INVESTIGATING CHALLENGES FACING IMPLEMENTATION OF CLEAN DEVELOPMENT MECHANISM PROJECTS AT KENYA ELECTRICITY GENERATING COMPANY

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Investigating Challenges Facing Implementation of Clean Development Mechanism Projects at Kenya Electricity Generating Company

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DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

Signature……..... Date…….....

James Kipchumba Metto,

This thesis has been submitted for examination with our approval as university supervisors.

Signature……... Date….....

Dr. Paul Njogu, PhD

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Signature……..... Date.....

Prof. Erastus Gatebe, PhD

JKUAT, Kenya

DEDICATION

This Thesis is dedicated to my caring parents, Mr & Mrs Metto for their passion for education as evidenced by their commitment to educating their children in pursuit of knowledge despite the limited resources coupled with competing needs. Secondly I dedicate this piece of work to my lovely wife and our children Beryl and Neema for their continuous support especially during the times I had to be away from home for studies. I could not have done it without you! Your care and support mean the world to me. Thanks and I wish you all God's blessings.

ACKNOWLEDGEMENT

I wish to appreciate a number of people who have made significant contribution in development and successful completion of this research project.

First I would like to thank the almighty God for his presence and provision in my life, without him this process would not have been a success.

Secondly I would like to thank my supervisors; Dr. Njogu and Prof. Gatebe for giving me inspiration and advice throughout my study period and especially during the research period. I wish you both God's blessings.

The KenGen management and the staff who took their time to complete my questionnaire, am indebted to you for your support. We can contribute to mitigating the challenges of climate change together by ensuring successful implementation of renewable energy projects and as a result move our country to a low carbon development trajectory.

Last but not least I wish to thank my parents, wife, children, brothers and sisters for their inspiration and support during the study period; you have made a difference by your support and presence in my life.

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ACRONYMS AND ABBREVIATIONS

AfDB	African Development Bank
APF	Africa Partnership Forum
BAU	Business as Usual
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CFA	Community Forest Associations
CO_2e	Carbon dioxide equivalent
COP	Conference of Parties
DNA	Designated National Authorities
GHG	Greenhouse-gases
GWh	Gigawatt hours
Gt CO_2e	Giga tonnes of carbon dioxide equivalent
GBM	Green Belt Movement
Ha	Hectares
HND	Higher National Diploma
IETA	International Emissions Trading Association
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
KenGen	Kenya Electricity Generating Company
KP	Kyoto Protocol
MDGs	Millennium Development Goals
MEMR	Ministry of Environment and Mineral Resources
MSCL	Mumias Sugar Company Limited
MW	Mega watts
NAMA	Nationally Appropriate Mitigation Action
NGO	Non-Governmental Organization

OECD	Organisation for Economic Co-operation and Development
OEC	Ormat Energy Converter
PDD	Project Design Document
PIN	Project Idea Note
PHD	Doctor of Philosophy
PLDVs	Passenger light duty vehicles
REDD	Reducing Emissions from Deforestation and forest Degradation
SSA	Sub-Saharan Africa
SPSS	Statistical Package for the Social Scientists
tCO_2	Tonnes of Carbon dioxide equivalent
TWh	Terawatt-hour
UN	United Nations
UNECA	United Nations Economic Commission for Africa
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

ABSTRACT

Climate change has become the biggest global environmental challenge. The International community acknowledged it as a global concern with the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) at the Rio de Janeiro Earth Summit in 1992. The clean development mechanism (CDM) was established under the UNFCCC as one of the mechanisms to achieve sustainable development while reducing emissions. African countries unfortunately have not benefited from CDM with only 2.4% of the projects registered and only one country Egypt contributing 0.8% from amongst the nine countries contributing 93.6% of the issued carbon credits. The objective of this study was to determine the challenges affecting implementation of CDM projects at KenGen which is a major player of CDM process in Kenya. The study findings demonstrate that there were low awareness levels among key persons in relation to KenGen's CDM implementation requirements. The study further identified complex and tedious CDM procedures, lack of adequate internal capacity and the long approval process as the main challenges at the development stage of KenGen CDM projects. The Chi –Square test shows a statistic of 38.32 with an associated p of 0.001 ($P<0.05$). The P value of 0.001 is statistically significant in explaining the influence of the organizational constraints, rules and procedures and level of awareness on implementation of CDM Projects considering that the P-value is less than 0.05 at the 95% level of confidence. In conclusion the study found that the implementation of CDM at KenGen is influenced by organizational constraints, rules and procedures and level of awareness. It's expected that the results from this study will contribute towards fast tracking the development of CDM projects at KenGen as well as enabling the company to benefit from the global initiatives geared towards sustainable development.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Climate change has become the biggest global environmental challenge and the International community acknowledged it as an important global issue with the establishment of the United Nations Framework Convention on Climate Change (UNFCCC) at the Rio de Janeiro Earth Summit in 1992 (UNFCCC, 1992). The ultimate objective of the UNFCCC and its related legal instruments that the Conference of the Parties has adopted was to achieve stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The convention envisaged that such level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner (UNFCCC, 1992).

Growing evidence of human influence on climate change and the possible irreversible nature of its impacts led the international community to adopt the Kyoto Protocol of 1997. The Kyoto Protocol resolved to reduce emissions of greenhouse gases (GHGs) on a global scale and stabilize their concentration in the atmosphere to a level that would prevent dangerous anthropogenic interference with the climate system (UNFCCC, 1997).

The effects of climate change have a global impact for example the loss of ice sheet on polar land and thermal expansion of seawater over very long time scale could lead to metres of sea level rise, major changes in coastline and inundation of low lying areas. In Australia there is reported decline in agricultural production and forestry in the southern

and eastern regions. In the case of Africa some countries will see reduced agricultural yields by up to 50% as early as 2020 (IETA, 2009).

One of the proposed mitigation of the effects of climate change is limiting global warming and keeping temperatures at levels where human life remains possible, global GHG emissions must therefore be reduced by 40% by 2020 and 95% by 2050, with 1990 emission levels as baselines (Reddy, 2011). These demanding targets can only be met by urgently and drastically changing the way we live and by moving towards low carbon development which includes reducing use of fossil fuels which in turn reduce greenhouse gas emissions.

Deforestation and forest degradation are among the most important single sources of emissions of greenhouse gases (GHG), contributing about 20 percent of total emissions annually and the associated losses of livelihoods, biodiversity, environmental services and cultural benefits (Pagiola & Bosquet, 2009). The Parties to the UNFCCC agreed in December 2007 in Bali to explore policies and financial incentives that could be implemented to encourage Reduced Emissions from Deforestation and Forest Degradation in Developing Countries (REDD). This initiative is expected to address the challenges related deforestation and forest degradation while at the same time contribute to reducing GHG emissions.

1.2 Statement of Problem

CDM was expected to have considerable effects in the climate change regime by assisting developed nations in reducing their cost of climate change mitigation and contribute to sustainable development by the developing nations. The execution of CDM project activities were expected to generate employment, technology transfer, environmental improvement, generation of income, attraction of foreign investment, de-carbonization of the economy. The involvement of developing countries in the climate change regime has however been low with the current geographical distribution of CDM project activities indicating that only 2.4% of CDM projects registered by the UNFCCC

are in Africa (UNFCCC, 2014). As of December 2013, Kenya had sixteen registered projects but only Olkaria II project had been paid for the sale of emission reductions. Kenya has therefore not yet benefitted from its registered projects despite registering its first project in 2008. An analysis of the time it took to register four KenGen CDM projects gave an average duration of 1,307 days from start of public participation to registration. Olkaria II took 1,232 days, Tana 1,372, Kiambere 1,689 and Ngong wind took 935 days (UNFCCC, 2014). The global average time from start of public participation to registration as analysed by the UNEP (2014) had the highest average as 938 days in September 2009, 356 days in September 2011 and 169 days in November 2012.

Upon registration of the projects, monitoring and verification process is expected to lead to issuance of CER's. The analysis of issuance indicated that CERs amounting to 93.6% of the total issuance from the registered projects has been contributed by only nine countries as shown by figure 1.3. Out of the nine countries only one country is African i.e. Egypt contributing 0.8% of the issued CERs (UNEP, 2014).

This study therefore was undertaken to determine the main obstacles affecting implementation of CDM projects at KenGen which is a major player in the CDM process in Kenya.

1.3 Null Hypothesis

There are no challenges affecting the implementation of clean development mechanism projects at Kenya Electricity Generating Company

1.4 Objective of the Study

1.4.1 Main Objective

To assess the challenges affecting the implementation of clean development mechanism projects at Kenya Electricity Generating Company.

1.4.2 Specific Objectives of the Study

1. To determine the levels of awareness with regard to implementation of CDM among staff involved with KenGen's CDM implementation process.
2. To determine KenGen's organizational, administrative and policy issues that impedes the implementation of Clean Development Mechanism projects.
3. To establish the challenges faced by KenGen in relation to the rules and procedures of the CDM projects registration process.
4. To recommend measures that will enable KenGen successfully implement clean development mechanism projects

1.5 Conceptual Framework

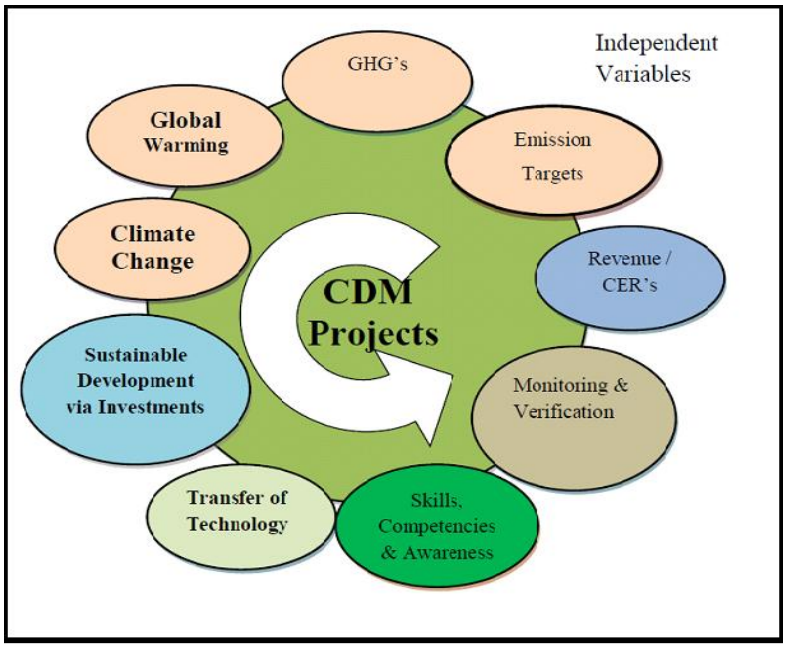

Figure 1.1 CDM Projects Conceptual Framework

In the conceptual framework depicted in Figure 1.1 CDM is hypothesized to lead to reduction of global warming through reduced anthropogenic emissions (GHG's). GHG's

have been shown to contribute to rise in temperatures and climate change (UNFCCC, 1997). The benefits expected from implementation CDM includes contribution to sustainable development by attracting investments, transfer of technology, earning of carbon revenue by sale of CER's and finally it enables developed countries to comply with Kyoto protocol's emissions targets (UNFCCC, 1997).

