KENYA'S OPPORTUNITIES IN CARBON TRADING: A FOCUS ON THE ENERGY SECTOR

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ABSTRACT

The idea of carbon trading exists as a product of increasing awareness of the need for controlling emissions attached with the understanding that in order to progress, a monetary value needs to be positioned along with the environmental importance. The Kenyan administration attaches high priority to Carbon Development Mechanism (CDM), which is seen as an instrument for mobilizing investments in the country and advancing the development of new industrial projects. National CDM guidelines had already been developed shortly after the turn of the millennium. Practical project implementation has, however, made slow progress so far, as it is still hampered by a number of factors. Above all, these include lack of information about the scope of CDM on the part of prospective project developers and insufficient technical and institutional capacity. Although Kenya already has quite a substantial number of projects in the pipeline, including some that have already been approved by the competent national authority (NEMA), as at October 2007, only one has been registered with the CDM Executive Board (EB), the UN body responsible for the international approval of CDM projects. The current CDM projects stem largely from the energy sector with a major potential in the geothermal sector. Only three were in the process of validation in October 2007. Regarding international registration by the EB, the 35-MW power station project of the leading sugar producer Mumias Sugar Company Limited for electricity generation from sugarcane bagasse is rated as the most advanced. This paper illustrates key opportunities presently available in Kenya's energy sector for carbon trading and some challenges that the sector is facing. It draws attention to viable market opportunities in the energy sector that potentially could engender lofty investment income.

Keywords: CDM, Carbon trade, Greenhouse gases, Geothermal Energy.

INTRODUCTION

Energy and the Environment

It is now accepted worldwide that the globe is warming to such an extent that the livelihoods of large swathes of the world's population are under serious threat. Violent and frequent storms wreck people's habitats; unpredictable weather drastically changes conditions for agriculture; new health threats emerge. As a result, awareness of global warming is increasingly influencing views all over the world. The main cause of global warming is rapidly increasing carbon dioxide emissions; primarily the result of burning fossil fuels despite international agreements to reduce such emissions.

To manage these risks responsibly, the stock of greenhouse gases in the atmosphere should be held below some target level and brought down from there. Linking energy development to climatic degradation has affected this sector calling for appropriate mitigation measures and now international communities have opted for environmentally friendly sources of energy. It is said that one thing that we have really broadly started to appreciate more is that climate is not an environmental issue. Climate change is a systematic and fundamental issue about the way our economics work and the way we get our energy.

Energy development: Dynamics of Energy Demand

World usage of energy of all types has been increasing at an average annual rate of 2.6 percent per year since the 1960s (Spiegel & McArthur, 2009). The price may as well rise and fall from time to time, particularly as the financial meltdown of 2008 played itself out and the global downturn disclosed. But no matter how prices vary in the short term, the adamant growth in energy use will continue over the long term. Slower growth in the developed world will be offset by faster growth in developing nations.

Kenya, like most sub-Saharan African countries face a major challenge in trying to attain their development and social obligations because of inadequate modern energy services. Low levels of electricity access in sub-Saharan Africa demonstrate this deficiency as an estimated 17% of the region's population, and less than 5% of rural areas are electrified (Davidson & Sokona, 2002). This situation needs to change if sub-Saharan Africa is to be economically competitive with other developing regions of the world and realize its sustainable development goals.

Energy for the future

Demand for renewable energy sources is also going to increase, but for the foreseeable future it will be limited, by the industry's ability to provide it at competitive costs (Spiegel & McArthur, 2009). Key factors that has led to the substantial growth in the renewable energy industry includes; the high fossil-based energy costs related to increased demand and uncertainties in supply; economies of scale and falling capital equipment costs for alternative technologies, improving both yield and efficiency, and thereby improving, competitiveness; legislative action by governments worldwide; greater public awareness of environmental concerns, particularly regarding greenhouse gas (GHG) emissions associated with fossil fuels; the Kyoto Protocol, through which certain countries have committed to reduce GHG emissions, and which in turn motivates those governments to implement policies that decrease the use of fossil-sourced energy and increase the use of alternative technologies.

Increase in nuclear-generating capacity in most nations alongside their long-term outlook is still unclear. Renewables, given the current trend lines, seem unlikely to play a large role in the energy transformations between now and meeting 2030. What would be needed for either of these carbon-free alternative energy sources to grow rapidly enough to make noteworthy inroads into fossil fuels' share of electricity generation is a big, unrelenting push from governments.

