

Republic of The Gambia



United Nations Development Programme
(UNDP)



**UNDP Global Project:
Capacity Development for Policy Makers
to Address Climate Change**

Executive Summary

**Assessment of Investment and Financial Flows
to Mitigate Climate Change in the Energy and Forestry
Sectors and for Adaptation in the Agriculture and Water
Sector in Gambia**

October 2011

Investment and Financial Flows to Address Climate Change UNDP Global Project

Climate Change poses significant challenges to development and policy makers are faced with complex tasks to respond to them and to ensure sustainable development. Particularly in Least Developed Countries decision makers have to balance poverty alleviation, economic development as well as social and environmental questions, while also questions of costs that occur with associated policies and measures play a vital role.

To better understand the magnitude of funds needed to tackle climate change now and in the long term, developing countries are undertaking assessments of investment and financial flows (I&FF) to address climate change for key sectors in a groundbreaking UNDP Environment & Energy Group project: Capacity Development for Policy Makers to Address Climate Change.

Gambia is one of 19 countries participating in this project, which was launched in May 2008 with the generous contributions of the Government of Norway, Government of Finland, Government of Switzerland as well as the UN Foundation and UNDP.

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Acronyms

CBD	Convention of Biological Diversity
CSO	Civil Society Organization
FF	Financial Flows
GBoS	Gambia Bureau of Statistics
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GMD	Gambian Dalasi
I&FF	Investment and Financial Flows
IF	Investment Flows
LPG	Liquefied Petroleum Gas
MoA	Ministry of Agriculture
MOFEA	Ministry of Financial and Economic Affairs
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity Strategy and Action Plan
NGO	Non-governmental Organization
O&M	Operation and Maintenance costs
PAGE	Programme for Accelerating Growth and Employment
PRSP	Poverty Reduction Strategy Paper
PURA	Public Utility Regulation Agency
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change

1. Introduction

Climate Change threatens to jeopardize socio-economic development in The Gambia. According to a national assessment of investment and financial flows (I&FF) completed in October 2011, more than \$ US 1.35 billion is needed through to 2030 for The Gambia to implement priority actions to:

- Reduce emissions of greenhouse gases from the energy sector and forest degradation, and
- Adapt to the impacts of climate change in the agriculture and water sector.

US\$ 420.66 million of these funds are needed to ensure availability of drinking water and to secure the agriculture sector against the effects of climate change. Additionally, \$US 925.74 million is needed to replace biomass use with more sustainable energy sources and to improve energy efficiency.

Having completed the I&FF assessment, the government of The Gambia is now well placed to discuss the costs of climate change in the international climate change negotiations. This work was conducted as part of the global UNDP project, *Capacity Development for Policy Makers to Address Climate Change*, in which 20 countries participate. The project is funded by the governments of Norway, Switzerland, Spain, and Finland, UNDP and the UN Foundation.

1.1 Objectives

The objective of assessment of investments & financial flows is to strengthen national capacities of national policy makers in order to enable the development of policy options that address climate change in the energy and forestry sectors, as well as to adapt in the agriculture and water sectors. It is anticipated that the assessment would also contribute to national climate change policy strategies by engaging line ministries and encouraging an enabling environment.

The main objective of the I&FF assessments is to determine the amount and identify the sources of funds to address climate change concerns at the national level, including:

- Information on investment and financial flows in key sectors, both for a baseline scenario, as well as for mitigation / adaptation scenarios up to 2030;
- Identification of measures to address climate change adaptation and mitigation;
- Identification of incremental I&FF needed to implement the identified measures;
- An assessment of political implications and policies needed to implement the identified mitigation and adaptation scenarios.

1.2. Choice of sectors

The Gambia has selected to assess the sectors energy and forestry from the perspective of mitigation, and the sectors agriculture and water from the perspective of adaptation.

Current patterns of **energy** production and use are inefficient and not sustainable. Combined with a growing population and limited biomass resources, energy consumption is leading to depletion of natural forests and therefore contributing to drought and desertification, causing negative social and environmental consequences.

85% of the population derive their daily energy supply from **forest** resources, together with land-use changes GHG emissions arise through the logging and burning of forest cover among others for farm clearing or game poaching.

Agriculture in The Gambia is about 99% rainfed and therefore very vulnerable to climate change and its impact on water availability and soil conditions. At the same time the sector contributes 30% to the GDP and 70% of the national workforce.

While the **water** sector is crucial not only for agriculture and drinking water provision for a growing population, it is under constant pressure from climate change, exemplified by a drop in annual rainfall of around 30% between 1950 and 2000, as well as greater penetration of oceanic saline water in the River Gambia during the dry season months.

1.3 Previous analyses utilized

In The Gambia, the following analyses were used to conduct the assessments of investment and financial flows:

Initial National Communications of The Gambia to the UNFCCC

The first GHG inventory was reviewed regarding data for improvements in the energy and forestry sectors, as well as proposals on research and systematic observations, capacity needs and strategic needs for development, as well as financial, technical and capacity needs.

Second National Inventory of GHG

The Second National Inventory of GHG was conducted in 2008. The results of this assessment also confirmed the contribution of various sectors in the energy matrix to GHG emissions.

National Adaptation Programme of Action (NAPA)

The NAPA explicitly accounts for synergies between adaptation and national development plans, such as the National Biodiversity and Strategy Action Plan, as well as with multilateral initiatives such as the Millennium Development Goals (MDGs), Convention on desertification, to name a few.

Poverty Reduction Strategy Paper (PRSP)

The PRSP II is the Gambia five year (2002-2007) development strategy that is intended to form the basis for the economic development of the country. It has been under implementation until replaced by the Programme for Accelerating Growth and Employment (PAGE). The PRSP and the MDGs are the foundation pillars of The Gambia's development agenda.

