GHANA

Population: 22,901,000 (2008)
Source: Demographic Yearbook 2008, Table 5 Estimates of mid-year population: 1999-2008. http://unstats.un.org/unsd/demographic/products/dyb/dyb2008.htm

Carbon emissions per country: 2007: 396
Source: (CDIAC) Carbon dioxide emissions (CO_2), thousand metric tons of CO_2. http://unstats.un.org/unsd/mdg/SeriesDetail.aspx?srid=749&crid=

Carbon emissions per capita: 2007, Ghana: 0,4289
Source: (CDIAC) Carbon dioxide emissions (CO_2), metric tons of CO_2 per capita. http://unstats.un.org/unsd/mdg/SeriesDetail.aspx?srid=751&crid=

Population below $1 (PPP) per day, percentage: 2006: 30 %
Source: http://unstats.un.org/unsd/mdg/Data.aspx

GDP per capita: Ghana $ 1,600 (2010 est.)
Source: https://www.cia.gov/library/publications/the-world-factbook/rankorder/2004rank.html

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GHANA

This section on Ghana constitutes to a large extent an extract and analysis of the WWF commissioned national review titled "Report on assessment of climate innovation and entrepreneurship in Ghana", produced by Science and Technology Policy Research Institute (CSIR-STEPRI) July 2009. More elaborate description and analysis of Ghana's national climate innovation system can be found in the full report at www.climatesolver.org.

As with many African countries, Ghana is particularly vulnerable to climate change, due to its lack of capacity to undertake adaptive measures to address environmental problems, and the socio-economic costs of climate change - health problems associated with malaria are a prime example. Available statistics indicate that malaria is one of the biggest causes of death in the country.

Climate-induced disruption of agricultural systems, flooding of coastal areas, and sea erosion are all tangible effects of climate change in Ghana, a country which ranks high amongst African countries most exposed to risks from multiple weather-related hazards. Ghana is vulnerable to floods and droughts, particularly in the Northern Savannah belt. Epidemics, pests, infestations and wildfires occur across the country. There are risks of landslides, storms, and storm surges. Coastal erosion has become more pronounced, especially along the Eastern coastline. The catastrophic floods in the North in 2007 affected more than 325,000 people, with close to 100,000 requiring assistance in some form or another to restore their livelihoods.[103]

When it comes to energy production, the large Akosombo dam has since its construction in 1965 produced the bulk of the total electricity generated; until the 1990s, Akosombo produced about 80% of national electricity supply. However, erratic and reduced levels of precipitation have in recent years started to seriously threaten the production capacity of the dam. Currently it produces about 65% of the electricity supply, which is still very significant. This is one factor among many demonstrating Ghana's need to review the nation's options for strengthening future resilience with a reliable and clean energy mix.

The Climate Innovation System in Ghana

The role of the Government

The Environmental Protection Agency (EPA) constitutes the designated national authority on climate change in Ghana. EPA, situated under the Ministry of Environment, Science, and Technology, has as one of its core objectives to "ensure environmentally sound and efficient use of both renewable and non-renewable resources in the process of national development" (2009) Furthermore, under the same Ministry, a National Climate Change Committee was established in 2009 whose objective to "develop strategies to deal with the current challenges of climate change and also develop a comprehensive National Action Plan to adapt to climate variability and change for the sustained livelihood of Ghanaians."[104] Apart from these central government actors there are several other actors including Ministries, Departments, Agencies, and Commissions that lead various programmes, projects, and activities relating to climate change, climate innovation, and entrepreneurship.

In 2003, Ghana produced its technology needs assessment (TNA) as required by the UNFCCC. Through a consultative process, a set of criteria was adopted for selecting

103 World Bank (2010) .
104 Article from Ghana News Agency, 24 June 2009: http://www.ghananewsagency.org/.

Several climate and environmental challenges can be addressed with climate innovations in Ghana, e.g. waste treatment and coastal erosion.