To benefit from implementation of CDM projects the project participants require skills and competencies in order to ensure that project requirements comprising of monitoring and verifications are complied with.

1.6 Rationale and Justifications

Although Africa is the continent least responsible for climate change, it is particularly vulnerable to the effects of climate change, including reduced agricultural production, worsening food security, increased incidence of both flooding and drought, poverty, spreading disease and an increased risk of conflict over scarce land and water resources. Currently limited studies have been carried out to establish the cause of the slow uptake of CDM projects in Africa which currently stands at 2.4% yet it's the most vulnerable continent with regard to the impacts of climate change. In the Kenyan context no documented research has been carried out on CDM at project level in general and power generation in particular where KenGen is the single largest participant in the Kenyan CDM development with Six Projects**.** It is hoped that the results of this study will be of benefit to the project managers in the renewable energy sector to benefit from the global initiatives which apart from contributing to emission reductions enable organizations to get additional revenue as well as creation of employment within the community.

CHAPTER TWO
LITERATURE REVIEW

2.1 Climate Change

Climate change is the variation in climate over time (IPCC, 2007). The UNFCCC in its Article 1, defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (UNFCCC, 1992). Climate change is a major threat to sustainable growth and development in Africa, and the achievement of the Millennium Development Goals (MDGs). It is being argued that, poorer developing countries are especially vulnerable to climate change because of their geographic exposure, low incomes and greater reliance on climate sensitive sectors, particularly agriculture and poses multiple threats to economic growth, wider poverty reduction, and the achievement of the MDGs. Climate change may spark conflict between nations because it turns arable land into deserts, melted ice fields and poisoned water supplies. These occurrences indicate that climate change is the major threat in future decades (AfDB, 2002).

Africa is particularly vulnerable to climate change because of its overdependence on rain-fed agriculture, compounded by factors such as widespread poverty and weak capacity. The main longer-term impacts include: changing rainfall patterns affecting agriculture and reducing food security; poverty, worsening water security; decreasing fish resources in large lakes due to rising temperature; shifting vector-borne diseases; rising sea level affecting low-lying coastal areas with large populations; and rising water stress (APF, 2007). Africa's agricultural yields are already on the decline, so the attainment of MDG 1 - eradicating poverty and hunger – could be seriously threatened. A 3°C warming could put 150 million to 550 million additional people at risk of hunger (APF, 2008). More extreme weather events are occurring worldwide, sometimes in unexpected ways – such as the flooding events in the dry regions of Ethiopia in 2007 and in Brisbane Australia in 2010. Flood and windstorm events together from 1900 to

2006, accounted for 56.7% and more than 21.7% of the total number of disasters and fatalities (UNESCO, 2009).

Other effects of climate change include decreased hydro-power generations, widespread increase in the risk of flooding in many human settlements sequel to increased heavy precipitation affecting people living in river valleys and sea-level rise, also affecting people living in low lying coastal areas (Agbogidi, 2011). Global warming is a major consequence of climate change particularly the depletion of the Ozone layer by greenhouse gases (Aluko, *et al*., 2008). The interactions of man with the environment through agriculture, urbanization/industrialization, human settlements, logging, and deforestation, burning of fossil fuels, population explosion and others contribute significantly to climate change (Agbogidi, 2011).

The predicted global temperature increase of between 1.5 ^{o}C and 4.5 ^{o}C could lead to potentially catastrophic environmental impacts (Defra, 2006). These include sea level rise, increased frequency of extreme weather events, floods, droughts, disease migration from various places and possible stalling of the gulf stream. This has led scientists to argue that climate change issues are not ones that politicians can afford to ignore, and policy makers tend to agree (Defra, 2006).

The IPCC (2001a) Third Assessment Report presented possible consequences from extreme climatic events such as the higher maximum and increasing minimum temperatures, more intense precipitation events, and intensified droughts and floods associated with El Niño events, among others. Carbon emissions to the atmosphere need to be curtailed to address climate change and many carbon emissions are related to energy processes and activities. One of the greatest emitters of carbon to the atmosphere is the energy sector, making the sector one of the largest contributors to climate change (Rosen, 2009). According to the World Energy Council the world's energy

consumption today is estimated to be 22 billion kWh per year and expected to reach 53 billion kWh by 2020 (WEC, 2009). The increasing demand could lead to damage of the world environment by CO, CO_2, SO_2, NO_x effluent gas emissions and global warming (ASHRAE, 2005).

The Copenhagen Accord of 2009 and the Cancun agreements of 2010 have been identified by the United Nations Environment Programme (UNEP) as some of the international efforts under the United Nations Framework Convention on Climate Change that are focused on keeping the average rise in global temperature to below 2 °C, compared to pre-industrial levels. Although current commitments and pledges by developed and developing nations can take the world partly towards achieving this 2 °C target, an assessment by UNEP shows that the there is still a significant gap between political ambition and practical reality. One of the most important areas for international cooperative initiatives that has been identified to contribute to emission reductions is Renewable energy estimated to lead to reduction of 1–3 $GtCO_2e$ by 2020 (UNEP, 2013).

Kenya has developed a National Climate Change Response Strategy (NCCRS), which seeks to strengthen nationwide focused actions towards adapting to, and mitigating against a changing climate. Initiatives being undertaken include ensuring commitment and engagement of all stakeholders while taking into account the vulnerable nature of our natural resources and society as a whole (GOK, 2010). The strategy enhances understanding of the global climate change regime: the negotiations process, international agreements, policies and processes and most importantly the position Kenya needs to take in order to maximize beneficial effects.

2.2 Kyoto Protocol and Global Response to Climate Change

In 1992, The United Nations Framework Convention on Climate Change (UNFCCC) was tabled at the Earth summit in Rio de Janeiro and has subsequently been ratified by

approximately 190 nations (Dessler & Parson, 2006). The UNFCCC under the Kyoto Protocol established the Clean Development Mechanism as one of three flexibility mechanisms and it is the only mechanism open for participation by parties from both industrialized and developing countries. It has two complementary objectives: to support sustainable development objectives and to provide cost-effective emissions reductions, (UNFCCC, 1997). The Kyoto Protocol is founded on numerous internationally accepted principles including; the Precautionary Principle, Preventative Principle, Common but Differentiated Principle, Polluter Pays Principle, the Principle of Sustainable Development and the Principle of Intergenerational Equity.

Negotiations on a new climate regime are currently underway with a growing demand for increased contribution to climate change mitigation by all Parties, and calls for carbon market mechanisms, including the CDM to deliver net mitigation beyond offsetting. A review of the existing mechanisms is currently underway with new approaches being developed under the United Nations Framework Convention on Climate Change (UNFCCC). The negotiations are ongoing on a global climate regime from 2020 onwards including negotiations based on the Bali Action Plan concluded at COP 18 in Doha. As a part of the agreed outcome, developing country Parties are expected to take Nationally Appropriate Mitigation Actions (NAMAs) in the context of sustainable development. (UNFCCC, 2014).

The concept of Nationally Appropriate Mitigation Actions (NAMAs) was developed in the context of the international negotiations under the United Nations Framework Convention on Climate Change (UNFCCC). NAMAs are considered to be voluntary climate protection measures taken by developing countries, which are embedded within their national development plans. By moving countries towards a low-carbon development trajectory, NAMA's have the potential to significantly contribute to global efforts to reduce greenhouse gas (GHG) emissions. Simultaneously, they offer

developing countries and emerging economies a framework for combining broad-based climate action with the achievement of sustainable development goals. This concept is gaining momentum as many developing countries are already developing NAMA's in the context of their national development strategies and plans. Their aim is to assist developing countries that wish to reduce emissions to a level below that of Business as Usual (BAU), but they do not represent a legal obligation under the UNFCCC. Determining which actions to take under a NAMA is each country's sovereign right, since the definition of "appropriate mitigation action" is relative to a party's particular national circumstances. In general, NAMA's are designed to support efforts towards sustainable development, as interpreted by the host country. NAMAs refer to any action that reduces emissions in developing countries and is prepared under the umbrella of a national governmental initiative. They can be policies directed at transformational change within an economic sector, or actions across sectors for a broader national focus. NAMAs are supported and enabled by technology, financing, and capacity-building and are aimed at achieving a reduction in emissions relative to 'business as usual' emissions in 2020.

2.3 Clean Development Mechanism

The Clean Development Mechanism as defined by Article 12 of the Kyoto Protocol has two basic objectives. The first objective is to assist developing countries achieve sustainable development and the second is to assist Annex I parties achieve compliance obligations to reduce their GHG emissions by approximately 5.2% below 1990 levels over the first commitment period 2008 – 2012 as defined by the Kyoto Protocol, 1997.
Annex 1 parties are the 43 Parties to the UNFCCC listed in Annex I of the Convention, including the European Union. These Parties are classified as industrialized (developed) countries and "economies in transition" (EITs). The 14 EITs are the former centrally-planned (Soviet) economies of Russia and Eastern Europe (UNFCCC, 1997).

In order to achieve this objective, the Kyoto Protocol allows the use of three flexible mechanisms: Emissions Trading, Joint Implementation and the Clean Development Mechanism (UNFCCC, 1997). Kenya ratified the UNFCCC on 30th August 1994, Kyoto protocol on 25th February 2005 as well as the amendment to the protocol on 7th April 2014 (UNFCCC, 2014). The ratification of the protocol is one of the requirements for any country to implement CDM projects.

The CDM allows carbon offset projects in non-Annex I Parties (developing countries) to generate Certified Emission Reductions (CERs) from investing in CDM projects which can be used towards the national compliance obligations of Annex I Parties under the Kyoto Protocol. For developing countries CDM contributes to sustainable development objectives through increased technology transfer, increased financial resources, sustainable energy production, increased energy efficiency and poverty alleviation through income and employment generation.

The CDM project goes through a number of steps in its implementation process as shown by Figure 2.1. The first stage is the preparation of the project idea note (PIN) or Project design document (PDD) by the project participants (PP), this document captures the information on the project as specified by the Executive board of the UNFCCC. The eligibility of CDM projects is defined by the requirement that they should be voluntary, show long-term climate change mitigation benefits and contribute to emissions reductions above-and-beyond business as usual and the demonstration of compliance to these requirements are validated by an independent designated operating entity (DOE) prior to registration by the UNFCCC.

Validation process then commences by implementation of an independent evaluation by an approved designated operating entity (DOE). The aim of validation is to confirm that all the requirements of the methodology have been met. One of the requirements of the validation is the confirmation that the projects requirements of the host country sustainable development criteria have been met. The designated national authority

(DNA) plays a critical role by issuing a letter of acceptance (LOA) to the project participants confirming that the project contributes to sustainable development.