National Biodiversity Strategy and Action Plan (NBSAP)

To fulfill its obligation under Article 6 of the Convention on Biological Diversity (CBD), The Gambia prepared its National Biodiversity Strategy and Action Plan in 1998. This document sets out the overall goals, principles and strategic actions for the conservation and sustainable use of the Natural Resources in The Gambia.

Convention on Biological Diversity: 4th National Report

The Gambia, through the Department of Parks and Wildlife Management, is preparing its fourth National Report on CBD.

Additionally, specific sectoral analyzes have been used including on identification and prioritization of water sector issues and management options in the face of non-stationary climate, as well as research issues on water supply and sanitation in urban agglomerations within The Gambia.

1.4 Institutional arrangements and collaborations

At the national level, project coordination was carried out by the national UNFCCC focal point, in close collaboration with the existing inter-institutional arrangements that have been established during the preparation of the Second National Communication.

Four multidisciplinary expert teams have been established to carry out the I&FF assessments in the key sectors. Numerous national institutions provided data and other information for the assessments. The four teams were trained in Banjul from 11-13 November 2009 on the use of a bottom-up UNDP methodology developed under the project for assessing investment and financial flows.

1.5 Basic methodology and key terms

Basic I&FF methodology

The overall objective of the I&FF assessment is to determine the extent and sources of funds needed to address climate change at the national level, and builds directly on national government strategies, plans and programmes. In essence, the assessment seeks to answer the question: "From a development perspective, what can my country do to address climate change in selected key sectors, and what level of financial contributions will be needed to achieve these objectives?"

In this context, the I&FF team examined the following questions:

- What are the main adaptation / mitigation measures for the selected sectors in the next 25 years?
- Who is investing in the sector / Who are the main stakeholders and sources?
- What changes / increase in I&FF will be needed in the sectors?
- What additional I&FF are needed to address climate change?

The I&FF assessment covered the time period 2005-2030, using a baseline scenario and a reference scenario. The assessment looks at the changes in I&FF needed for three different groups: households (families, individual farmers), corporations (private and NGOs), and the government. Values are given in constant 2005 US\$. Different currency conversion rate have been used in the different sectors due to different approaches used (Energy sector: 1US\$ = 28.13Gambian Dalasi (GMD), Forestry sector: 1US\$ = 27.70GMD, Agriculture: 1US\$ = 24.60GMD, Water: 365-day averaged floating exchange rate during that year). Although the conversion rates differ it is worth to note that the magnitude of difference these conversion rates bring to the assessments is not exceptionally large – and can be seen as a simplified sensitivity analysis for currency conversion rates.

Conceptually; the methodology employed is simple. Pertinent investment and financial flows are projected for selected scenarios in a baseline scenario that assumes no additional efforts to address climate change. Additionally a mitigation / adaptation scenario is developed that includes additional efforts and scaling up of existing efforts to address climate change. The difference between those two scenarios will show the additional resources needed for adaptation in the sector. The analysis of investment and financial flows (I&FF) for greenhouse gas mitigation and climate change adaptation is an important activity for the development of effective and appropriate national responses to climate change. This methodology spells out clearly what each investment is and the related terminologies.

The eight step approach includes:

1. Establish the key parameters of the assessment
 - Define the detailed scope of the sector.
 - Specify assessment period and base year.
 - Identify preliminary mitigation / adaptation measures.

- Select analytical approach.
2. Compile historical IF, FF, and O&M cost data, and other input data for scenarios
 - Compile historical annual IF and FF data, disaggregated by investment entity and source;
 - Compile historical annual O&M cost data, disaggregated by investment entity and source;
 - Compile other input data for scenarios.
 3. Define the baseline scenario
 - Describe socioeconomic trends, technological change, sectoral and national plans, and expected investments given current sectoral and national plans.
 4. Estimate annual IF, FF, and O&M costs for the baseline scenario
 - Estimate annual IF and FF for each investment type, disaggregated by investment entity and funding source;
 - Estimate annual O&M costs for each IF, disaggregated by investment entity and funding source; and,
 5. Define mitigation / adaptation scenario
 - Describe socioeconomic trends, technological change, mitigation / adaptation measures, and investments given implementation of mitigation or adaptation measures.
 6. Estimate annual IF, FF, and O&M costs for mitigation / adaptation scenario
 - Estimate annual IF and FF for each investment type, disaggregated by investment entity and funding source;
 - Estimate annual O&M costs for each IF, disaggregated by investment entity and funding source; and,
 7. Calculate the changes in IF, FF, and O&M costs needed to implement the mitigation / adaptation measures
 - Calculate changes in cumulative IF, FF, and O&M costs, by funding source, for individual investment types and for all investment types;
 - Calculate changes in annual IF, FF, and O&M costs for individual investment types, for individual sources of funds, and for all investment types and funding sources;
 8. Evaluate policy implications
 - Re-evaluate the initial priority mitigation (or adaptation) measures undertaken in step #5;
 - Analyze feasibility and compatibility with development and sector plans
 - Determine policy measures to encourage changes in I&FF; and,
 - Consider a variety of instruments, including incentives, economic instruments (e.g., taxes), regulatory instruments (e.g., fuel portfolio standards), voluntary agreements, education, information dissemination and other instruments (e.g., research, development, and demonstration (RD&D) programmes).

Key terminology

The Investment and Financial Flows (I&FF) methodology distinguishes between two distinct types of investments: investment flows and financial flows.