Carbon trade

Carbon finance should be a "win-win" opportunity for Africa and in particular, Kenya, and its investors: a way to promote new development initiatives, such as renewable energy projects, while reaping financial benefits and effectively responding to climate change. Kenya possesses abundant natural resources in the energy sector suitable for sustainable energy production. The lack of existing energy infrastructure, particularly in Sub-Saharan Africa, makes it possible to leapfrog the emission-intensive stage of economic development to clean technologies. While the continent is well endowed with renewable energy prospects (solar, wind, geothermal, biomass, hydro), only a very small proportion of the sources is currently exploited. For example, as Figure 1 shows, only 7% of hydroelectricity and less than 1% of geothermal potential is exploited.

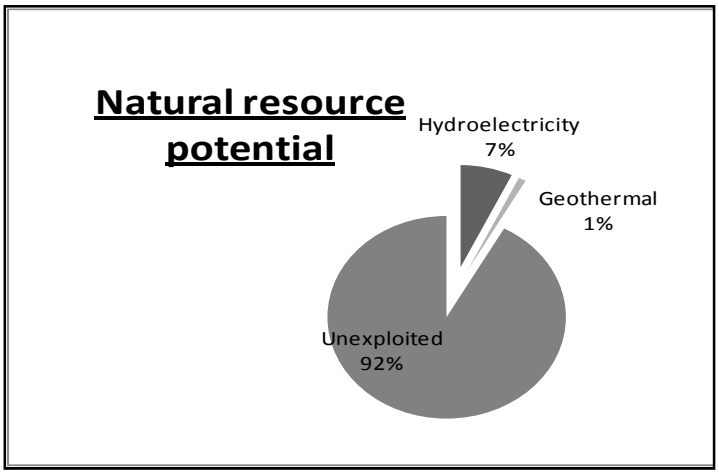

Figure 1: Natural resource potential in Kenya (IEA, 2007)

Analysis of the International Energy Agency's (IEA) most recent (2007) statistics shows that although renewable energy makes up 16 percent of all Africa's energy sources used for power generation, the vast majority comes from combustible renewables and waste. In addition, less than one percent of the total figure is made up of hydro electricity. Other forms of renewable energy in the continent (geothermal, solar, tide and wind) are negligible (International Energy Agency- World Energy Balances, 2009).

POLICY INTERVENTION

Kyoto Protocol

The Kyoto Protocol ratified in 2005, commits many developed countries, defined as Annex I countries, to reduce their greenhouse gas emissions to specific targets. The Protocol defined the Clean Development Mechanism as a mechanism to help these industrialized countries to reduce the costs of meeting their targets by buying certified emission reductions (CERs) generated from projects implemented in developing countries. The

quantification of the CERs, generated by different projects, is made using a methodology that provides all the steps to determine the emissions reductions in an accurate and conservative way.

Kenya National Guidelines on CDM

The National Environment Management Authority (NEMA) in collaboration with the Ministry of Environment is the National Designated Authority (NDA) which handles all CDM activities in Kenya. In 2001, NEMA formulated Kenya National Guidelines on CDM to ensure that CDM projects are environmentally effective and sustainable. This required CDM projects to be based on principles of equitable allocations with focus on non-greenhouse gas emitting technologies especially non-carbon renewable energy technologies (GoK, 2001).

Environmental Management and Coordination Act (EMCA) 1999

The Kenyan Government enacted EMCA to consolidate environmental statutes within a single framework law to enhance environmental management in the country. The law provides for environmental impact assessment and environmental audits for all projects likely to have adverse negative impacts on the environment. NEMA has further developed Environmental Impact Assessment and Environmental Audit regulations, 2003 to further guide the implementation of EIA/A. The process ensures sustainable development while maintaining environmental integrity which directly addresses climate change challenges.

Kenya's Vision 2030

In preparation to curb climate change, the government came up with the Carbon offset scheme to exploit opportunities within the Kyoto Protocol on the establishment of voluntary carbon markets to promote conservation and compensation for environmental services. To integrate planning approaches and improve overall governance of the environment by 2012, at least five CDM projects per year in the next five years should be attracted (GoK, 2007).