Once a positive validation opinion is provided by the DOE the registration process is carried out by UNFCCC through its Executive Board (EB) by issuing a formal acceptance of the project. After registration of the project the PP implements the project as documented in the PDD. Monitoring of the information that is required to quantify the emissions reductions achieved by the project is a key requirement if the CDM project activity is to succeed. The monitoring process entails collection and archiving of all relevant data necessary for establishing GHG sources occurring within the project boundary during the crediting period which are used for verification.

The project verification is carried out by an independent audit firm a DOE who reviews and determines GHG reductions that have occurred due to the registered CDM project activity during the period. At the end of the verification process the DOE will certify by giving a written assurance that a project activity achieved the GHG reductions during the specified time period.

The EB will review the recommendation of the DOE report and if in agreement will issue the Certified Emission Reductions (CER's) to the PP's account and finally payment is made.

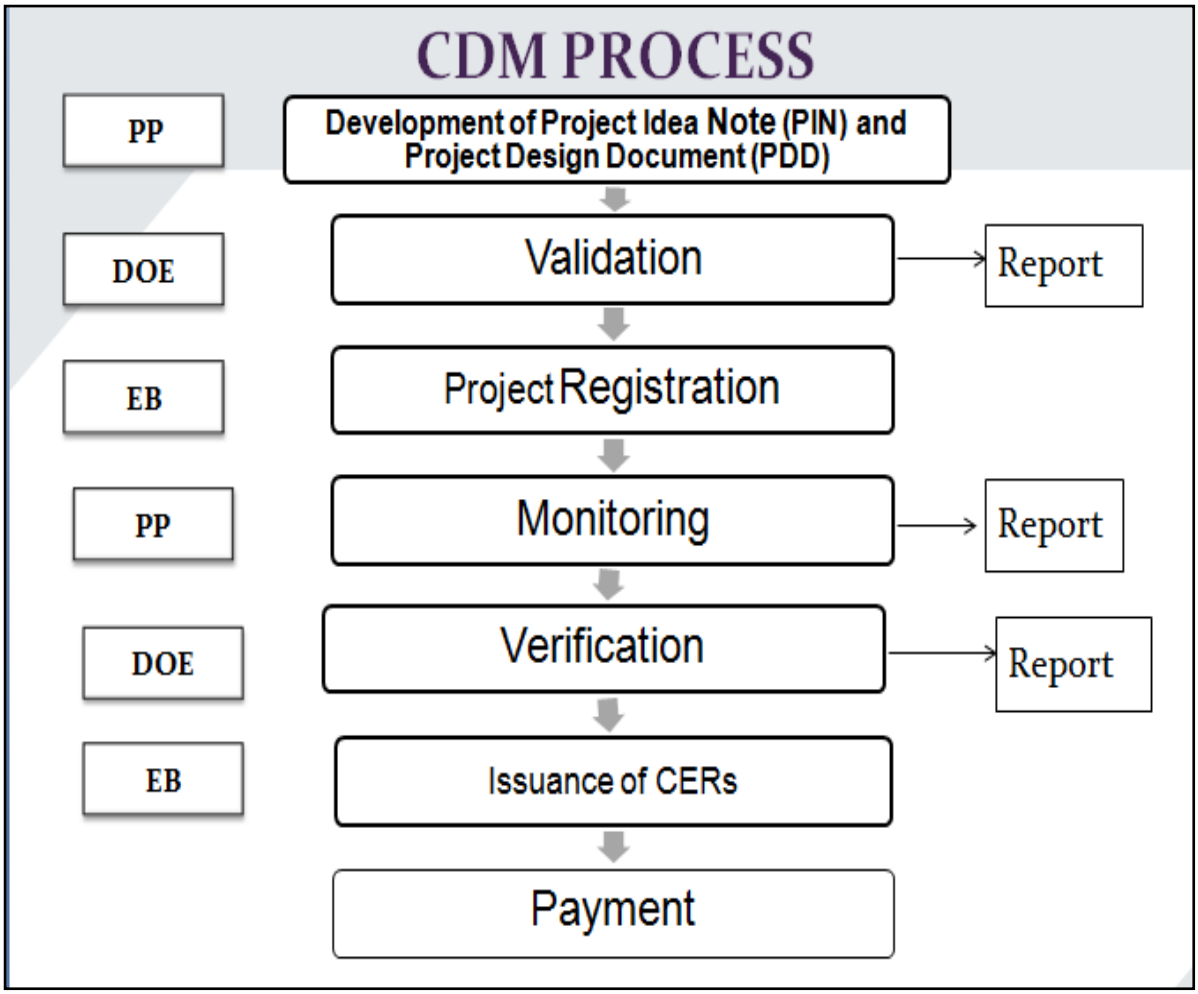

Figure 2.1: CDM Implementation process

The adoption of CDM globally has gradually grown over the years but Africa unfortunately still has few projects being registered with only 2.4% of CDM projects, Asia and Pacific Region are currently leading and represents the highest number of CDM projects registered at 84.2% followed by Latin America and Caribbean with 12.8% of the registered projects and the Economies in Transition have 0.6% of registered projects as shown by Figure 2.2 (UNFCCC, 2014).

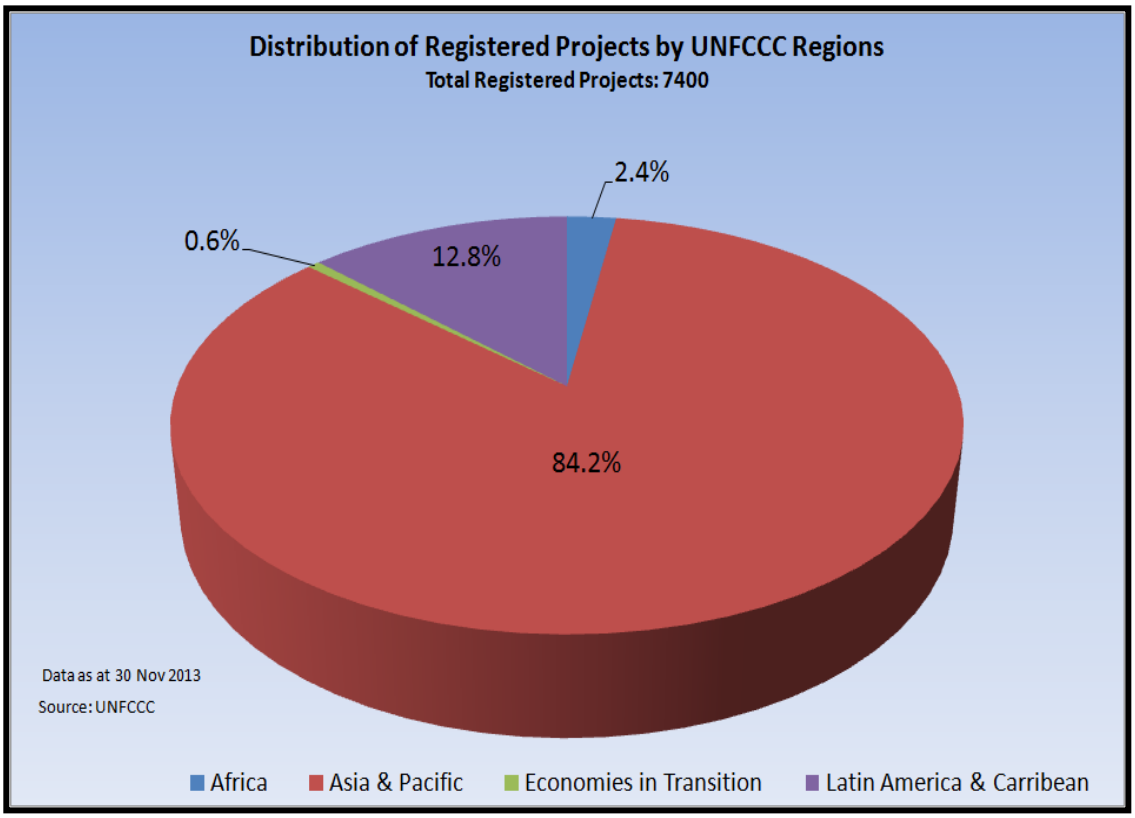

Figure 2.2: Regional distributions of CDM projects

Issuance of CERs amounting to 93.6% of the total issuance from the registered projects was contributed by only nine countries as shown by Figure 2.3. Out of the nine countries only one country is African i.e. Egypt contributing 0.8% of the issued CERs. (UNEP, 2014).

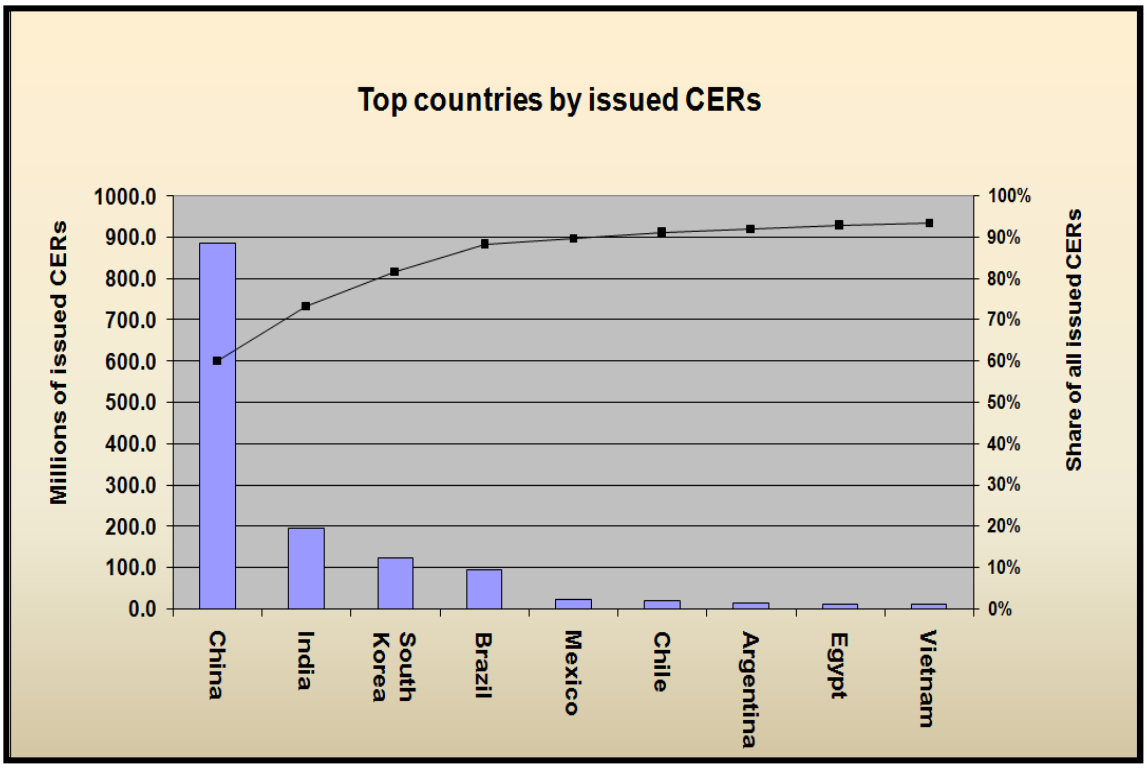

Figure 2.3: Distributions of CERs issuances among the top countries

Source: UNEP (2014).