Investment flows: An “investment flow” (IF) is the capital cost of a new physical asset with a life of more than one year, such as the capital cost of a new power plant, a new automobile, a new household appliance, or a new agricultural irrigation system. Investment flows are limited to new physical assets because such investments have climate change implications for the duration of the operating lives of the facilities and equipment purchased. However, investment flows to retrofit, or

considerably expand, an existing physical asset such that the climate change implications of that asset are significantly altered would be included in IF. Investments in financial assets (such as stocks and bonds), and in physical assets that neither affect climate nor have climate impacts implications are excluded because they are unrelated to climate concerns.

Financial flows: ‘Financial flow’ (FF) is an ongoing expenditure on programmatic measures, the costs of operation and maintenance (O&M) of new assets (e.g., salaries of personnel, fuel costs) and encompass expenditures other than those for expansion or installation of new physical assets.

Operation and maintenance costs: ‘Operation and Maintenance’ (O&M) Costs is associated with physical assets purchased with investment flows and will have operation and maintenance costs associated with them (i.e., ongoing fixed and variable costs such as salaries and raw materials). Operation and maintenance costs of new assets need to be included in I&FF assessments because these costs can vary considerably among investment flow types, and can have a significant effect on the total cost of an investment over its lifetime. For example, O&M costs are a much greater share of total costs (capital costs plus O&M costs) for gas-fired electricity generation than photovoltaic electricity generation. O&M costs include the following categories of costs: Salaries or wages of personnel, Fuel costs such as power and/or fuel for operations, fuel for production, Public utilities such as telephone service, Internet connectivity, etc., Raw materials, Maintenance and/or leasing of equipment, Office supplies and consumables, Advertising, insurance, etc.

Investment entities: An “investment entity” is an entity that is responsible for an investment. This methodology utilizes three types of investment entities: households, corporations, and government. These are described below:

- Households are individuals or groups of individuals (e.g., families) who act as one unit financially.
- Corporations include both financial corporations and non-financial corporations, and can be either for-profit or non-profit.
- Governments are the national, provincial, state, and local governments of a country. Financial and non-financial corporation’s owned wholly or in part by governments, such as public universities and research institutions, and public oil companies, utilities, and water authorities, are included in this category.

Sources of I&FF funds: The “sources of the I&FF funds” are the origins of the funds invested by the investment entities. They can be both domestic and foreign, and can be in the form of equity, debt, domestic government assistance (subsidies), or foreign aid or official development assistance.

Scenario: A ‘scenario’ is an internally consistent and plausible characterization of future conditions over some specified time period. Each sectoral I&FF assessment for mitigation / adaptation requires that both a baseline scenario and a mitigation scenario be developed for that sector. In the I&FF assessment methodology, each scenario will have associated with it a stream of annual IF, FF, and O&M costs. The relevant investment costs for a sector are projected for two scenarios: 1) a baseline scenario, which reflects a continuation of current policies and plans, i.e., “business-as-usual” scenario, and 2) a mitigation / adaptation scenario, in which new policy measures are introduced to forestall continued GHG emission in order to reduce climate change or to adapt to climate change. The investment costs of the baseline and mitigation scenarios are then compared to determine the changes in investments needed to mitigate emissions from the sector. Note that changes in investments may include not only increases in investments (new funding), but also shifts in existing investments (reallocations of existing and currently projected funding levels such that funds in one area decrease, and funds in another area increase).

Baseline scenario: The ‘baseline scenario’ in both cases is a reflection of business-as-usual or non-policy case conditions, i.e., it is a description of what is likely to occur in the absence of new policies to address climate change. The baseline scenario describes expected socioeconomic trends (e.g.,

population growth and migration, economic growth), technological change (if relevant), private sector and government plans for the sector, and expected business-as-usual investments in the sector (i.e., specific new assets and programs) given those trends and plans. If policies to address climate change are already being implemented, they should be reflected in the baseline scenario. The description of the plans or forecasts for investments should include information about the nature, scale, and timing of those investments; i.e., information that is needed to derive estimates of annual I&FF, and associated O&M costs.

Mitigation scenario: The 'mitigation scenario' describes a scenario that incorporates policy measures to mitigate GHG emissions. This includes policy measures that describe expected socioeconomic trends, technological change (if relevant), new measures to mitigate GHG emissions, and the expected investments in the sector given implementation of the mitigation measures. Mitigation scenarios should include information about the nature, scale, and timing of the investments.

Adaptation scenario: The adaptation scenario incorporates new measures to respond to the potential impacts of climate change and describes the expected investments in the sector given implementation of the measures to respond to potential impacts. Both the mitigation and adaptation scenarios should include information about the nature, scale, and timing of the investments.

Assessment period: 'Assessment Period' refers to the time frame for the assessment; i.e., the number of years spanned by the baseline and climate change scenarios and the associated stream of annual IF, FF, and O&M costs. The assessment period for I&FF assessment should be at least 20 years and not more than 30 years.

Base year: The base year is the first year of the assessment period, i.e., it is the first year of the baseline, mitigation, and adaptation scenarios. The base year should be set at a recent year for which I&FF and O&M information is available so that the IF, FF, and O&M costs for the first year of all the scenarios are historical data. This grounds the start of the streams of cost data for each scenario in reality.

2. Summary of sectoral assessments

2.1 Energy sector

Sector scope

Following team meetings on the sectoral scope, the Energy Team members decided to select the cooking fuels substitute as their main focus due to the fact that more than 80% of the national energy consumption in the resident sector is from fuelwood. Liquefied petroleum gas (LPG) was selected as the substitute.