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relevant technologies within the energy and waste sectors. The TNA identified several recommendations pertaining to the use of technology in the energy and waste sector to address climate change problems. Some of these recommendations include:

- To develop policy guidelines that will address issues like subsidies, ownership, tariffs, awareness, standardization, quality control, institutional set-up, and promoting private sector involvement in the transfer of technologies.
- Build indigenous capacities to develop technologies locally.
- Develop policy, regulations, and enforcement capacities for increased public and private participation in energy-efficiency programmes, taking into consideration the programmes already implemented by the Energy Foundation.
- Review Technology Transfer Regulations needed to allow the incorporation of issues consistent with the criteria for encouraging the introduction of these technologies, in particular the reduction of GHG emissions.

Examples of climate mitigation measures that institutions under the Government of Ghana are undertaking primarily include the promotion of energy-efficiency practices and technologies in industry and public buildings. To facilitate the promotion of renewable energy, the government is taking steps to provide an enabling platform for renewable energy resources to be exploited in the country. In this direction, the government is considering a renewable energy law, which is envisaged to provide regulations on pricing and tariffs, mandatory purchase, and the provision of incentives (tax exemptions and subsidies for instance) that will facilitate the deployment of renewable energy technologies in Ghana.

To help the population adapt to climate change and build resilience against climate-induced natural disasters, the government's National Development Planning Commission (NDPC), in collaboration with the EPA, is working to mainstream environment and climate change concerns into national development planning and budget. Such work is also underway at local levels via an on-going initiative,

supported by the World Bank, in which ten District Assemblies have been assisted to mainstream climate-change adaptation and disaster-risk management into their district plans.

Ghana is in the process of preparing a National Climate Change Policy Framework (NCCPF) which is intended to integrate action on climate change into policies for national development objectives. Furthermore, as a means to ensure the systematic integration of climate change into national development processes for sustainable development, the Ministry of Environment, Science, and Technology is developing a Low Carbon Growth Plan with the vision to integrate all aspects of the economy related to technologies that produce energy and materials with little GHG emissions. As part of the implementation of the Low Carbon development Plan, the establishment of a Climate Innovation Centre is being planned.

Entrepreneurs and the private sector

The understanding of climate entrepreneurs' role in Ghana appears to be vague. However, there seem to be several entrepreneur-driven initiatives that use innovations in relation to climate change. Such activities are mostly in the area of converting healthcare waste, biodegradable waste, and sewage into energy, as well as driving the uptake of biogas technology in the country. There are also examples of entrepreneurs engaged in designing and constructing rainwater harvesting technologies, and entrepreneurs assisting industries in improving energy efficiency through heat and mass transfer. Analysis shows that most climate entrepreneurs are at market introduction stage in their development, mainly focusing on various waste-to-energy solutions and collaborating with companies outside Ghana to implement systems for energy efficiency in industries.

Knowledge Institutions

Climate change research in national knowledge institutions is recent in Ghana. Nevertheless, teaching and research institutions are working to establish the science, collecting the Ghanaian evidence of climate change, and working with local communities to understand climate risks and to identify adaptive measures in areas of high vulnerability.

At the University of Ghana, the Regional Institute for Population Studies, with other collaborators, is working with farmers in a livelihood-mapping exercise, as well as risk-mapping flooding in vulnerable communities. These research activities build the capacity of rural communities to enumerate and interpret information on climate change, vulnerability, and adaptation. Studies are also under way by some knowledge institutions to understand the seasonal variability of rainfall and trends of temperature in Ghana.

The Energy Centre of the Kwame Nkrumah University of Science and Technology (KNUST) is also providing training in renewable energy through hands-on short courses and post-graduate programmes by distance learning. Some fellows of the Centre are supervising post-graduate students who are bundling public universities together to develop CDM projects based on biogas technology. To increase understanding of the national climate innovation system, the University of Ghana is identifying and analysing the linkages that can be established among knowledge institutions in Ghana, as well as the linkages between knowledge institutions and industry.

Knowledge institutions are providing information on climate change to policy makers and have assisted in policy formulation, with some knowledge institutions engaged in providing consultancy services to industry and individuals. The Institute

There's a large forestry industry in Ghana which could benefit greatly from climate innovations.

of Industrial Research of the Council for Scientific and Industrial Research has conducted studies on wind and solar energy.