2.4 Clean Development Mechanism Implementation Process

CDM is a set of operational rules for the trade of greenhouse gas emissions between developed and developing countries defined by the Kyoto Protocol. Based on the evidence of global warming due to anthropogenic causes (IPCC, 2001b), the Kyoto Protocol, with its three flexible mechanisms, aims to mitigate the emission of GHG to the atmosphere (UNFCCC, 1997).The main target of the Kyoto Protocol is to reduce the overall emissions from industrialized countries (referred as Annex I countries) from six (6) selected greenhouse gases (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6) by at least 5% below the levels recorded in 1990 during the commitment period covering 2008 – 2012 (UNFCCC, 1997). In order to achieve this objective, the Kyoto Protocol allows the use

of three flexible mechanisms: Emissions Trading, Joint Implementation and the Clean Development Mechanism (UNFCCC, 1997).

CDM provides incentives for developing countries to implement climate-change mitigation projects, which must be compatible with and supportive of the sustainable development principles set at the national level. CDM defined in Article 12 of the Kyoto Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement an emission-reduction project in developing countries. Such projects can earn saleable certified emission reductions (CERs) credits, each equivalent to one tonne of CO_2, which can be counted towards meeting Kyoto targets (UNFCCC, 1997).

A tradable emissions permit system has been proposed as the most cost-effective instrument that can combine the economic efficiency with the social and environmental constraints. The system is based on the marginal abatement cost for each user. In a tradable emissions permit systems, users are allowed to have a certain amount of emissions. When two users have different marginal abatement costs, the users with a lower cost can profit from selling their allowances when their emissions are under the assigned limit. Users with higher abatement costs can comply with their limits and profit by buying cheaper allowances. Both users can benefit from the trade until they reach the point when their marginal abatements costs are equal for both of them (Blignaut, 2004).

Sub-Saharan African countries have not yet successfully benefited from the CDM mechanism with only 2.4% of CDM projects registered by the UNFCCC, as opposed to those in Latin America with 12.8% registered projects and Asia Pacific with 84.2% registered projects as of November 2013 (UNFCCC, 2014). Sub-Saharan Africa lags far behind other regions in terms of the implementation of CDM projects due to several reasons. One of the reasons is a general perception that, since the region contributes very little to global GHG emissions, it also offers few opportunities to reduce these

emissions. Previous studies by Govinda, *et al*. (2010) found that sub-Saharan Africa could develop 3,227 CDM projects, including 361 programs of activities, which could reduce approximately 9.8 billion tons of GHG emissions during the CDM project cycles. The study also estimates that the realization of this CDM potential could significantly enhance sustainable development in the region as it would attract more than US$200 billion in investment and could generate US$98 billion of CDM revenue at a CER price of US$10/t$CO_2$. Another notable finding of the study is that the realization of this CDM potential could supply clean electricity by doubling the current capacity and thereby providing access of electricity to millions of people in the region (Govinda *et al*., 2010). The transport sector is a major contributor of emissions that are harmful to atmosphere, terrestrial ecosystems and human health. It's estimated that an increase of 880 TWh of electricity consumption will be realised in transport in 2030 compared with the reference scenario. 90% of this occurs in passenger light duty vehicles (PLDVs) which results in about 250 Metric tonnes of additional CO_2 emissions (IEA, 2009).

Many African governments and environmentalists also note that the CDM's rules favour pollution-reducing projects rather than those that could help Africa cope with climate changes, such as irrigation schemes, soil conservation and flood-control programmes. Such projects were instead to be met by the Kyoto Protocol's adaptation fund, financed in part by a 2% levy on CDM credits (Fleshman, 2007**).** The development of CDM projects is a daunting task for developers, especially of small-scale projects. The detailed project cycle, emission baselines, regulations concerning grid connectivity and requirements for additionality require skills and experience to succeed. A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (UNFCCC, 2001). Determination of return on investment, processes of validation, verification and approval are complex issues that interested project developers must become familiar with if they are to produce accurate Project Idea Notes (PINs) and Project Design Document (PDDs). (Brunt & Knechtel, 2005)

One drawback of the CDM, however, is its high transaction costs and specialized skills requirements that have tended to limit the participation of African countries and experts to date (Karekezi, *et al*., 2009). Other previous research on the subject have showed that the main constraints that hinder sub-Saharan African countries from benefiting for the CDM initiatives come to a large extend from within the country (Kreuger, 2005)

2.5 Clean Development Mechanism in Kenya

As of November 2013, Sub-Saharan African countries had only 2.4% of CDM projects registered by the UNFCCC, as opposed to those in Latin America with 12.8% registered projects and Asia Pacific with 84.2% registered projects (UNFCCC, 2014). Africa has now registered 249 projects registered consisting of 54% in the renewable sector as of August 2014 which is still low compared to 1,156 projects registered by the Latin America and 7,103 projects that have been registered by the Asia and Pacific region (UNEP, 2014).

The government of Kenya acceded to the Kyoto Protocol in February 25, 2005, however it took up to 2008 for the first CDM project to be registered from Kenya i.e. the 35 MW Bagasse Based Cogeneration Project by Mumias Sugar Company Limited (UNFCCC, 2014). Olkaria III Phase 2 Geothermal Expansion Project and Olkaria II Geothermal Expansion Project were registered in 2010 (UNFCCC, 2014). Lake Turkana 310 MW Wind Power Project, Aberdare Range/Mt. Kenya Small Scale Reforestation Initiative Kamae-Kipipiri Small Scale A/R Project, Aberdare Range/Mt. Kenya Small Scale Reforestation Initiative, Kirimara-Kithithina Small Scale A/R Project and Redevelopment of Tana Hydro Power Station Project were registered in 2011. Aberdare Range/Mt. Kenya Small Scale Reforestation Initiative Kibaranyeki Small Scale A/R Project, Nairobi River Basin Biogas Project, 60 MW Kinangop Wind Park Project, Karan Biofuel CDM project – Bio residues briquettes supply for industrial steam

production, Optimisation of Kiambere Hydro Power Project, Corner Baridi Wind Farm, Kipeto Wind Energy Project, Olkaria IV Geothermal Project and Olkaria I Units 4&5 Geothermal Project were registered in 2012 (UNFCCC, 2014). Energy efficiency improvement project through modification of heat exchanger network at Kenya Petroleum Refineries Ltd was registered in 2013 (UNFCCC, 2014). Restoration of Degraded Lands through Reforestation in MAU Forest Complex, Restoration of Degraded Lands through Reforestation in Aberdare Forest Complex & National Park area and 5.1MW Grid Connected Wind Electricity Generation at Ngong Hills were registered in 2014 (UNFCCC, 2014). The Implementation of CDM projects in Kenya has progressed at a slower pace based on the analysis above. The Kenya Electricity Generating Company (KenGen) commenced the development of green energy projects under CDM in 2006 when the Company entered into a partnership with the World Bank. The World Bank approved six project idea notes (PIN's) of the nine that KenGen presented but the first KenGen project was registered in 2010 and the latest was registered in 2014 which demonstrates that the process takes long and hence the need to carry out this study. The need for specialized skills requirements has been shown by Karekezi, *et al*. (2009) to limit the participation of African countries.

2.6 Clean Development Mechanism Implementation at KenGen

The Kenya Electricity Generating Company (KenGen) commenced the development of green energy projects under CDM in 2006 when the Company entered into a partnership with the World Bank, (Kollikho, 2008). The World Bank approved six project idea notes (PIN's) of the nine that KenGen presented. Out of these six projects as detailed by table 2.1 have been registered by UNFCCC and the World Bank has provided technical support on some of the current projects.

Table 2.1: KenGen CDM registered projects

No.	Project Registration Date	Project Title	Estimated Emission Reductions (tonnes of CO_2e)	Project Commissioning Dates
1	04-Dec-10	Olkaria II Geothermal Expansion Project	149,632	15/03/2010
2	11-Oct-11	Redevelopment of Tana Hydro Power Station Project	25,680	23/12/2010
3	24-Oct-12	Optimisation of Kiambere Hydro Power Project	41,204	5/09/2009
4	19 May -14	Ngong Wind	9,941	21/08/2009
5	28-Dec-12	Olkaria IV Geothermal Project	651,349	Expected in 2014
6	28-Dec-12	Olkaria I Units 4&5 Geothermal Project	635,049	Expected in 2014

Source: UNFCCC, 2014

The current generation mix at KenGen indicated in Table 2.2 comprises of 80.84% renewable energy from hydro, geothermal and wind (KenGen, 2014).

Table 2.2: KenGen's Existing Generation Facilities

Generation Type	Installed Capacity (MW)	Percentage Contribution (%)
Hydro	**819.9**	**61.31%**
Geothermal	**256.1**	**19.15%**
Thermal	**256.2**	**19.16%**
Wind Turbine	**5.1**	**0.38%**
Total	**1,337.30**	**100**

Source: (KenGen, 2014)

The potential for KenGen to consider more projects for CDM is therefore feasible based on research that has shown that the composition of CDM projects in Africa is 54% renewable energy as indicated by Figure 2.4, UNEP (2014).