Base year and assessment period

The base year of the assessment is chosen as 2005. The assessment period for the exercise has also been agreed as 2005 – 2030 according to the I&FF methodology. In the utilization of the currency in the exercise, the Gambian Dalasi (GMD) was converted to constant 2005 USD. The central bank policy rate of 19 per cent is used to compute the Present Value. The current value of the Dalasi was first deflated using the CPI and then converted to US\$. The exchange rate used is taken from the Central Bank of The Gambia Annual Reports where 1US\$ is equal to GMD 28.13.

Mitigation measures for which I&FF were assessed & results

To reduce emissions of greenhouse gases in the energy sector the following key measures have been proposed:

- provide fiscal incentives to reduce high consumption through energy efficiency;
- better manage natural resources by integrating the local population;
- diversify fuel substitutions for cooking including modern biofuels;
- use improved cooking stoves to reduce fuelwood and charcoal consumption;
- promote biogas production in rural areas from animal and crop residues;
- promote solar cookers as an alternative to wood and charcoal for cooking.

The team of national experts has determined that US\$ 423.29 million is needed

The mitigation options selected for this sector activity is the widespread utilization of LPG for:

- Buildings: Investments in this category include construction and maintenance of warehouses and other physical structures for offices and proper storage of equipment and plants for safe and efficient operation and maintenance. A typical example is that one of the Gas Dealers does not even have a warehouse for the vehicle fleet including the truck tankers and this could be dangerous from safety point of view: US\$ 86.90 mil.
- Plant & Equipment: In this category, all the filling plants and associated infrastructure related to operation in receiving the gas for bulk supply and delivery to dealers and other retailers. It includes large tanks for storage at dealer's site, gas cylinders and burners, filling plants, etc.: US\$ 257.40 mil.
- Vehicles: As the name suggests and covers all road transportation and could include a barge as well for efficient supply to the rural areas using the river. This is applicable for taking delivery from the bulk storage depot in large truck tankers to dealers' filling plants in the urban, rural and peri-urban areas and also delivery to various retail outlets: US\$ 78.99 mil.

With an annual projection increment of 8% in the consumption of LPG in the mitigation scenario, as a result of government policy interventions and increase in population, there is evidence for a need to increase the capacity of LPG storage facility to match with the increased demand.

Major investment shifts in I&FF are needed for expansion of LPG storage facilities. Additional ton of storage capacity is needed anytime the demand is double or almost double the capacity of the storage facility. Operation and Maintenance expenses increased as LPG business expand. Based on

the projection for the mitigation scenario, additional metric ton capacity will be needed in 2015, 2019, 2022, 2024 and 2026.

In the baseline scenario, the use of LPG for cooking is not expected to increase beyond 5% and therefore major investment on bulk storage facility is projected in 2012 and 2028.

With the policy objective of private sector led growth, corporate entities are expected to be major investors and not government. The government intervention will focus mostly on creating enabling policy environment to attract private investment in order to sustain the supply and increasing LPG demand to reduce the dependence on the environment.

Policy implications

There is large difference between the IF, FF and O&M for both the baseline and mitigation scenarios, causing large incremental costs to implement the mitigation measures. The following outline the concrete steps that need to be undertaken and reinforced:

- Elaborate a legal and regulatory framework to enhance and develop among other things standards, safety, enabled market environment for private sector participation and consumer participation and confidence;
- Conduct education and sensitization campaign for safe and efficient utilization of LPG;
- Conduct widespread sensitization in urban and peri-urban areas for greater awareness, understanding and adoption in the use of LPG as a cooking fuel in order to achieve the targeted percentage of population use and save the environment;
- Introduce further fiscal incentives such as complete tax exemption to further reduce high cost of the gas particularly for the ordinary people to increase the demand and thereby reducing dependency on forest resources;
- Provide tax breaks to companies and businesses to create additional favourable investment climate and thereby increase supply of LPG and make the price affordable;
- Explore innovative financing schemes such as carbon funds, that would cushion the high infrastructure investment costs since LPG is a clean cooking fuel substitute;
- Introduce security stock of LPG to ensure sustainable supply of the gas and avoid shortage to switch to LPG;
- Introduce clean fuels levy on traditional biomass from the supply side so as to make LPG competitive and use this levy also to support the sensitization campaign and the supply price;
- Encourage private sector Partnerships for private sector investments for the LPG sector in the procurement of the fuel and supply/manufacture of components and parts.

Uncertainties and methodological limitations

In conducting the assessment the major limitation was the availability of the data and hence the estimates for the projections. It was one of the gas dealers involved in the distribution market who cooperated with the Energy team to provide the data. Based on the data provided from this company, the assumptions were made and projections calculated. From the overall national LPG data collected from the bulk importer and supplier of LPG, this company accounts for about 37.5% of the LPG distribution market.

Other data availability posed the same problem as there continues to be anxiety within the business community about the issue of confidentiality and taxation. Therefore, a better mechanism needs to be in place to assure the business community.

2.2 Forestry sector

Sector scope

The assessment considers investments and financial flows already made in the following forestry sub sectors:

- natural forest management,
- forest plantation development form state and private, and
- the community forestry scheme.

In using these three sectors for scoping purposes, we are compelled to define the following forest mitigation options to be considered during the length of this assessment:

- Reducing emission from deforestation and forest degradation (REDD)
- Addressing forest degradation by enhancement of carbon density of degraded and other existing forests through SFM / forest restoration (FR)
- Afforestation and reforestation (A/R) as defined in the CDM framework, which includes agro forestry.

Due to data constraints, it was decided to focus only on the third of these measures, namely afforestation and reforestation.

Base year and assessment period

After a thorough desk review of various forestry study and climate change documents, the forest consultancy group accepted working on the assessment period for 30 years starting from the year 2000 with 2005 as the base year.