KENYA'S OPPORTUNITIES IN CARBON TRADING: ENERGY SECTOR

The current interest to reduce emissions of CO_2 worldwide gives a new boost for renewable energy development in Kenya, hence an additional source of revenue. (Muusya & Ojoo-Massawa, NEMA). The Ministry of Energy, Kenya is therefore taking a deliberate strategy to pursue renewable sources of power from the indigenous geothermal, wind and hydro sources.Kenyan companies are losing out on the global carbon emissions trade, where industrialized nations invest in clean energy projects in poorer nations and in return get offset credits which can be used towards emissions goals or sold for profit. In the energy sector, several projects qualify as CDM projects. This include gas-fired power generation, hydro-electricity to replace coal fired power stations, co-generation (biomass or fossil fuel based), other renewable types of energy (geothermal, wind, photovoltaic, biomass, biogas), and use of forest and agricultural wastes to generate electricity and heat.

KenGen, Green Belt Movement, Mumias Sugar Company, East Africa Portland Cement are some of the Kenyans companies engaged in carbon market projects. KenGen's strategy for green energy is focused on the geothermal sector with planned projects in its portfolio estimated to generate 5 million tonnes of CERs/yr in 2019, which are to be developed through carbon financing. (Simon N., 2009).

Geothermal Energy

Study results reveal that geothermal power production has a significant environmental advantage over burning fossil fuels for electrical power production. Electrical production from geothermal fluids results in an order of magnitude less CO_2 per kilowatt-hour of electricity produced compared to burning fossil fuels. Thus, the data clearly demonstrate that increased geothermal utilization can help Kenya reduce greenhouse gas emissions, assisting National Climate Change Technology Initiative goals while helping to meet increasing power demands. Kenya is in a position to take advantage of carbon finance mechanisms to expand investment in (and access to) energy. The potential of geothermal energy sources is great, with an estimated potential of 4,000MW by 2030 (Geothermal Development Company Ltd (GDC), Kenya). With the empowerment of scientists and engineers in the geothermal field in Kenya and the vast geothermal resource in the Kenyan Rift, the opportunities in carbon trading in the energy sector are quite enormous.

Development of geothermal projects in Kenya faces a number of barriers and these can be partly offset by CDM revenues. While various opportunities continue to arise for Kenya to increase its clean energy projects after ratification of the Kyoto Protocol, KenGen's/GDC, Olkaria Geothermal Project is pursuing its capacity expansion programs with a focus on projects that generate less greenhouse gas emissions.

This expansion can help Kenya to meet the growing power demands as well as securing energy independence. However, some projects face barriers that prevent them from being carried out if they are not registered as CDM activities. Being a registered CDM project activity, and negotiating a CER purchase agreement, has both financial and institutional benefits that enhance the viability of the project. In particular, the Olkaria II expansion project faced four main barriers i.e. investment, tariff, financing and transaction/financing cost barriers (Kollikho, 2007). The third extension phase of the Olkaria II geothermal power station financed by the World Bank has also progressed quite far. Capacity is being increased from 70 MW to 105 MW. For this project, KenGen has already signed an emission reduction purchase agreement (ERPA) with the World Bank's Community Development Carbon Fund for 900,000 tons of CO_2 equivalent. Among others, the Kreditanstalt für Wiederaufbau (KfW) has expressed interest in financing the future fourth extension phase, a project amounting to US$ 150 million.

The country's will in establishing the Geothermal Development Company GDC, to pave way for development of all the geothermal prospects in the Kenyan Rift and realizing the 4000MW by the year 2030, is a move towards the attainability of the carbon reduction and carbon finance.

The Eburru geothermal power station is another CDM project in preparation (expected annual electricity generation of 21 GWh; with an anticipated carbon dioxide equivalent savings according to KenGen of 13,400 tons a year). Ormat (Africa's first privately funded geothermal plant), the US geothermal developer, currently producing 48MW (Olkaria III) is also expected to qualify from the CDM. Olkaria IV, a 140MW plant funded by the Kenyan Government and KfW, is in the planning stage (Hackenbroch *et al.*, 2007).

