

## NATIONAL ISSUE REPORT ON KEY SECTOR OF ENERGY FOR MITIGATION

### 1. Why Energy is a key Sector for the Country

Energy is commonly described as the engine that drives the economy. In The Gambia this description is not in anyway less true and the authorities have since realised the importance of energy in national development with the transfer of the energy portfolio into the Office of the President in 2002 and the creation of a Department of State (or ministry) for Energy in September 2007.

The economy is primarily agrarian, with agriculture employing about 70% of the labour force and accounts for about 22% of GDP (2007). In the same year, the energy sector account for about 0.8% of GDP attributed to the electricity, gas and water supply. The other sub-sectors of fuelwood and petroleum products are accounted under the forest produce and trades sub-sectors. The entire sector account for over 2000 employees which is less than 2% of the formal workforce.

Other than electricity sub-sector, trade in the entire energy sector in The Gambia is not regulated. Formal sectors include electricity, petroleum products including Liquefied Petroleum Gas (LPG) and small renewable energy sub-sector. Trade in fuelwood sub-sectors comprising firewood and charcoal is not regulated and it is informal. The trade involves the petty traders and middlemen, who commandeer all the profit leaving very little profit for the retailers and local people.

Revenue accrued from the energy trade is enormous. For fuelwood, volume of sales is estimated at D304 million per annum. This corresponds to the aggregated market value of firewood and charcoal traded within the GBA for 2007. In comparison, electricity sales for 2007 were D1300 million and petroleum products sales for the same year is estimated over D3000 million. Sales in solar PV and other renewable energy sources are minimal.

The Gambia's endowment with energy resources is modest. It comprises fuelwood, petroleum products including liquefied petroleum gas (LPG), electricity, and renewable energy (solar energy) potentials are high. However, the initial cost of systems makes this option less favourable. Amidst these unsustainable means of energy supply, where all the modern energy sources of petroleum products and electricity are relied heavily on external supply, that requires the availability of foreign currency, the energy supply situation is therefore insecure and over dependent. Widespread adoption and utilization of solar, wind and modern biomass will provide more energy security and independent and this has been recognised by the government.

The issue of food security is related to the sustainable supply of energy services in most aspects. Food production, processing, transportation and preservation for certain food items depend on a larger extent on the availability energy services. Food security can be achieved with a combination of import and local production but sustainable supply of energy services is critical to enhance its security.

Provision of energy services in the Gambia is viewed from different perspectives: diversifying the supply option, energy efficiency measures through both the supply and demand side management and through regional cooperation. The Gambia is participating actively in the OMVG Energy Project that consists of the construction of two hydroelectric power generating stations at Sambangalou in Senegal and Kaléta in Guinea with an installed capacity of 368 MW. In addition, the project would also construct a transmission interconnection network between the electrical networks of the four countries of the OMVG of The Gambia, Senegal, Guinea Bissau and Guinea Conakry. The OMVG Energy Project is part of the greater West African project of interconnecting the transmission networks of the ECOWAS member states within the West African Power Pool (WAPP).

The OMVG Energy project is significant because it is expected to produce cheaper and more environmentally friendly electricity. This will diversify the energy mix and reduce the utilisation of fossil fuels for power generation that contribute to green house gas emissions. The utilisation of fuelwood, petroleum products and electricity generation using diesel and HFO contribute to emission of green house gases (GHG). Therefore the wider use of renewable energy, implementation of energy efficiency programmes will serve as mitigation option to reduce GHG.

In addition to the effect of utilising fossil fuels and fuelwood on the environment, there are effects on the imports of petroleum products on the economy for the balance of payment. While the utilisation of fossil fuels become a drain on the economy with little participation of the population in its trade activity and hence no social benefits, renewable energy, on the other hand, can contribute to employment creation, rural cash income and hence contribute to poverty alleviation. The cost of initial investment for solar systems have become the main barriers to widespread implementation.