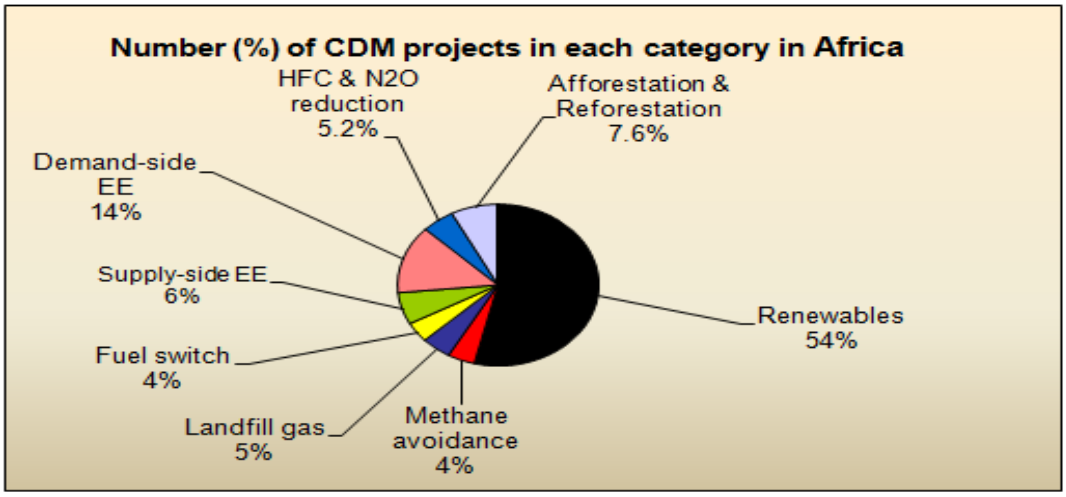

Figure 2.4 Categories of CDM projects in Africa

Source: UNEP (2014)

The sale of certified emissions reductions (CER's) generated by the CDM projects will act as a catalyst to focus on renewable energy in the country. The rural communities living in and around the project areas are also expected to benefit from CDM projects

through implementation of community programs funded by carbon revenues. An example is the constructions of classrooms, water lines and water pans for livestock by KenGen in Olkaria after the registration of its first project (KenGen, 2014). The implementation of clean energy CDM projects will also go a long way in reducing the number of people with no access to electricity. The challenges of implementation of CDM projects were identified by Kollikho, (2008) to include the few validators leading to challenges in validation of CDM projects which was rarely achieved in less than three months, lack of capacity to develop CDM projects and the monitoring protocol comprising of monitoring procedures, calibration procedures and collection of despatch data for emission reduction calculation. The implementation of the monitoring protocol is the basis for the issuance certificate of CER's and hence is in the critical path to the success of CDM implementation.

CHAPTER THREE
METHODOLOGY

3.1 Introduction

Authority (See Appendix 7.1) was obtained from KenGen to carry out the research at the sampled power stations while persons sampled for interview and survey during the research were made aware of their right to respond, give information and withdraw at any stage of the study and such decision was respected. Confidentiality has been upheld during the research and the findings of this study shall be used for the benefit of those who participated.

3.2 Research Design

In order to investigate the objectives of this study and answer the hypothesis, the qualitative research method was employed as this was deem the most appropriate too for this kind of research. The questionnaires shown in appendix 1, 2 and 3 were designed and survey technique was used to collect data. The questionnaire document was structured to facilitate easy and short answering of questions by the respondent and this was expected to increase the chances of response from the targeted sample population. The choices of questions for this investigation included questions on personal background; age- lowest range was 18 - 30 and highest was 51-60; gender- male/female; education level (Diploma, HND, Bachelors, Masters and Doctor of Philosophy), duration of employment (less than 10 years to more than 25 years), area of operations (Head Office, Tana, Olkaria, Kiambere and Ngong Wind).

Specific questions on variables related to the CDM Implementation process as shown by figure 2.1 were also developed. The choices of questions and targeted sample was aimed at the assessment of challenges related to CDM Implementation at KenGen covering the policy level, CDM implementation and level of awareness with respect specific stages of the CDM process. The rating scale varied from “Most Important” to “Absolutely Not

Important". Please see the Appendix 1, 2 and 3 for full details of the questionnaire. The questionnaires were tailor made to suit the various cadres of KenGen staff related to the CDM process comprising of head office team who are expected to shape the policy direction of the company, the Environment and CDM department team with respect to the expert opinion on CDM process and finally the operations team who run the generation component of KenGen business but are also expected to know the impact of the power plants running to CDM process.

The questionnaires were administered to the employees that were chosen for the research based on their involvement in CDM related projects and representation of all CDM project areas via mail and followed up with individual phone calls. The choice of respondents who are involved in the CDM process was expected to enhance the potential of having a response based on prior interaction with the subject. Secondary data was reviewed from current information from scientific journals, research project reports, publications, Project Design Documents (PDD) of the KenGen CDM projects and public information from the UNFCCC and UNEP websites in order to determine the process of CDM Implementation process.

The study focus considered was in three broad areas as indicated in section 3.2.1 to 3.2.3.

3.2.1 Determination of the level of awareness with regard to implementation of CDM

The level of awareness among key persons in the company and whether the level of awareness plays a role in the CDM implementation process was determined during this study by use of the developed questionnaire and interviews with the program managers at the respective areas of operations within the company where CDM projects have been implemented as detailed by the study sites as described in section 3.4.

3.2.2 Determination of organizational, administrative and policy issues that impede the implementation of CDM projects

In order to appreciate the organization constraints limiting the implementation of CDM projects at KenGen, the developed questionnaire was administered to the respondents'. Secondly CDM officers who are tasked with implementation of CDM projects at KenGen were interviewed. Data on the geographical distribution of CDM project activities and role of actors in the CDM process was obtained through the official website of the United Nations Framework Convention on Climate Change (https://cdm.unfccc.int/). This website makes data available on all projects in the CDM project cycle including validation and registration process.

3.2.3 Determination of challenges faced by KenGen in relation to the rules and procedures of CDM implementation

Literature on policy analysis, evaluation and the role of actors in the CDM process was studied to develop an analytical framework for the empirical data interpretation. Thereafter the challenges faced by KenGen related to rules and procedures of the CDM projects implementation process were determined. Secondary data was also reviewed in the course of the study to understand the CDM Process. The reviewed data came from current information from scientific journals, research project reports, publications, Project Design Documents (PDD), project validation reports and project monitoring reports for the KenGen CDM projects.

3.3 Sampling

3.3.1 Sample Size determination

A non-probability or judgmental sampling technique was adopted with focus on the divisions/department within the Company where the four CDM projects have been implemented. This was deemed as the appropriate technique due to the technical nature of the subject under investigation. The respondents were expected to possess the

required knowledge of the subject matter and therefore the sample population comprised of representatives from a team of staff that have a direct link/familiar with KenGen CDM projects as shown by the Table 3.1. The study sample covered staff representatives comprising of top management (Directors & Managers), middle management (Chief Officers) and other staff members (Officers). The Sample was therefore purposively chosen based on their experience and proximity to projects that had a CDM component and this was deemed to be likely to give feedbacks that will contribute to improvement of the CDM process in KenGen.

Table 3.1: The sample population

Sampled Staff Members	Sample Population (%)	Total Population of Potential Respondents	Responsibility with respect to CDM Projects
Directors	1 (11.11%)	9	Leadership and Policy Matters
Managers	5 (22.73%)	22	Leadership and Policy Matters
Capital Planning and Strategy team	1 (12.5%)	8	Strategy and Planning
Environment and CDM team	5 (45.45%)	11	CDM Project development and Monitoring
Operation Team in Olkaria II power station	5 (27.78%)	18	Plant Operations and Monitoring
Olkaria II Steam Field Management and Laboratory	4 (26.67%)	15	Plant Operations and Monitoring
Operation Team in Tana power station	2 (28.57%)	7	Plant Operations and Monitoring
Operation Team in Ngong power station	1 (33.33%)	3	Plant Operations and Monitoring
Operation Team in Kiambere Hydropower project	2 (25%)	8	Plant Operations and Monitoring
Total	**26 (25.74%)**	**101**	

3.4 Description of Study Site

The study was carried out at the Kenya Electricity Generating Company installations comprising of the head office located at Stima Plaza, Phase 3, Kolobot Road, Parklands and the specific generation sites where CDM projects have been implemented and

registered by the UNFCCC up to 2014. The head office plays an administration role in all of KenGen's operations. All policies and programs are ordinarily initiated, implemented and monitored by a team of senior managers based at the head office. The research therefore incorporated a team of senior staff at the head office as well as the operation sites as detailed by the results in chapter 4.

The registered projects visited were the 35 MW Olkaria II geothermal expansion project, the 20 MW re-development of Tana hydro power, 20 MW optimization of Kiambere hydropower project and the 5.1 MW Ngong 1 wind power project.

The KenGen CDM registered projects which are located in various parts of the country that were considered in this study are as detailed in sections 3.4.1, 3.4.2, 3.4.3 and 3.4.4.

3.4.1 The 35 MW Olkaria II geothermal expansion project

The Olkaria II Geothermal Expansion Project located in the Rift valley as shown in figure 1.7 was developed with an objective to increase the capacity of the existing Olkaria II Geothermal Power Plant by adding a third generating unit of 35MW. Prior to the project implementation Olkaria II had an installed capacity of 70 MW (2 x 35MW) and its steam gathering capacity could produce approximately 98 MW. To make use of this surplus steam KenGen added a third generating unit (Unit 3) of 35 MW at Olkaria II. A part from the increased generating capacity, the project was expected to result in greenhouse gas (GHG) emission reductions by displacing fossil fuel-based electricity generation in the Kenyan grid with clean geothermal power.

The project activity is located at Latitude 0 51" 45" and Longitude 36 17" 55" and lies within Kenya's Rift Valley as shown by Figure 3.1

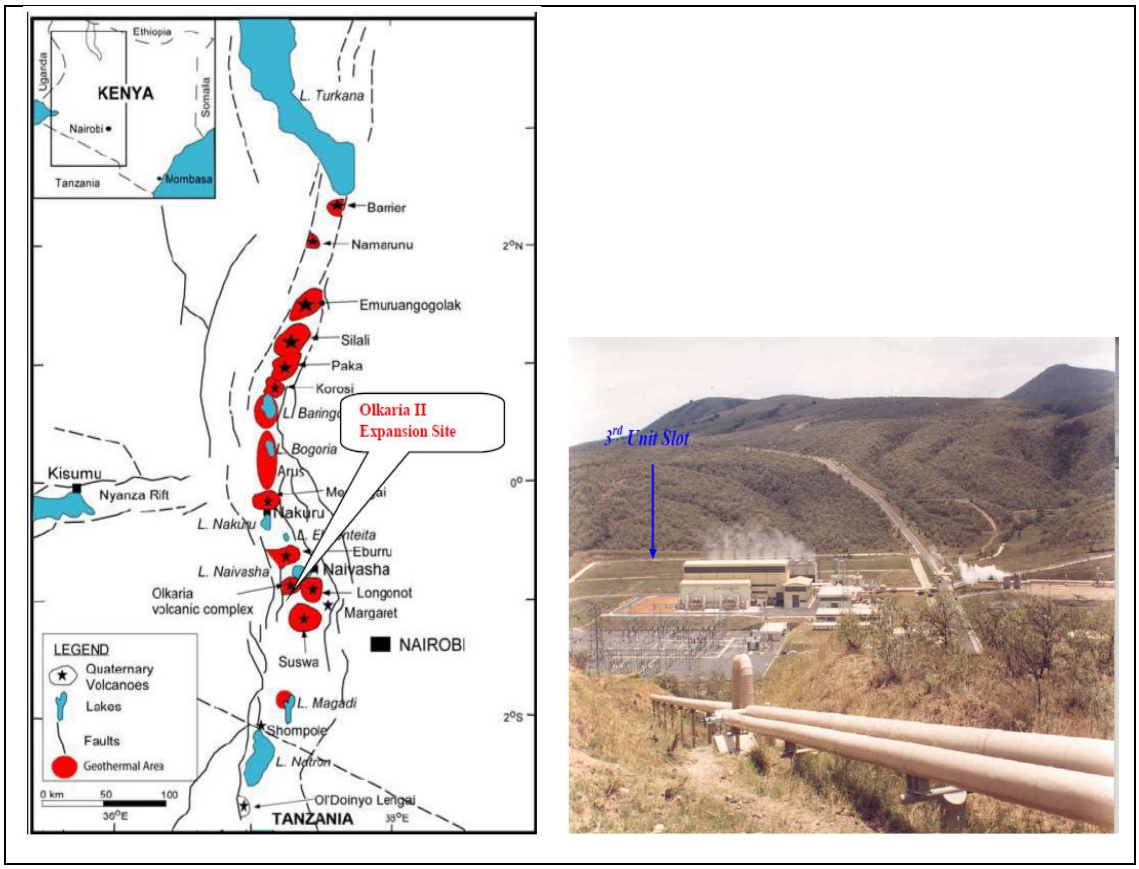

Figure 3.1 Location of Olkaria II Expansion Project

3.4.2 The 20 MW Re-development of Tana hydro power project

The Redevelopment of Tana Power Station Project involved rehabilitation through replacement of the existing Tana power station which was a run-of-river hydropower generation plant. The project utilises water from the Tana and Maragua Rivers to generate electricity. The Tana power station originally had an installed capacity of 14.4 MW. At the completion of the project it was expected to increase capacity to 20MW. The redevelopment project was expected to have a net electricity generation for export to the grid amounting to 130.3 GWh per year and greenhouse gas (GHG) emission reductions by displacing fossil fuel-based electricity generation in the Kenyan grid with clean hydropower.