Geothermal investments promise to enhance energy unit sales

Based on the KenGen report 'Geothermal Development in Kenya, 2006' geothermal power occupies about 11% of the electricity sub-sector and has huge potential for growth (estimated at 4,000MW in Kenya). Kenya has emerged as one of the leaders in Africa in exploiting this form of renewable energy and the Geothermal Development Company was created in 2009 to explore, appraise and undertake steam production. This form of generation is crucial to the generation mix because of its high (94%) load factor (the ability to generate a consistent energy supply from installed capacity). The expected new tariffs on new geothermal projects are also considerably higher than hydro and ranging between KShs 7.00 to KShs 8.20 per kWh. However, despite the massive potential to impact KenGen's top-line growth the ability to fund these projects (high upfront costs) as well as the complexity of the development process represents the biggest headaches. The management estimates that they could earn up to US$1.29 million (Kshs100 million) in CDM revenue from the new projects (Olkaria II 3rd unit and Eburu) through the emerging carbon credits market (Faida Investment Bank, 2009).

Table 1: Installed Geothermal Capacity in Kenya (GDC, 2010)

Project	Capacity Installed (MW)	Year Commissioned	Additional (MWe)	Year Expected
Olkaria I	45	1981 -1985	140	2012
Olkaria II	70	2003	35	May 2010
Olkaria III	48	2000, 2009	50	2013
Olkaria IV	-	-	140	2012
Oserian	4	2004, 2006	-	-
Eburru	-	-	2.5	2010
TOTAL	**167**		**367.5**	

Hydropower

Hydropower is Kenya's main energy source. In the years immediately following World War II (1939-45), Kenya met the increased demand for electricity mainly through the use of fuel oil to provide thermal power. Since 1950, hydroelectric capacity has been dramatically increased, and new hydroelectric schemes have been developed. Kenya has an installed capacity of 737 MW, which is 73.4% of the KenGen's installed capacity. The bulk of this electricity is tapped from five generating plants along the River Tana. Projects in validation as CDM projects include; Sondu Miriu hydropower station for the annual generation of 330 GWh of electricity, Sang'oro hydropower station Lake Victoria (21.4 MW; planned CO_2 equivalent reduction of 57,400 t. Other CDM projects include the Redevelopment of Tana Power Station Project of 130.3 GWh; 83,200 tons CO_2 equivalent a year and the optimization of the Kiambere power station of 60 GWh; 38,300 tons CO_2 equivalent

annually. Research findings indicate that the 2009-13 expansion of hydro capacity will result in only half the potential to raise unit sales as compared to the geothermal projects due to the existing tariffs. KenGen estimates that they could earn up to US$1 million (KShs 80 million) in CDM revenue from the new hydro projects (through the emission reductions purchase agreement signed with the World Bank) (Faida Investment Bank, 2009).

There are also significant endowment sites for small hydros (mini or micro hydros) which are suitable to rural energy demand patterns. The current known potential for mini and micro hydro is estimated to be 300 MW. A number of pilot projects in the area of mini and micro hydro have been implemented to assess the viability of such systems and create the impetus for accelerated exploitation of the mini/micro hydro resource (Hackenbroch *et al.*, 2007).

This CDM project has improved livelihoods by creating employment and business opportunities for the Kenyan people. But recent droughts have slashed capacity at Kenya's main dams, forcing shutdowns and leading to reliance on costly diesel-powered generators, which in turn have pushed up energy bills.

Wind Energy

Wind has been identified as a clean, inexpensive source of energy. Inventions have been made that can harness the energy of the wind and put it to practical use. Wind generated electricity ought to be installed on the grounds that it is already profitable at the present energy prices. Wind energy has been used in Kenya primarily for water lifting since the beginning of the 19th century but its use declined with the advent of oil fired internal combustion engines, which are flexible and more convenient to use. However, with the rising cost of oil, the exploitation of wind energy is becoming increasingly more attractive particularly in areas remote from the grid and oil supply outlets.

To promote investment in wind energy generation, the Ministry of Energy recently completed preparation of a broad National Wind Atlas (www.energy.go.ke/renewable energy). In addition, the Government is promoting the development of wind-diesel hybrid systems for electricity generation under rural electrification programme in areas remote from the national grid. In the meantime, a total of 550 Kilowatts are installed in Ngong and Marsabit, generating about 0.4 gigawatt-hours (GWh) of electrical power, which has been approved by the Kenya Designated National Authority; NEMA as CDM Projects (Hackenbroch *et al.*, 2007).