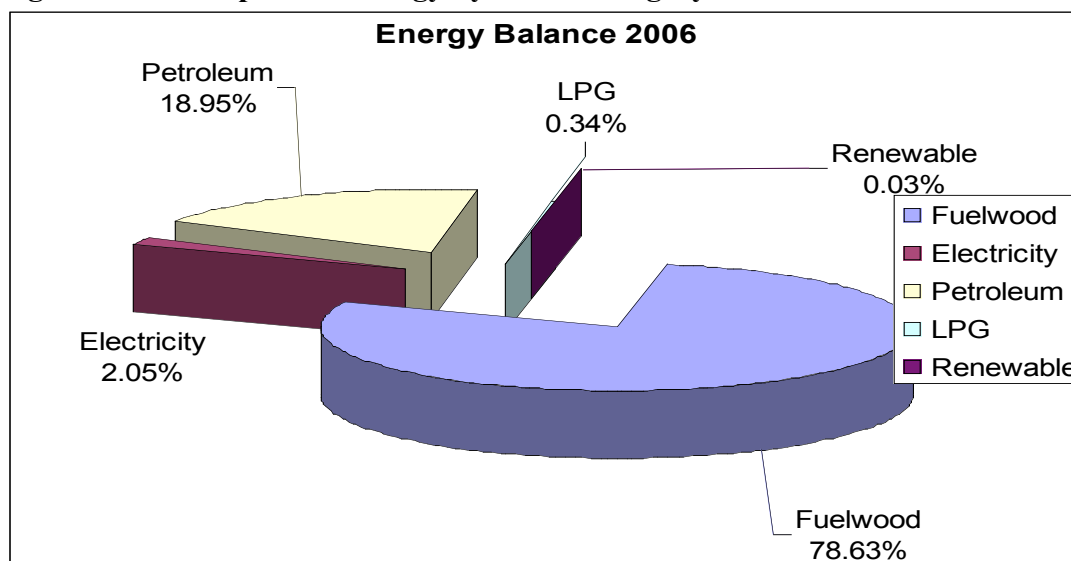
According to the Report on the Second National Communications in the energy sector in The Gambia, the energy sector contributed 1593.39 Giga grams (Gg) of CO<sub>2</sub> in 2006 compared to 885.7 Gg of CO<sub>2</sub> in 1995. This is an increase of 707.69 or 80% increase in CO<sub>2</sub> over the period. By segregated data, residential sector account for 78%, transport sectors 11% and electricity generation 8%. According to the Second National Communication, the energy sector contributes the greatest amount of the GHG emission for 2006. Consequently, the energy sector, which is now the most polluting sector, could contribute significantly in mitigating national GHG emissions with adoption of mitigation options. Attached at the Annex is a summary of the GHG emissions from the energy sector from 1995 to 2006.

Therefore, in the identification of mitigation options for The Gambia, cooking fuel substitute ranks the highest priority with the greatest potential to reduce GHG emission. Maintaining the consumption of fuelwood and other domestic fuels for 2006 at the 1995 figures would reduce GHG emission by 62%. This is followed by the transport sector and then the electricity production.

## 2. Energy Sector in The Gambia

The major sources of energy, according to the Energy Data (1996 – 2006), are fuelwood and its derivatives, which are extracted from the country's forest resources, petroleum products, electricity and renewable energy. Total energy consumed in 2006 is estimated at 506 thousand Ton Oil Equivalent (TOE), of which fuel wood accounted for about 79%. Electricity services account for about 2% and are available mostly in the urban areas and provincial centres of the rural areas with coverage of less than 25%, petroleum products account for 16% and renewable energy (other than fuelwood) less than 0.01%.

**Figure1: Consumption of energy by source category for 2006**



Source: DOS for Energy

More than 90% of the population depends on fuelwood as their domestic fuel for cooking. The rapid expanding populations especially in the urban areas and its very high dependence on fuelwood (firewood and charcoal) is contributing to the rapid deforestation.