The currency of the Gambia is the Dalasi. The team used Google search (http://en.wikipedia.org/wiki/Tables_of_historical_exchange_rates_to_the_United_States_dollar) to convert the Gambian Dalasi from 2005-08. From 2005 to 2008, the currency conversion rate of the US\$ to the Dalasi is 29.24, 25.00, 27.75 respectively. From 2009 to 2010, the currency fluctuates between 27.00 to 29.00. For this scholarly work, the team used 1US\$: GMD27.70 as an average for the current conversions on the investments.

Mitigation measures for which I&FF were assessed & results

The analyzed mitigation options are:

- reducing emission from deforestation and forest degradation (REDD);
- Addressing forest degradation by enhancement of carbon density of degraded and other existing forests through Sustainable Forest Management / forest restoration;
- Afforestation and reforestation as defined in the CDM framework, which includes agro forestry.

US\$ 502.45 million will be needed for the forestry sector to reduce emissions from afforestation:

- Plantation: Woodlot development took a center stage in the fight against desertification and supply of fuel wood for domestic energy at community level. The government with the Internat. Fund for Agricultural Development (IFAD) established over 150 ha of forest plantation with fast growing or multi-purposes trees like Gmelina, Mangoes, Eucalyptus, Oranges, Cassia, and Cashew, sometimes combined with Cassava, Maize, Solanaceae as in an Agroforestry system.
- National tree planting: In 1996, the Government of The Gambia gave a directive for the Ministry of Forestry to annually plant 1,000,000 trees, which is being carried out until present. The seedlings or planting stock are provided from the National Forestry Fund, individuals and the private sector.
- Road side tree planting: Road side tree planting to enhance road drainage and stability is being done as part of the afforestation programme. This planting is done mainly within the villages.

- Research and Development: Included in development programme of the forestry sector, research and development will be done to ensure that appropriate measures are adapted towards conserving the genetic pool of species natural to the Gambia that are more drought resistant and useful for community livelihoods. The protection and conservation of mangroves which have the highest value for carbon sequestration will be encouraged including their growth through plantings.
- Forest management equipment and training: Better prevention of forest fires and illegal loggings through better equipment of vehicles and transport facilities. More trainings to be done from communities to collaborating institutions on the rational use of forest resources and reforestation after harvesting. Renovation of dilapidated forest buildings including administrative centers and communication facilities. Forest fire fighting equipment, nursery centers to produce adequate planting stocks will have to be developed. Finally, community forestry be highly promoted with adequate staff and community trainings.

➔ The total investment in the afforestation activities mentioned above was mainly made from Government budget and allocation. There will be a significant change in mitigation if direct foreign investments are made available for investment particularly on Afforestation. Since the country depends heavily on fossil fuel for generating electricity and powering machines, the greenhouse gas release continues to increase with the increase in population. There is need to shift from heavily investing on SLM to Afforestation on degraded lands.

Policy implications

- Issues of land tenure need to be addressed to solve issues with logging, more secure land tenure needed: The Local Government Act (2003) states that all land within the country belongs to the State. However, according to traditional land ownership the Governors, Chiefs and Alikalolu are assigned to administer land ownership on behalf of Government. However, owning land does not necessarily make an individual the owners of the natural forest on that land. Therefore land ownership goes along with forest ownership transfer to an individual / community through a forest tree transfer process. In the entire land ownership, the Forest Policy has not to discriminate gender in the transfer of forest ownership to any sector of the society. So women have been given a special priority to acquire tree branches for domestic and commercial purposes in order to reduce forest dry biomass against fires.
- Finding approaches to meaningfully restore wastelands rather than to use forested areas for agriculture, which only offers short-term agricultural benefits, but long-term environmental damage through loss of soil fertility and eventually erosion: Causes of wastelands are the application of chemicals, use of inappropriate equipment, commercial monoculture, expanding settlements, bushfires, road constructions and electrification, over grazing and illegal logging, wind erosion and drought, leading to desertification in the North Bank Region. As the call for food self sufficiency and supply of domestic energy is a priority, the rehabilitation of waste lands for agricultural and afforestation is necessary, e.g. through fast growing trees. Therefore, forest investments and Financial Flows should give high priority on waste land rehabilitation and management.
- Positive co-benefits include health aspects such as when traditional cooking systems are replaced with non-smoke emitting alternatives: Benefits need to be shared fairly between Government and communities to build incentives. The Departments of Community Development, Forestry and Energy needs to continue introducing alternative domestic energy equipment and to ensure that the devices are environment friendly and socially acceptable such as the modernized cooking stoves as the 'Kumba Gaye, No Fly' on including briquetting of biomass and waste. The use of the new stoves and briquetting of biomass (as opposed to the open three stone stoves), leads to a strong reduction of fuel wood use as well as a strong reduction of disease records, particularly among women who collect and use fire wood. Disease like bronchitis, lung cancer, chest problems including burns and eye reddening from smoldering and open fires on women can be drastically reduced. The emission of Carbon dioxide using modern stoves can be said to be insignificant. Eventually, another positive co-

benefit is that with less wastelands i.e. more arable land conflicts between land users can potentially be reduced.

→ Priority measures would be incentives for investing on forests such as loans and grants. Land tenure arrangement should be revisited that people who are interested in land for forest use have clear rights. People should be adequately sensitized on sustainable forest management. Private individuals with the potential to establish plantations on degraded land should be encouraged.

The potential implementation barrier on the investments are that neither the Government nor the population is aware of the enormous long term benefits that can be realized from forest management.

Uncertainties and methodological limitations

The uncertainties include:

- Difficulty to ensure regular and reliable funding from funding sources
- Unstable climatic environment
- High staff attrition in institutions leading to knowledge loss
- Low community confidence in forest ownership transfers from the state to them
- Forest destruction and degradation
- Forest fire ravages
- Competition on land for other uses.