Co-generation using bagasse and other opportunities

Co-generation using bagasse as a primary fuel is common practice in the domestic sugar industry in Kenya. The industry comprising seven sugar companies produces an average of 1.8 million tonnes of bagasse with fibre contents of about 18% by weight annually. Out of this quantity, about 56% is used in co-generation using an installed capacity of 25 MW and the balance disposed at cost. Mumias, the only registered CDM project in Kenya, is the only sugar company among the seven factories that is self-sufficient in electricity production and has the capacity to export about 2 MW of surplus power to the national grid). A bagasse-based electricity generation project in a joint venture with the Chemilil Sugar Company Ltd. (25 MW; 67,400 tons CO_2 equivalent a year) is in the offing as an additional CDM Project (Hackenbroch *et al.*, 2007).

Other projects have already been approved by the Kenyan Designated National Authority as CDM projects include; the Kipevu (Thermal) Combined Cycle Project (223 GWh an annual 142,500 ton CO_2 equivalent and several industrial projects in the area of fuel switch (the largest being at the Michimukuru/Kiegoy Tea.

CDM Project Portfolio, Kenya

Table 2: CDM (Energy Sector) Project Portfolio in Kenya, January, 2010

	PROJECT	STATUS
1.	35 MW Bagasse Based Cogeneration Project" by Mumias Sugar Company Limited (MSCL) Ref 1404	Registered
2.	Sondu Miriu Hydro Power Project	Validation -re issued
3	Olkaria II Geothermal Expansion Project	Validation on
4	Redevelopment of Tana Hydro Power Station Project	Requested Validation
5	Optimisation of Kiambere Hydro Power Project	Requested Validation

6	6 MW Bagasse Based Cogeneration Project by Muhoroni Sugar	Requested Validation
7	Olkaria III Phase 2 Geothermal Expansion Project in Kenya	Requesting Registration

(DNA – CDM Kenya, 2009)

BARRIERS/RECOMMENDATIONS TO CDM ENERGY PROJECTS IN KENYA

Whilst the opportunities have been stressed, there are however significant challenges. One of the most significant is population growth and rapid urbanization, which will put additional pressure on planning (including spatial planning) for a lower carbon future. These drivers will increase demand on energy, food and water, leading to increases in emissions. This means that opportunities for implementing lower carbon alternatives needs to be an integral element of the planning and policy making system. Grantham Research Institute (2009) summarizes other barriers that need to be overcome to increase uptake of low carbon technologies to include:

- Economic / market barriers (e.g. no finance, poor commercial case). This includes relatively high cost of equipment and services (Phillipines vs. Kenya in Geothermal development) and limited ability to access internationally available "sustainable energy financing", from the Global Environment Facility (GEF) and various other financing schemes. Price distortions and high initial capital costs is also a disadvantage
- Low levels of information (statistics and data), awareness including baseline and methodological constraints for renewable energy and programmatic CDM. This is due to limited availability of comprehensive and well-documented data sets on the dissemination of energy efficient systems in the region and their potential benefits in the economic development of the region,
- Political instability, inadequate policies (regulatory framework), plans and weak dissemination strategies for renewable energy
- Technical problems of use in-country due to renewable energy and energy efficiency industry infancy. Technical knowledge is needed to build a critical mass of policy analysts, economic managers and engineers who will be able to manage all aspects of efficient systems development.
- Inadequate skills, knowhow and research developments
- Limited institutional capacity and infrastructure
- Limited local private sector participation

To overcome the barriers the following recommendations (Karekezi and Kithyoma, 2005) need to be implemented:

- Build local capacity in developing CDM project activities and adoption of appropriate technologies.
- Clear and well defined policies, plans and good governance
- Support to CDM project financing and replication
- Improve information sharing /technology transfer and training.

CONCLUSION

Kenya has contributed very little to global warming itself, but is heavily affected by possible climate changes. The current interest to reduce emissions of CO_2 worldwide gives a new boost for geothermal development in Kenya. Geothermal energy is a clean, renewable and environmentally friendly energy source having greater resource and economic potential. However there is quite some scope for more CDM projects in the energy sector and a variety of measures in the pipeline. Implementation has thus been hampered by a number of factors including; absence of framework legislation, inadequate institutional, financial, technical and personnel capacity on the opportunities afforded by CDM.

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