Petroleum products, including the Liquefied Petroleum Gas (LPG) used as a cooking fuel substitute and diesel and HFO for generating electricity, is the second most important source of energy in the country. In 2006 The Gambia imported 128 thousand metric tons of petroleum products and there has been increasing trend since 1995.

Until August 2006, electricity power supply was grossly inadequate, erratic and extremely unreliable, negatively impacting on the economy and the environment. The electricity generation however has increased tremendously after the commissioning of the power plant in Brikama of 25 MW in August 2006 with an Independent Power Producer

(IPP). This new installation adds up to the existing installed capacity at the main power station at Kotu, which is about 28 MW to provide an available capacity of 50 MW in the Greater Banjul Area.

The transmission and distribution networks remain with some major bottlenecks due to aged and overloaded systems resulting in high losses. Transmission offloading capacity stands at 40MW while distribution capacity is only 32 MW against an estimated peak power demand of about 80 MW (March 2007).

A Rural Electrification project was recently implemented by the national utility NAWEC (National Water and Electricity Company) serving 46 towns and villages. The project was funded by ADB, BADEA and IDB at a cost estimate of US\$22.3 million (net of taxes).

### **Renewable Energy**

There have been some applications of renewable energy technology in solar, wind and biomass, which are the basic renewable energy resources in the country. The Gambia's geographical location endows it with abundant sunshine and therefore making it the most promising form of energy in the country. However, the high initial cost of installation makes it less attractive to ordinary Gambians. More than 700 KWp of solar PV system have been installed in the country as at end 2006 and it is increasing.

Wind speeds in the country vary according to season and location. The wind regimes are stronger during the dry harmattan season throughout the country than during the rainy season. A recent assessment of renewable energy potentials across the country reveals average wind speeds of 3 m/s especially at Tujereng, Kombo North, Western Region (WR). Wind energy has been exploited for water pumping across the country with over 20 wind water pumping systems installed.

Biomass (other than fuelwood) consumption in the Gambia is quite low and is limited to agricultural waste (saw dust or groundnut shell in the form of briquette). Biofuels of biodiesel and bioethanol were gaining recognition until March of this year when the global food crises lead to policy pronouncements that dampened this enthusiasm. There are however limited activities in the area of biofuels using jatropha. A number of projects have been initiated by The Gambia Government in the past to find alternatives and reduce the country's dependence on fuelwood and charcoal. These include Improved cooking stoves using both firewood and charcoal and Groundnut shell briquette. Biogas, has until recently remained in the research stations. In an attempt to curtail the rapid destruction of the forest, The Gambia banned the production of charcoal in 1981.

**Public Utilities Regulatory Authority (PURA)** was created by Government as a multi sectoral utility regulatory body in 2004 to regulate electricity, water and telecommunication operators in the country. In Petroleum Exploration and Production, the Petroleum Act (2004) on exploration and production was enacted to govern the administration and management of the upstream sector of the petroleum industry. The

Commissioner on Petroleum Exploration and Production administers this Act. Electricity Act 2005 provides a legal framework for regulation relating to electricity subsector and it is administered by PURA. For petroleum products, a bill has already been prepared and is awaiting validation.

The promulgation of the various legislations is to provide confidence to investor (both domestic and foreign) by creating a level-playing field for all interested individuals and businesses. Other than electricity sub-sector, where the Government has a public enterprise (NAWEC) for providing electricity to the population, the entire energy sector activities are dominated by the private sector. Recently the Government created another public enterprise – Gambia National Petroleum Company (GNPC) to take part in commercial operations in the petroleum sub-sector.

### **3. Mitigation Options for the Energy Sector**

From the various studies and reports, the following mitigation options for the energy sector are proposed.