The project activity is located at Latitude 9913468 N and Longitude 306523 E. The Tana power station lies just upstream of the confluence of the Tana and Maragua Rivers at the end of the Masinga Reservoir as shown by Figure 3.2

Figure 3.2 Location of Tana Power Station

3.4.3 The 20 MW optimization of Kiambere hydropower project

The Optimisation of Kiambere Hydro Power Project involved rehabilitation of Kiambere Power Plant including upgrading of the turbines with new efficient runners at the existing Kiambere power plant. The existing (2 x 72 MW) turbines were replaced with (2 x 84.5 MW) turbines with new efficient runners. The project activity was expected to result in greenhouse gas (GHG) emission reductions by displacing fossil fuel-based electricity generation in the Kenyan grid with clean hydropower. Emission reductions

associated with the project activity was expected from the additional 20 MW of contracted capacity.

The project activity is located at Latitude 0° 38' 24" S (-0.6400) and Longitude 37° 54' 36" E (+37.9100). The Kiambere power station is the last of the five hydropower stations on the Tana River as indicated by Figure 3.3

Figure 3.3 Location of Kiambere Power Station

3.4.4 The 5.1 MW Ngong 1 wind power project

The Project is a newly built wind farm located in Kajiado District. The project comprises of six (6) Vestas V52 turbines having a power rating of 850kW. The project involves the generation of electricity through renewable energy i.e. wind energy at the Ngong Hills in Kenya, to displace grid electricity generated by fossil fuel based electricity. The project activity was expected to result in greenhouse gas (GHG) emission reductions by displacing fossil fuel-based electricity generation in the Kenyan grid with clean wind power.

The project activity is located at Co-ordinates 36^{o} 38’ East, 01^{o} 22’ South as shown by Figure 3.4

Figure 3.4 Location of Ngong Power Station

3.5 Data Collection

3.5.1 Primary data

The source of primary data for this research was obtained from the administered questionnaires and interviews of selected program managers, interviews of selected heads of the departments responsible for the development of CDM projects, site visits to make observations and finally a review of secondary data based on records on the subject. Appendices 1, 2 and 3 outlines the structure of the sample questionnaire used to gather information. The questionnaire document was designed to facilitate easy and

short answering of questions by the respondent based on the role played in the implementation of CDM projects at KenGen.

3.5.2 Secondary data

Secondary data was extracted from current information from scientific journals, research project reports, publications, Project Design Documents (PDD) of the KenGen CDM projects and public information from the UNFCCC website. The role of actors in the CDM process was studied to determine the organization constraints that impede CDM implementation at KenGen.

3.6 Data Analysis and Presentation

The relationships between responses to different questions and frequencies of responses was worked out using the Statistical Package for the Social Scientists (SPSS), interpreted, and explained in terms of the general trends that emerged from the analysis. The Statistical Package for Social Sciences (SPSS) 17.0 was used to analyze the data collected. The descriptive statistics was applied to assess the level of respondent's awareness to the challenges of implementing of CDM projects at KenGen. The CDM project implementation attributes, specific demographic variables and challenges was analyzed to show the relationships using tables, graphs and charts as detailed in chapter four.

CHAPTER FOUR
RESULTS AND DISCUSSIONS

4.1 Introduction

The study results discussed below were achieved based on descriptive statistics which were applied to assess the level of respondent's awareness to the challenges of implementing of CDM projects at KenGen. The relationship between the CDM project implementation attributes, specific demographic variables and challenges were based on the results presented in graphs, tables, charts and analysed using the SPSS software.

4.1.1 Demographic Characteristics of the Respondents

The demographic characteristics of the respondents comprising of level within the organization structure, age, gender, educational level, area of operation and years of service with the company have been analysed and presented in Figure 4.1.

As shown by Figure 4.1, majority of the respondents (61.90%) were officers while the other levels were adequately represented with chief officers (23.81%), managers (9.52%) and directors (4.76%) covering the entire spectrum of the company. The study findings as shown by Figure 4.2 found that 47.6% of the study participants were aged 41 – 50 years, 28.6% aged 31 – 40 years, 14.3% aged 51 - 60 years and 9.5% were aged 18 - 30 years. The results from the study therefore represent views of all the age groups within KenGen with a higher number (76.2%) being those between 31 – 50 years, the findings from this study therefore are based on a study population that is knowledgeable as well as experienced with respect to the subject matter under study.

Gender representation comprised of 81% male and 19% female as shown by Figure 4. 3, this is based on the technical nature of roles in the company hence the biasness towards the male gender.

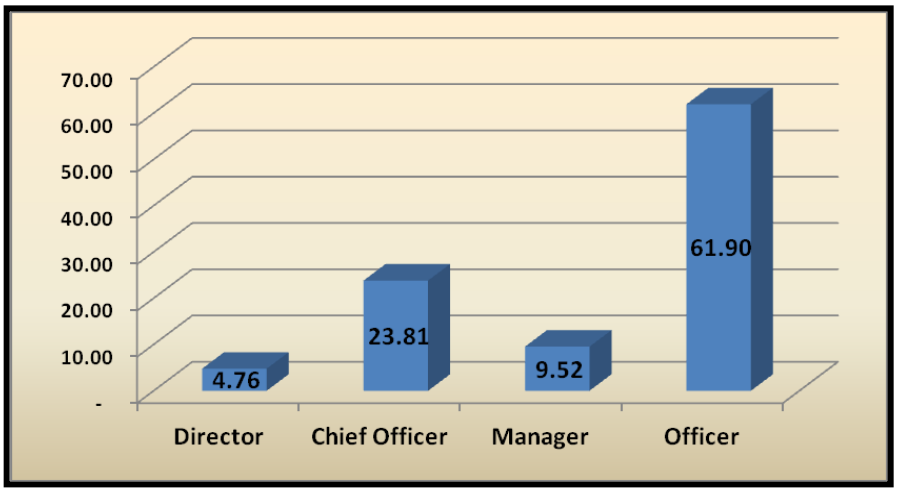

Figure 4.1: Distribution of respondents at KenGen

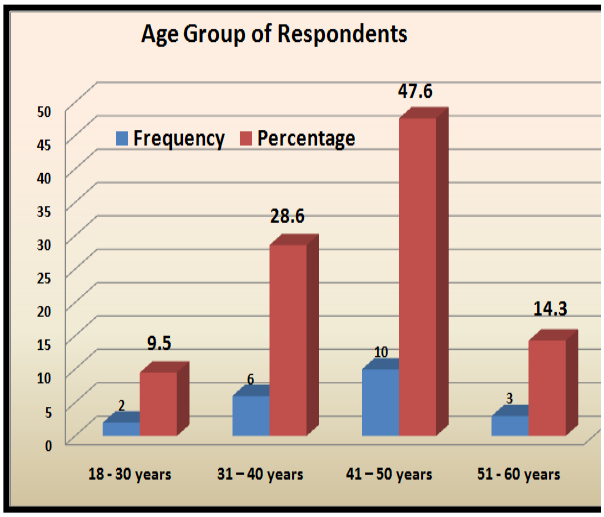

Figure 4.2: Age group of the respondents

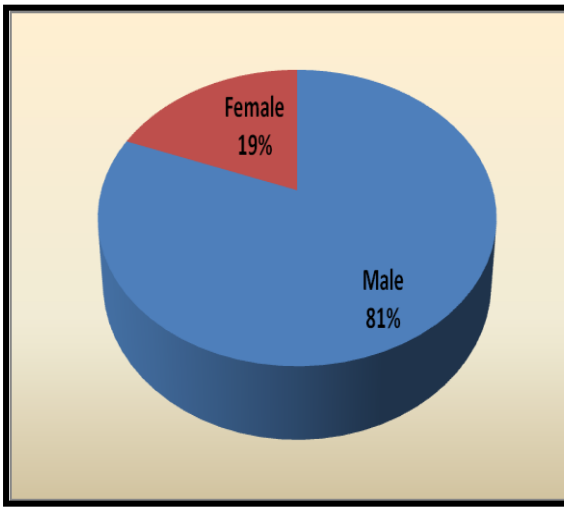

Figure 4.3 Gender of the respondents

Level of education as shown in Figure 4.4 has shown that majority of the respondents had university level education with 42.9% first degree, 38.1% with masters and 4.8% with doctor of philosophy (PhD). Diploma at 9.5% and Higher National diploma at 4.8% completed the spectrum of the respondent's qualification. The study therefore found that all the respondents had adequate education to respond to the research questions. The

feedback obtained from this study therefore demonstrates a true reflection of the challenges of implementing CDM projects at KenGen. The study has established that KenGen has a highly trained manpower. However due to the specialized nature of the CDM process implementation, the team requires training specific to CDM processes. Currently only 19% of the staff involved in the CDM projects implementations have undergone CDM specific courses. Studies on implementation of CDM projects among the African countries have been shown to face limitation due to the need for specialized skills (Karekezi *et al*., 2009). It is therefore expected that the low level of training specific to CDM among KenGen's staff at 19% is likely to have an effect on the success of its CDM projects.