Future analytical efforts should focus on funding of projects and programmes including capacity development for staff, communities and infrastructural development.

2.3 Agriculture sector

Sector scope

It was decided to concentrate on the rice subsector rather than the entire agriculture sector. The reason is that about 81% (22.1 Gg) of the CH₄ emissions in the country is from rice production and related activities, and knowing that there is substantial investment requirement in the area. Another salient point is the contribution of the subsector to present and future staple food supply, food and nutrition security, and its contribution to the national economy and potential for economic growth are highest.

Out of the total cereal (early millet, late millet, sorghum, maize and rice) area of 317,079 hectares cultivated in 2010, about 27% was allocated rice cultivation, which is the highest land area under cereals. Another salient indicator why rice sub-sector is selected is the per capita consumption of cereals in the country which is about 175kg, and rice alone is about 67% of the 175kg (NASS, 2010).

Base year and assessment period

The year 2005 was chosen as the base year for the assessment. The assessment period for the exercise has also been 2005 to 2030. The Gambian Dalasi (GMD) was converted to constant 2005 USD, the central bank policy rate of 19 per cent is used to compute the Present Value. The current value of the Dalasi was first deflated using the CPI and then converted to US\$. The exchange rate used is taken from the Central Bank of The Gambia and GBoS for the base year, 2005 was US\$ 1 = GMD 24.60.

Adaptation measures for which I&FF were assessed & results

The government of The Gambia in line with the Millennium Development Goals (MDGs) and Vision 2020, is to transform the agricultural sector not only to establish peri-urban and urban enterprises but also to transform the subsistence farming system particularly the rice sub-sector to a surplus producing system that will free the small farmers from traditional institutional constraints and

practices hence achieve the MDGs goal of eradicating extreme poverty, hunger, ensuring environmental sustainability, and food self sufficiency.

US\$ 434.96 million is needed to adapt to the effects of climate change in the agriculture sector through the implementation of four main measures:

- Improvement of Agricultural Land and Water Management: To increase food security, income generating capacity and nutritional status of the farmers, especially women and youth through the use of sustainable land and water management practice for the cultivation of 25,000ha of land through: 1. lowland development for rice production; 2. irrigation for horticulture and upland crops; and 3. capacity building of support services institutions: US\$ 147.65 mil.
- Development of Agricultural Chains and Market Promotion: To transform the agricultural sector from a traditional subsistence economy to a modern market-oriented commercial sector with well integrated food chains and a viable agro-processing private sector, resulting in increased incomes of agricultural value chain actors (including farmers, input suppliers, processors, traders and exporters) through: 1. Development of Agricultural Marketing Chains (including food crops, groundnut, horticulture, agro-forestry food products, short-cycle livestock, dairy products and fisheries products); 2. Strengthening of National Operator Support Services and Structures; and 3. Development of Domestic, Intra-regional and Extra-regional Markets: US\$ 46.33 mil.
- Sustainable Farm Development: To achieve increased and sustained agricultural production and productivity growth by introducing agricultural practices through people-centered learning processes that enhance and conserve local natural resources and the environment, and help smallholder farmers to adapt to climate change through: 1. Sustainable Farm Management; 2. Land Use Suitability and Land Tenure Security; and 3. Capacity Building of Support Services and Farmer Organizations: US\$ 75.02 mil.
- Development of Livestock Species Resistant to Weather Conditions: Production of short-cycle livestock expanded (small ruminants, poultry and pigs). These activities will appropriately manage so as to have no negative impact on the environment. It will increase dairy products, food security farm incomes and foreign exchange savings: US\$ 165.95 mil.

Policy implications

- The national policy makers have the responsibility to introduce radical and sweeping new priority investment initiatives such as the Gambia National Agricultural Investment Program.
- Consequently, the political class must be won over to appreciate the gravity of the problem. Here is a quite a ray of hope in that currently, there exists an active a dynamic Environment and Sustainable Development Sub-Committee of the National Assembly whose members are mainly people with backgrounds in agriculture and natural resources discipline.
- The fact that top appointees to positions of environmental management such as the current Minister of Forestry and the Environment (Ex Head of the Forestry I&FF Team) is a positive sign for a sustained positive policy environment for national budgetary support towards climate change investments, which have to be turned into practice now.
- Given the potential severe consequences of a 'business as usual' scenario, huge public sensitizations on both the causes, consequences and mitigation/adaptation options required to save the country from the calamities of climate change. This is necessary because many climate change related problems are attitudinal or cultural in nature and hence, demand painstaking education, training and mentoring of broad strata of society. Civil Society Organizations (CSOs) are particularly suited for these grassroots forms of this program component and would prove critical to its successful implementation.

Uncertainties and methodological limitations

There are institutional, economic, social and technological challenges to accomplishing a high quality investment and financial flows assessment. Institutionally, relevant data are scanty at best in such

lead institutions like the Gambia Bureau of Statistics (GBoS), and Ministry of Finance and Economic Affairs (MOFEA), and even the Central Bank of the Gambia.

Such human factors like the loss of institutional memory arising out of the departure of experienced staff, unwillingness to divulge information to others, and perhaps, hidden envy to the consultants, are social causes of the analyses. The Government may be willing, but simply lacks the revenue base to provide the needed resources.

2.4 Water sector

Sector scope

The assessment covers the water resources management problemshed (“sector”) from which specific issues (“sub-sectors”) are taken up and studied in depth. For consistency and benefit of the current assessment, we have used a developmental lens to identify: 1) water resources assessment; 2) water supply; 3) drainage and sewerage; and 4) hydropower generation sub-sectors. The assessment focuses on water resources assessment and water supply in the Kombo Peninsula and rice-growing areas in the Central River Region which best epitomize water security hotspots within the country. The table depicts the framework highlighting sub-sectoral processes and activities as well as investment entities.