Non-governmental Organizations

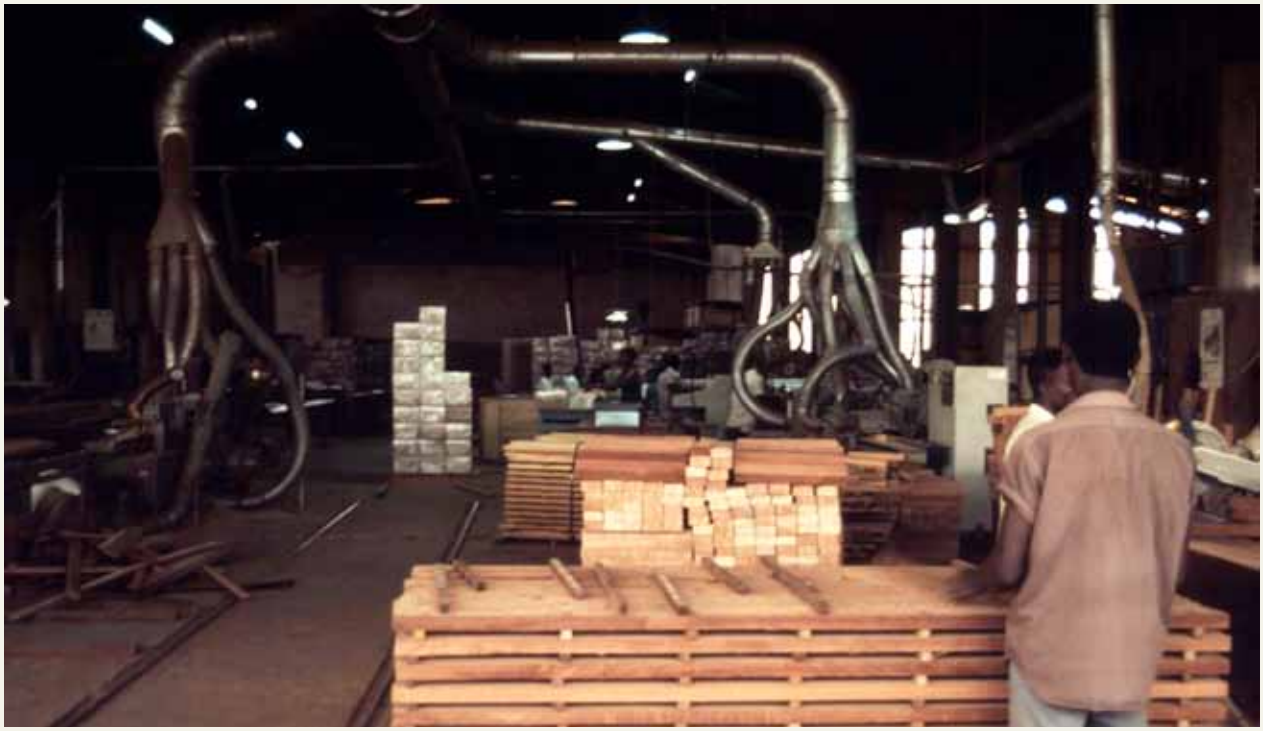
Several NGOs in Ghana are engaged in facilitating the development and growth of climate innovations and entrepreneurship. NGOs have specifically invested resources in clean energy (solar lanterns and other photovoltaic systems), production of energy-efficient cooking stoves, and training of seedling growers and tree nurseries. As an actor in the national climate innovation system, the NGO community is facilitating interaction between the private sector and the government on environmental issues, and is engaged in advocacy for energy efficiency in large public institutions and industries. NGOs in Ghana support research in the area of climate change, and are also engaging children and youth in work on environment and climate change.

Challenges and Recommended strategies

Strengthening systems for knowledge development and information-sharing

Generally low awareness of climate change issues and of climate innovations in Ghana is a major challenge for enhancing the national climate innovation system. While this challenge requires targeted information campaigns by all key stakeholders, it is recognised that there are difficulties in packaging the information on climate change to reduce its abstract nature and make it tangible for the public.