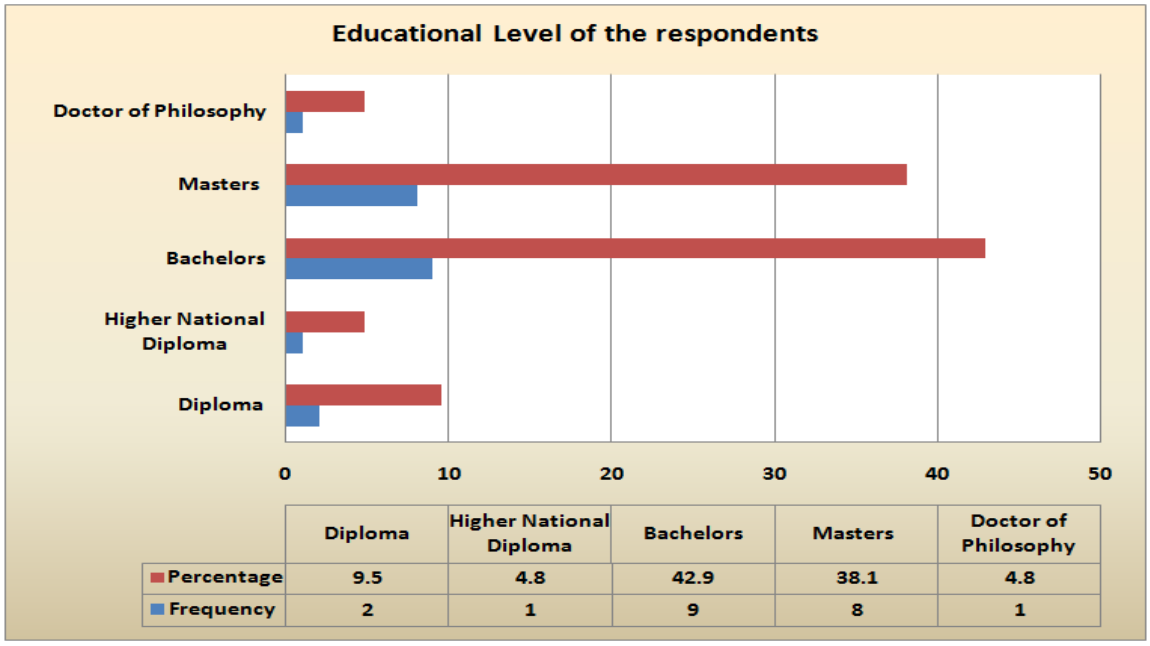

Figure 4.4: Educational Level of the Respondents

Years of service KenGen was considered during this study as an indicator of the experience levels of the study participants. According to the findings as detailed in Figure 4.5, majority of the respondents (52.4%) had worked with the organization for less than 10 years. The findings on education level (Figure 4.4) demonstrated a highly trained team with 85% comprising of Bachelors, Masters and PhD degrees in the

respective fields of competence for the KenGen employees. The short duration with the company is therefore taken care of by the skills and competence exhibited by the participants. About 47.6% of the participants had more than 10 years of work experience with the organization comprising 23.8% (More than 25 years), 14.3% (15-20 years), 4.8% (20 – 25 years) and 4.8% (10-15 years). The respondents to this study therefore comprise of adequate mix experience which is an important contribution in achieving the objective of establishing the challenges faced by KenGen in implementing CDM projects by drawing on individual experience during the project implementation process.

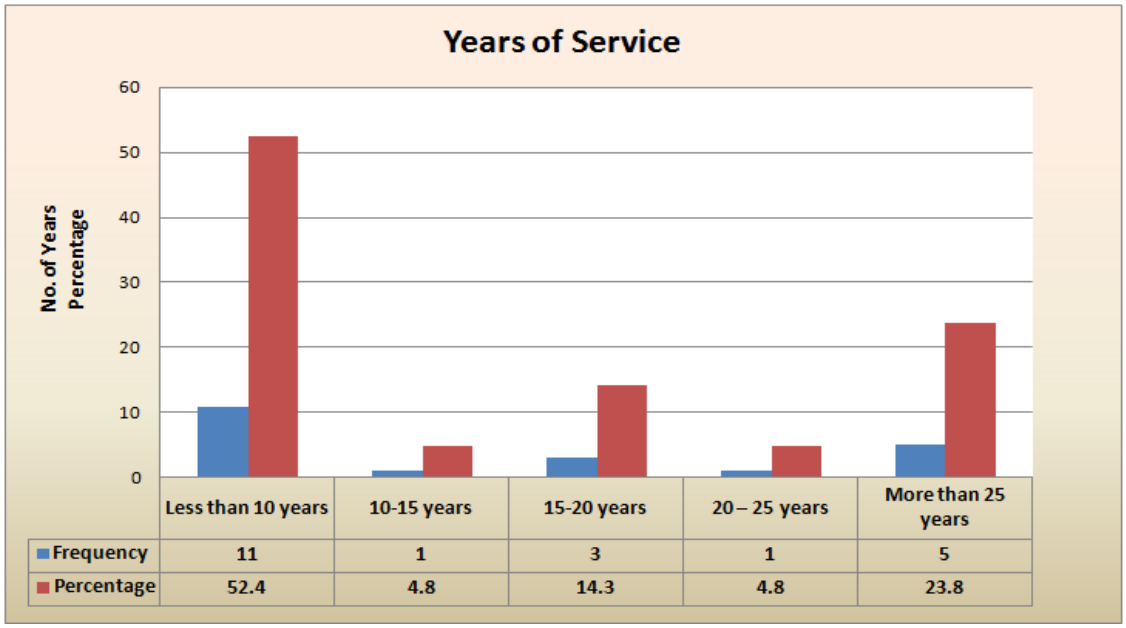

Figure 4.5: Duration of employment of respondents

KenGen has implemented CDM projects across its business operation areas and according to the findings as shown by Figure 4.6, 38.1% of the respondents operated at Olkaria, 28.6% operated at Head Office, 19.1% operated at Kiambere, 9.5% operated at Tana and 4.8% operated at Ngong Wind. The respondents to this study therefore comprise of representatives from all the areas where the CDM projects have been implemented at KenGen.

The study participants have a critical contribution by sharing their CDM experience at their specific station and as shown by Figure 4.6, the study has achieved adequate representation from the study population. The objective of study to establish the challenges faced by KenGen in implementing CDM projects has therefore been achieved based on the representation of the feedback from the KenGen teams operating from various geographical locations.

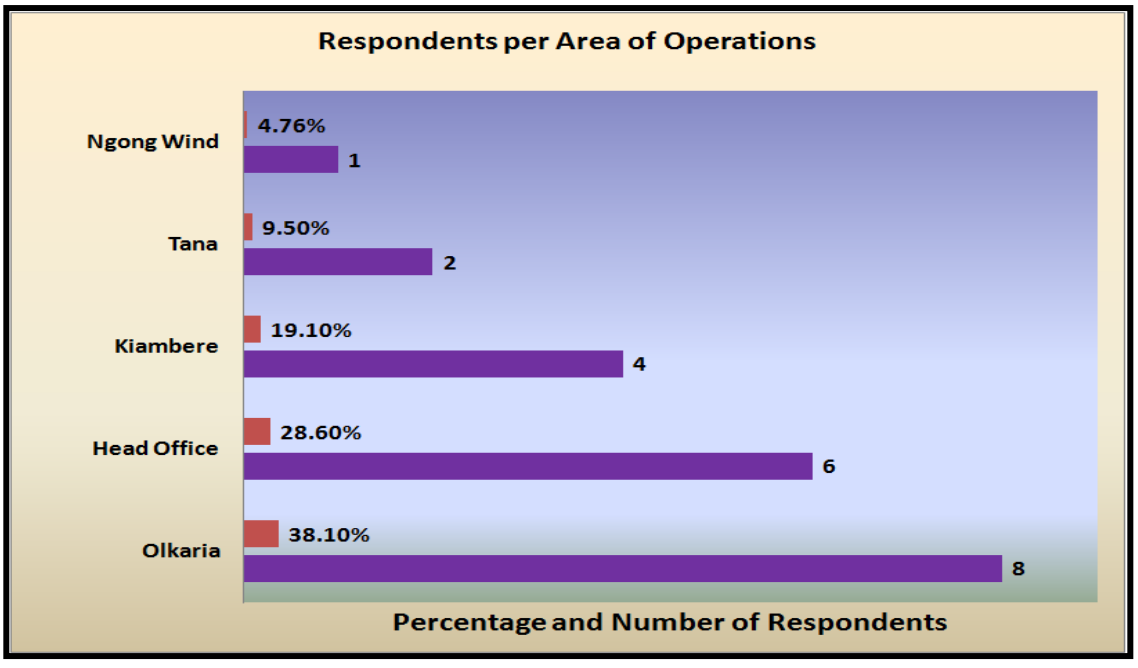

Figure 4.6: Respondents Area of Operation

4.2 Level of awareness in relation to Implementation of CDM at KenGen

The implementation of CDM involves a number of critical steps including preparation of the PDD, validation, monitoring, verification, issuance and payment as shown by figure 1.1 in chapter 1 of this report. The awareness by the stakeholders of what it takes to have a successful implementation of a CDM project is an important contribution to addressing the challenges of implementing CDM in KenGen. Kreuger (2005) in previous research found that the main constraints that hinder sub-Saharan African countries from benefiting for the CDM initiatives come to a large extent from within the country. The level of awareness therefore forms an important link to successful implementation of CDM projects.

This study has determined the level of awareness with regard to procedures of the CDM among key persons at KenGen and whether the level of awareness plays a role in the CDM implementation process. Based on the study, the level of awareness with regard to various aspects of the CDM procedures have been determined including awareness on availability of the climate change policy, CDM policy, the contribution of CDM projects to climate change mitigation and sustainable development. The awareness of the study participants on the CDM projects requirements including implementation, monitoring and quality assurance requirements among others were determined using a qualitative method. The findings with regard to the specific aspects of the CDM awareness within the Company are as detailed in Sections 4.2.1, 4.2.2 and 4.2.3.

4.2.1 Respondents level of awareness on Climate Change and CDM Policy

CDM process and procedures form an important component of the success of a CDM project, the study therefore sought to find out the level of awareness within KenGen on specific aspects including Climate Change Policy/Strategy, CDM policy, training on CDM process and benefits expected to be accrued from implementation of renewable energy projects. According to the study findings as shown by Figure 4.7, about 57% of the respondents indicated that KenGen did not have a Climate Change Policy/Strategy

while 29% indicated that KenGen had a Climate Change Policy/Strategy. As shown by Figure 4.8, majority of the respondents (52.4%) indicated that KenGen had a CDM Policy while 28.6% indicated that KenGen did not have a CDM Policy and the remaining 14 % did not respond.