Table: Subsectors processes, activities and investment entities

Sub-sector	Processes	Activities	Investment Entities
Water resources assessment	Replenishment/ renewal; Flow dynamics; Quality dynamics	Research and systematic observations/monitoring, regulation and enforcement,	DWR
Water supply	Water resources appropriation	Exploration, engineering, source protection, operations (water abstraction)	NAWEC, Ministry of Agriculture (MoA)*; Water bottling / packaging companies, households; Equipment suppliers, Engineering/consulting firms
	Water quality improvement	Water treatment / purification (pH rectification, deferration, chlorination), laboratory analyses	NAWEC, DWR, Water bottling / packaging companies
	Water distribution	Metering, leakage control, marketing	NAWEC, Water bottling / packaging companies, Retail outlets

* MoA = Overseer for Farmer-Managed Irrigation Systems, Community farms operate independently

Base year and assessment period

Investment and financial flows assessed in this study are for the period 2011 to 2030. Historical data for the period 2000 to 2010 are analyzed to uncover investment patterns that serve to inform projections over the assessment period. For purposes of comparability, constant 2005 US dollars, associated with the 365-day averaged floating exchange rate during that year, is used for conversion of expenditure made during other time periods.

Adaptation measures for which I&FF were assessed & results

US\$ 16.79 million is needed to adapt to the effects of climate change in the water sector through the implementation of three resource management measures:

- ✓ Institutional strengthening: Salaries and incentive packages for personnel, resource mobilization and allocation strategies to build greater resilience to climate change: US\$ 0.55 mil.
- ✓ Water conservation: Increasing water-use efficiency in irrigation and municipal water supply sub-sectors , decreasing industrial water demand in the next five years due to water saving techniques: US\$ 3.14 mil.

- ✓ Relocation of wellfields/abstraction points that are threatened by saline intrusion, regulation and licensing of water withdrawals, representing significant opportunities to address anticipated water scarcity and quality problems: US\$ 13.1 mil.

Yet a fourth management measure

- ✓ Supply augmentation: Leakage control in water distribution networks minimizing the percentage of water lost through leakages from current levels to 15% by 2015 and 10% by 2025 through investments in leakage detection activities and promote repair of leaking mains: Promises net savings of US\$ 30.92 mil. when synchronized and implemented in tandem with water conservation.

Implementing all four measures together will therefore lead to a saving of US\$ 14.13 mil.

The dominance of resource flows in the municipal water sub-sector is such that appropriate adaptation in this sub-sector holds the promise of significant investment savings in the water sector as a whole. In both baseline scenario and incremental expenditure analysis, external funding including loans varies between 14 and 59% of annual investment needs, averaging out over the 20-year study period to 44% of priority investments in the water sector. On the other hand, private investments in network expansion accounts for 9 to 27% of sector investments, higher figures coinciding with years in which public investments at relatively low. If interest on active loans, amounting to between 285,960 and 855,405 USD (2005 base), are taken into account, private sector participation drops a little to between 8 and 24%.

Policy implications

Important factors to be integrated in domestic and international policy frameworks to mobilize resources for adaptation include:

- The scale of investments and operational expenditures is linked to customer demand for services, status of capital stock, and relevant policies. Operational and strategic policies should be geared towards slowing down deterioration of assets, encouraging optimal borrowing, and fiscal discipline. Public utilities should develop dynamic asset management plans.
- The implementation of measures analyzed in the subsector municipal water holds the promise of significant investment savings in the water sector, which also has a significant bearing on foreign borrowing.
- Recommended per-capita figures in the national water policy could be cut down significantly with water-saving technology without loss of social welfare. This finding needs consideration and action in terms of developing industry standards that are enforced after expiry of a reasonable transition period.
- The water sector is divided into several sub-sectors handled by different ministries. In the absence of a strong coordinating body however, such fragmentation has made it difficult to undertake investment planning in a holistic manner. Implementation of a Science, Policy and Legislation, Investment, and Infrastructure Development-like framework is essential to optimal allocation of resources.
- End-users' ability-to-pay should be viewed in the context of service providers' (public institutions and enterprises) own ability to meet costs, and the impact of service fees on household budgets. Against the background of widespread poverty, pricing policies must not pressurize households into zero-sum budget decisions. Through direct and indirect taxes, households ultimately shoulder public institutions'/enterprises' full costs, albeit in an apparently disconnected manner.
- The Department of Water Resources should be the focal point for investment scheduling in the water sector to ensure coherent and efficient planning. The Ministry of Finance and Economic Affairs should be a privileged partner in the development and review of investment plans. To fulfil this role, the Department of Water Resources needs so build capacity.

- It would be necessary for the water sector to establish tariffs regulated by the Public Utility Regulatory Agency (PURA). The water policy and PURA's mandate should also prescribe minimum services standards to decrease investment risks.

Uncertainties and methodological limitations

Although executed with due diligence, the piece of work presented in previous sections of this report is not a perfect one. Epistemic uncertainties regarding the relationship between FF, O&M and asset life still remain. Government budget allocations to the water resources assessment sub-sector constitute another area of uncertainty.

We count our uncritical acceptance of some values presented in project budgets as a weakness in the approach, but the reasons are clear. First, these are officially adopted budgets, and second, budget reviews are outside the scope of our work. Specification bias in the context of scenario development, as well as partition coefficients applied to financial flow streams represent a methodological constraint imposed by lack of perfect foresight and absence of blue-prints for proposed interventions. In anticipation of case studies in which no or weak mathematical relationships exist between FF and O&M time series, it might be helpful to carry out a cross sectional analysis of FF and O&M data with the objective of recommending default values to analysts who find themselves in an impasses.