Under policy view point, the follow approaches are recommended:

- Provide fiscal incentives for mitigation projects using renewable energy and energy efficiency projects;
- Better management of natural resources by giving local populations a stake in sustainably grown forests;
- Planting more trees on agricultural land and establishing better prices for fuelwood derived from theses plantations to provide rural incomes and incentives to grow more trees;
- Carrying out research to identify none food crops that are high yielding and could be used for biofuel production species;
- Increasing the productivity of agricultural land. By planting trees and crops that can be used as energy; and
- Diversify fuel substitutions for cooking (including modern biofuels of ethanol, methanol and bio-diesel) and transportation (gasohol, methanol, modern bio-diesel (pure vegetable oil or etherified vegetable oil) and biogas)

On technological based approaches, the following proposals have been made as mitigation options:

- Utilization of waste heat from power plants at Kotu: The power plants at Kotu utilise HFO for power generation. The exhaust heat is released into the atmosphere with GHG. There is a possibility of utilising the waste heat for producing steam to generate additional electricity. For the same amount of HFO,

the electricity production could be increased without increasing the GHG emission.

- Fuels Cells for Power Generation: Fuel cells convert chemical energy into electricity without first burning the fuel to produce heat. Fuel cell power systems are characterized by high thermodynamic efficiency and low levels of pollutant emissions.
- Hydropower: Even though theories have indicated the lack of potential for large Hydroelectricity within the limits of The Gambian territory, The Gambia is participating in the sub-regional organisation for the development of The Gambia River Basin (OMVG) to construct two hydroelectricity power plants at Sambagalo and Keleta in Guinea and the interconnection of the transmission networks of the countries involved: The Gambia, Senegal, Guinea Bissau and Guinea.
- Biomass Production: Potential biomass energy supplies include municipal solid waste (MSW), liquid solid waste or sewage, industrial and agricultural residues, existing forests, and energy plantations.
- Use of improved cooking stoves to reduce fuelwood and charcoal consumption
- Biogas Production: Biogas digesters can be used in rural areas to produce biogas from manure and crop residues at scales ranging from household to village. They provide fuel for cooking and power generation and its by-products is used in the form of fertilizer and feed for pigs and fish farms, and substantial environmental and human health benefits.
- Biofuels for Transport: Biofuels of ethanol and bio-diesel can be promoted using third generation feedstock for use in the domestic cooking subsector and as alternative transport fuels. These concerns have led Brazil and the United States to adopt policies promoting alternative vehicles and fuels. In light of the increasing demand, such policies are likely to become more widespread
- Use of public transport: Encourage the use of mass transportation to reduce the amount of fuel consumed in smaller cars
- Use of CFLs: replace the use of efficient lamps or CFL with the inefficient incandescent bulbs
- Introduce efficient devices and motors: Promote the use of efficient devices and motors to reduce consumption of electricity, reduce demand for electricity and hence its production and therefore delay the construction of a new power station.
- Installation of wind energy system: Installation of wind electric power system for supplementing the power needs of the country in place of diesel-based power generation to reduce GHG emission.
- Solar Electric Technologies: Rural electrification using Solar Home PV Systems to displace a planned diesel plant. Since they are modular, create no pollution in

operation, can be operated unattended, and require little maintenance. PV systems often will be deployed at small scales and close to users.

- Solar thermal-electric technologies: Solar thermal-electric technologies used to drive a conventional power-conversion system using only direct rays from the sun. Solar thermal-electric systems have the long-term potential to provide a significant fraction of the world's electricity and energy needs.
- Solar Thermal Heating: Solar thermal systems provide heating and hot water for domestic, commercial, or industrial uses. This application would save the electricity produced using fossil fuel.
- Solar cooking and solar cooling cycles in simple solar thermal systems:

Based on the reasons advanced above for prioritizing mitigation options due to contribution of the various end-use application, residential sector end-use has the highest consumption/demand, followed the transport sector, and then the energy industry (electricity generation). On the basis of the foregoing, the mitigation options have been screened and prioritized as follows using the proven and acceptable technologies:

Under residential sector, the following options are proposed:

- 1) Use of improved cooking stoves to reduce fuelwood and charcoal consumption:  
(i) Improved wood stoves such as Nofflie and (ii) improved charcoal stove called 'Jambar'.
- 2) Widespread utilization of LPG as a cooking fuel substitute
- 3) Widespread production and utilization of biogas especially with people with livestock, or using liquid municipal waste (sewage) or vegetable waste

Under transport sector, the following options are proposed:

- 1) Use of public transport: Encourage the use of mass transportation to reduce the amount of fuel consumed in smaller cars;
- 2) Biofuels for Transport: Biofuels of ethanol and bio-diesel can be promoted using third generation feedstock for use in the domestic cooking subsector and as alternative transport fuels.

Under energy industries or electricity generation;

- 1) Solar Electric Technologies: Rural electrification using Solar Home PV Systems to displace a planned diesel plant.
- 2) Use of CFLs: replace the use of efficient lamps or CFL with the inefficient incandescent bulbs
- 3) Solar Thermal Heating: Solar thermal systems provide heating and hot water for domestic, commercial, or industrial uses. This application would save the electricity produced using fossil fuel.

## Action plan for proposed mitigation measures

S/N	Activity	Period in months (X represents a week)						
		1	2	3	4	5	6	
1.	Establishment of the Task team	X						
2.	Identification of lead institution	X						
3.	Review of proposed mitigation option	XX	XX					
4.	Conduct analyses of impact of options on GHG inventory		X XX					
5.	Select a suitable model for analyses			XX				
6.	Establish the reference scenario			XX	XX			
7.	Conduct potential investment flow opportunities				XX	XXXX	XXXX	
8.	Analyse financial flow opportunities						XX	X
9.	Report writing							

**Note: For the Period, 1 refers to February 2009**



#### **4. Key Issues in Assessing Investment and financial Flow to Address Climate Mitigation**

Data for use in any planning process is very crucial. In the development of mitigation options, inventory of green house gases in the energy sector is necessary to determine the areas of operations, sub-sectors or technologies that are emitting these gases and quantities. It is only useful to know one's carbon foot print to be able to know the benefits from the mitigation options and also try to identify the funding mechanisms to approach such CDM.

Data sources for the energy sector activities can be summarised below:

1. Fuelwood: Dept. of State for Energy (DOSEN) and Gambian Bureau of Statistics (GBoS)
2. Petroleum Products:  
Oil Companies – GAMPETROLEUM Company (GP), GALP Energia (Gambia) Ltd, Total Oil (G) Ltd, Elton Oil Company and Castle Oil Company and JAH Oil Company  
Gas dealers: - Gamgas, Musa Njie Gas and Touba Gas
3. Electricity: NAWEC and Global Energy Group
4. Renewable Energy: VM The Gambia, Gam-Solar, Dabakh Malick Energy Centre (DMEC), Chybon Solar, Gambia Electric and Sanfosi.
5. Energy Efficiency: DOSEN and Public Utility Regulatory Authority (PURA).

Collection of energy data, and indeed any data in The Gambia, has always been a challenge from both the public and private sector. For public sector, the constraints for providing the information are sometimes associated with improper archiving of the information or data. Sometimes, the information is available but not compiled or analysed and in few instances the allocation of time and personnel to provide the information, even if the information is available is the constraint.

For the private sector, the same reasons advanced above for public sector could be true. However, in addition, even if data is available, some companies always associate data or information collection with taxes to be levied or benefits. In such situations, the information provided by the private company is either overestimated in the case of anticipation for benefits or underestimated in the case of anticipation of tax related issues.

In other instances, data providers are wearisome on providing their data to institutions that request the data for fear that their data may be leaked to their competitors. In all these instances, the confidence of the data provider has to assured and guaranteed.

