

Smith School of Enterprise and the Environment
University of Oxford
Hayes House
75 George Street
Oxford
OX1 2BQ
United Kingdom
www.smithschool.ox.ac.uk