3. Summary tables of incremental investment costs

Table 1: Incremental Cumulative Discounted I&FF for All Investments in Each Sector, by Investment Entity and Funding Source (in million 2005 US\$)

Investment category	Funding source		Mitigation					Adaptation					
			Energy			Forestry		Agriculture			Water		
			ΔIF	ΔFF	ΔO&M	ΔI&FF	ΔO&M	ΔIF	ΔFF	ΔO&M	ΔIF	ΔFF	ΔO&M
Households	Total		-	-	-			5.73	0.00	0.00	0.00	0.01	0.01
Corporations	National	Total	-	-	-			54.20	32.18	3.68	-3.23	-1.56	-0.88
	Foreign	ODA	-	-	-			49.15	52.98	15.03	0.00	0.00	0.00
	Total		98.06	241.36	43.12			96.57	85.16	18.71	-3.23	-1.55	-0.87
Government	National	National Budget	-	-	-			59.87	-5.91	0.37	0.02	0.33	0.19
	Foreign	Loan	-	-	-			-65.54	6.94	0.00	-9.69	0.00	0.00-
		Bilateral ODA	-	-	-			-16.32	-4.60	0.00	-0.02	0.00	0.00-
		Multilateral ODA	-	-	-			18.37	9.24	0.00	0.51	0.07	0.04
		Total foreign source	-	-	-			62.73	46.00	8.84	0.00	0.00	0.00
	Total		-	40.76	-	119.74	382.72	59.11	51.67	9.21	-9.20	0.07	0.04
TOTAL			98.06	282.12	43.12	119.74	382.72	161.41	136.83	27.92	-12.43	-1.48	-0.83

Negative values mean net savings

IF = Investment Flows, FF = Financial Flows

ΔI&FF = incremental changes of Investment and Financial Flows

Source: National I&FF assessment

Table 2: Incremental Annual I&FF for All Investments in Each Sector (in million 2005 US\$)

Year	Mitigation					Adaptation					
	Energy			Forestry		Agriculture			Water		
	Δ IF	Δ FF	Δ O&M	Δ I&FF	Δ O&M	Δ IF	Δ FF	Δ O&M	Δ IF	Δ FF	Δ O&M
2005	-	-	-	3.068	11.028	18.67	9.63	2.40	0	0.0	0.0
2006	-	0.07	0.04	1.624	11.279	19.60	10.11	2.52	0.0	0.0	0.0
2007	-	0.17	0.08	3.249	13.593	20.58	10.61	2.64	0.0	0.0	0.0
2008	-	0.30	0.13	4.693	16.426	21.61	11.14	2.77	0.0	0.0	0.0
2009	10.01	0.45	0.21	2.888	17.395	22.69	11.70	2.91	0.0	0.0	0.0
2010	-	0.83	0.28	9.025	20.852	23.82	12.28	3.06	0.0	0.0	0.0
2011	-	1.11	0.35	14.560	36.449	25.73	12.72	3.33	0.0	0.0	0.0
2012	-10.01	1.46	0.43	20.096	54.673	27.19	13.15	3.52	0.0	0.0	0.0
2013	-	1.89	0.53	25.631	72.898	28.63	13.61	3.70	-8.7	0.0	0.0
2014	-	2.39	0.63	31.167	91.122	30.07	14.07	3.89	-8.5	0.1	0.0
2015	10.51	2.99	0.75	36.702	109.347	31.50	14.53	4.08	1.2	0.2	0.0
2016	-	3.70	0.88	42.238	127.571	32.94	15.00	4.27	9.2	0.1	0.0
2017	-	4.55	1.03	47.773	145.796	34.38	15.46	4.46	8.9	0.0	0.0
2018	-	5.56	1.19	53.309	164.021	35.82	15.92	4.65	-13.0	0.0	0.0
2019	11.03	6.75	1.38	58.844	182.245	37.25	16.38	4.92	-12.8	0.0	0.0
2020	-	8.16	1.58	64.380	200.470	38.69	16.84	5.11	0.0	0.0	0.0
2021	-	9.81	1.81	69.915	218.694	40.13	17.31	5.30	12.3	-0.1	0.0
2022	11.58	11.76	2.06	75.451	236.919	41.57	17.77	5.49	0.0	0.0	-0.1
2023	-	14.06	2.35	80.986	255.143	43.01	18.23	5.67	-11.8	-0.1	-0.1
2024	24.33	16.75	2.66	86.522	273.368	44.44	18.69	5.86	0.0	-0.1	-0.1
2025	-	19.91	3.01	92.057	291.592	45.88	19.15	6.05	11.4	-0.1	0.0
2026	51.10	23.62	3.39	97.593	309.817	47.31	19.62	6.24	0.0	-0.1	-0.1
2027	-	27.95	3.82	103.128	328.042	48.76	20.08	6.43	-10.9	-0.1	-0.1
2028	-10.51	33.02	4.30	108.664	346.266	50.19	20.54	6.62	-3.6	-0.1	-0.1
2029	-	38.95	4.83	114.199	364.491	51.63	21.00	6.81	7.0	-0.2	-0.1
2030	-	45.87	5.41	119.735	382.715	53.07	21.46	7.00	6.9	-0.2	-0.2
Total	98.06	282.12	43.12	1367.508	4282.222	18.67	9.63	2.40	-12.4	-0.9	-0.9

Negative values mean net savings

IF = Investment Flows, FF = Financial Flows

Δ I&FF = incremental changes of Investment and Financial Flows

Source: National I&FF assessment

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