To overcome the constraints mentioned above, the following methods are proposed to collect data. Depending on the institution and its mandate, data can be collected by:

- I. Surveys and from census data;
- II. Request through correspondence; and
- III. Legal and regulatory frameworks.

#### I. Surveys

Surveys have been one of the most reliable ways of collecting reliable information that is not available in any institution and cannot be reliably estimated. In The Gambia, surveys have been used for estimating the per capita fuelwood consumption, segregated consumption of some energy resources such as petroleum products consumption for sectors such as transportation, agriculture, industry, etc. Even though a representative sample size for the survey is adequately selected using statistical methods, the results provided are mostly estimates. In some instances, energy or economic information are included in a national census exercise.

#### II. Request through correspondence

Institutions that have reliable data for on their operations in the energy sector make the collection of data much easier. With this situation, the government department responsible for energy is in a better position to demand the data. It is however not always easy to receive data requested as some of the private companies are weary to provide data to even government agencies due to the concerns of taxation and confidentiality for others. In such situations, the response is never forthcoming and the need for follow-up giving explanation and confidence is required.

#### III. Legal and regulatory framework

Establishment of a legal and regulatory framework in any sector is the most appropriate tool to implement an efficient means of data collection. This is equally true for the energy sector. Development of legal and regulatory framework for the sector will provide the regulation of the sectors that could require the provision of annual reports with all the information required to the regulator and the supervising energy department. This makes the collection of data much easier and cheaper.

### **Modelling and scenario limitations and/or assumptions**

- Lack of capacity to run the model due to inadequate training or complexity of the model
- Lack of adequate data
- Models/scenarios sometimes cannot take into account all the scenarios such as social, environment and associated health benefits

- Default values are sometimes not representative of national values or circumstances

## **5. Recommendation for Conducting the Assessment of Investment and Financial Flows to Address Mitigation**

Department of Water Resources (DWR) is the UNFCCC Focal Point in The Gambia and they should lead all activities related to conducting the assessment of investment and financial flows to address mitigation. This should however be done in consultation with the Department of State for Finance and Economic Affairs (DOSFEA), as the Government agency responsible for coordinating aid flow (bilateral and multilateral) component, and the sector department of state (Department of State for Energy – DOSEN - in this instance), the participating civil society/NGO and private sector and the National Environment Agency.

DWR has always takes the lead in coordinating climate change issues including mitigation of GHG. In the conduction of assessment of investment and financial flow, DWR should serve as the coordinating department especially for identification of the mitigation options, screening, investment cost and complete financial analysis.

Once the final investment cost is established, DOSFEA should take the lead assisted by the DWR, DOSEN and the other collaborating institutions should identify the different sources of finance and approach the identified agencies/institutions.

Once the financing is secured, DOSEN should take the lead with the participation of DWR and DOSFEA.

In this process, there are two stages:

### **Stage 1: Identification Of The Mitigation Options And Complete Financial Analysis**

Coordination: Department of Water Resources

Other Stakeholders: DOSFEA, DOSEN, Department of Community Development (DCD) for improved wood cooking stoves, NAWEC for electricity and energy efficiency, Forestry Department and Department of State for Agriculture for biofuels, other Government Departments, NEA, NGO, and Private sector

### **Stage 2: Identification Of Sources Of Financing And Securing It**

Coordination: DOSFEA

Other Stakeholders: DOSEN, DWR, Department of Community Development (DCD) for improved wood cooking stoves, NAWEC for electricity and energy efficiency, Forestry Department and Department of State for Agriculture for biofuels, other Government Departments, NEA, NGO, and Private sector

## **National Sources Of Finance And Investment For The Energy Sector**

There are various options for financing and investment in the energy sector. However in The Gambia, the options are not many. The sources are:

- Gambia Government through the national Budget;
- Commercial Banks;
- Private Energy Companies;
- Micro financial institutions
- Bilateral and multi-lateral agencies: UNDP, British High Commission, US Embassy, Delegation of the European Union, etc.