Analysis shows that knowledge and information on climate change and climate innovations in Ghana is limited to key individuals rather than being anchored at institutional level. Due to this lack of established information systems, it is often



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Training, knowledge sharing and access to funding is required for capacity building in Ghana's innovation system.

difficult to access information on climate change. Establishing frameworks that increase dissemination of climate change information and innovations to knowledge institutions, entrepreneurs, the government, and to the broader public is an urgent need.

Efforts to disseminate knowledge and strengthen capacities by training people in climate mitigation and adaptation practices are moving very slowly in Ghana. Therefore, the government and knowledge institutions have an important role to play in facilitating training and information campaigns to targeted stakeholders, in order to systematically increase national capacities within the area of climate innovations.

Building capacities and increasing resources

For knowledge institutions to increase their important contribution to the climate innovations system in Ghana, there is a need to improve access to resources. While funding constitutes an important factor, limited access to the Internet is a major obstacle for networking and information exchange. Access to the Internet is crucial for obtaining information from scientific databases, linking up with other knowledge centres, and communicating effectively with foreign collaborators. Other identified obstacles for knowledge institutions are the lack of adequate equipment for conducting research, difficulties in obtaining tax exemptions to import such equipment, and poor working conditions (remuneration and facilities) of researchers in public knowledge institutions.

Inadequate sources of funding are often identified as a challenge by many of the stakeholders within the national climate innovation system in Ghana. In the private sector, expanding enterprises in the environment and climate sectors require increased access to funding. However, the level of understanding in existing financial institutions which could provide such funding is too low or fragmented. This mirrors the situation for many knowledge institutions, which face major difficulties in identifying external funding sources to produce prototypes of their innovations. At the same time, government agencies responsible for environment and climate change

have difficulties obtaining adequate funds in order to implement mitigation and adaptation programmes on climate change and to invest in green development.

Establishing an enabling institutional framework

There are several steps that could be taken by the government to promote the establishment of an effective climate innovations system in Ghana. The passing of enabling legislation and allocation of budgetary support for capacity-building programmes are two important steps. What is needed is firm political will to drive the national agenda on climate policy and practice forward. However, the shortage of policy frameworks for climate change and climate innovation is evident. Also, even though some regulations exist, responsible government institutions lack the capacity to ensure policy compliance in society.

The government of Ghana thus has an important role to play in creating a fruitful environment for enabling climate innovations. The government is advised to strive towards a catalytic function in the development, application, and dissemination of technologies and good practices on climate mitigation and adaptation. Responsible government agencies need to formulate key policies on climate change and take legislative measures that encourage and enable entrepreneurs to make investments into climate innovation solutions. At project level, it is important to seek opportunities for linking with and capitalising on the Clean Development Mechanism (CDM). A possible future scenario is that national plans for adaptation, mitigation and energy access will be a basis for possible external funding from the UNFCCC.

Establishing a national platform for coordination and information exchange

Since the negative consequences of climate change affect and are exacerbated by a number of different sectors in society, the actions to mitigate and adapt to climate change need to be multi-dimensional. The responsibility of tackling the challenge of climate change at government level cannot be placed with one or even a few isolated ministries/institutions. These interdisciplinary challenges require input from a multitude of stakeholders. The absence of an effective body coordinating climate change activities at government level brings major difficulties, since there is no 'rallying' point with respect to climate change and climate innovation. There is a need of a multi-stakeholder national platform that can enable national coordination and transfer of knowledge, best practices, and technological solutions between key stakeholders such as government institutions, researchers, entrepreneurs, and civil society.

The current national frameworks do not adequately support climate innovation and entrepreneurship in Ghana. There is a need for closer collaborations to be established among the actors to enhance knowledge production and technology transfer. As an important partner to the government in advancing the climate innovations agenda, the NGO community supports the formulation of policy and legislation. In view of their strong linkages to communities at the grassroot level, NGOs should be encouraged to increase collaboration with knowledge institutions and the private sector to establish proof-of-concept demonstration in vulnerable communities, as well as undertake technology transfer projects. This will, in many respects, serve to create awareness about the challenges of climate change as well as the possibility for climate innovations in Ghana. The establishment of a national platform that enables different actors to capitalise on each other's strengths and comparative advantages has the potential to create incentives for generating climate innovations and encouraging climate entrepreneurs to emerge and grow.