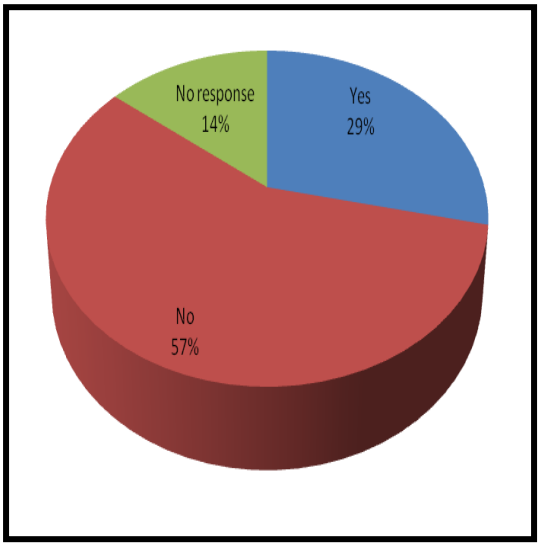

Figure 4.7 Knowledge of presence of a Climate Change Policy/Strategy in KenGen

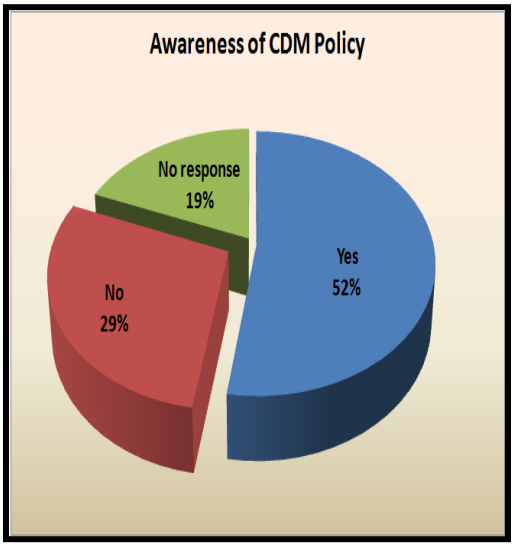

Figure 4.8 : Knowledge of presence of a CDM Policy in KenGen

The UNFCCC aims to mitigate the emission of GHG to the atmosphere and it is therefore an important process that requires to be communicated to project implementers (UNFCCC, 1997). The CDM mechanism can benefit KenGen and hence the need to create awareness by carrying out training of staff involved in renewable energy projects. The study however found that 76% of the respondents had not been trained on CDM related training while the minority (19%) had undergone relevant CDM training as shown by Figure 4.9. This creates a weakness in ensuring successful implementation of CDM projects at KenGen given that the success of the CDM project depends on compliance to requirements defined by the Kyoto Protocol. Specific methodologies and tools that specify activities to be implemented by project participants prior to registration

of the CDM project by the executive board of the UNFCCC are critical components in a CDM project process. Issuance of CER's occurs only after successful implementation and monitoring of the project as per the established procedures. The executive board makes its decisions based on the third party evaluations done by designated operating entities that are approved to validate and verify CDM projects.

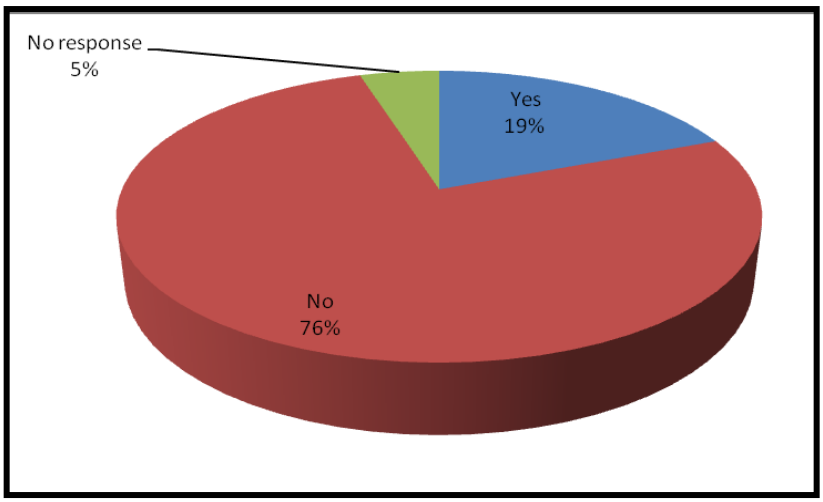

Figure 4.9: Status of CDM related training among respondents

4.2.2 Level of awareness on Contribution of CDM Projects to Climate Change Mitigation and Sustainable Development

According to the study as detailed in Table 4.1, the respondents agreed (Strongly agree and agree) that implementation of the CDM projects contributed to sustainable development (76%), reaching millennium development goals (81%) and reduction of poverty (94%). In addition the respondents agreed that implementation of the CDM projects contributed to improve local community livelihood (79%) and increase the overall population living standards (73%).

Table 4.1 Benefits of implementation of CDM projects

CDM Benefits (%) With N = 12	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
Sustainable Development	34	43	17	3	3
Reach the Millennium Development Goals	33	48	17	10	2
Reduce poverty	41	53	0	3	2
Diminish social inequalities	10	23	40	20	7
Improve local community livelihood	40	39	13	3	4
Increase the overall population living standards	63	10	17	6	4

Studies by AfDB (2002) have showed that poorer developing countries are especially vulnerable to climate change because of their geographic exposure, low incomes and greater reliance on climate sensitive sectors particularly agriculture and pose multiple threats to economic growth, wider poverty reduction, and the achievement of the MDGs. CDM will therefore contribute to alleviation of poverty and achievement of the MDGs as shown by the findings above.

The implementation of the CDM projects is expected contribute to sustainable development (UNFCCC, 1997), this study confirms this objective with 76% confirmation by the study participants. Sustainable development is a requisite criterion for approval of CDM projects by NEMA. Compliance to this criteria by each individual

projects before issuance of the letter of approval by NEMA is a necessary step for registration of CDM projects by the UNFCCC executive board.

4.2.3 Level of awareness with respect to the CDM Project requirements

The organizational awareness with respect to the various stages of the CDM process plays an important role in equipping the staff with the relevant skills. According to the findings detailed in Figure 4.10, 50% of the respondents were involved in project monitoring, while 16.7% were involved in both the PDD development and project implementation. A smaller number at 8.3% were involved in quality assurance yet this is an important process of ensuring the success of the issuance of CER's. Kreuger (2005) in previous research on the subject indicated that the main constraints that hinder sub-Saharan African countries from benefiting for the CDM initiatives come to a large extend from within the country and therefore the limitations to implementation of KenGen projects need to be addressed internally including involvement of key staff in all the critical stages of the CDM project implementation.

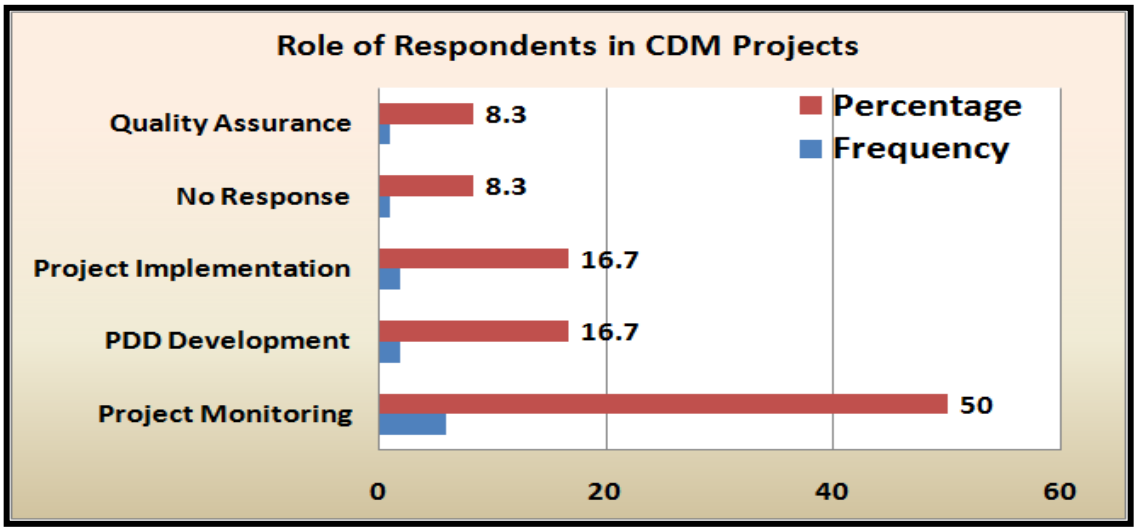

Figure 4.10: Respondents' role in KenGen's CDM projects

The level of awareness with regard to CDM project requirements was found to be high on some specific elements as detailed in Table 4.2. Project monitoring requirements (80%) and compliance to requirements of methodologies (70%) were rated highly (very high and high) by the respondents. The level of awareness with respect to quality assurance and quality control requirements had 47% ratings by the respondents. In addition, 50% of the respondents were undecided on their level of awareness in calibration of measuring equipment requirements and 60% of the respondents were undecided on their level of awareness in reporting and record control including data backup requirements. The two aspects where the respondents were undecided indicate an opportunity for KenGen to train its staff in order to enable the organization to benefit from the CDM process as this aspects affects the success of the KenGen CDM projects during the validation and verification phase.

Table 4.2: level of awareness with regard to CDM project requirements

CDM Project Requirements (%) **With** N = 12	**Very high**	**High**	**Undecided**	**Low**	**Very low**
Project Monitoring Requirements	55	25	7	10	3
Compliance to requirements of Methodologies	10	60	20	5	5
Quality Assurance and Quality Control requirements	7	40	10	40	3
Calibration of measuring equipment requirements	10	30	50	5	5
Reporting and Record Control including data backup requirements	0	35	60	3	2

The motivation for involvement was reviewed in this study and according to the study findings as detailed in Table 4.3, 80% of the respondents indicated that training on CDM Requirements was an important (Most Important and Important) influence on involvement with the CDM project development and implementation. In addition, 55% of the respondents indicated that involvement in the project operations was an important influence on their involvement with the CDM project development and implementation. Involvement in project development had 50% importance to the respondents for their involvement in the CDM implementation.

Table 4.3: Factors that influenced respondents' involvement with the CDM project

Motivation factors (%) With N=12	Most important	Important	Un-decided	Not important	Absolutely Not Important
Training on CDM Requirements	50	30	15	4	1
Involvement in the Project development	20	30	40	6	4
Involvement in the Project Operations	40	15	30	5	10

Pearson's correlations analysis conducted at 95% confidence interval and 5% confidence level 2-tailed found that there was also a positive correlation between implementation of CDM projects at KenGen and level of awareness with a correlation value of 0.39 as shown by Table 4.4. Based on the obtained data the level of awareness has an effect on the implementation of clean development mechanism projects at Kenya Electricity Generating Company. Kreuger (2005) had found that lack of knowledge, skilled labour and information on CDM are constraints' in all sectors (government, civil society and private). For KenGen to benefit from the CDM projects it therefore has to build its internal capacity as well as creating awareness among the employees.

Table 4.4: Pearson's Correlation Matrix

		Implementation of CDM projects	Organizational constraints	Rules and procedures	Level of awareness
Implementation of CDM projects	Pearson Correlation	1			
	Sig. (2-tailed)				
Organizational constraints	Pearson Correlation	0.27	1		
	Sig. (2-tailed)	0.02			
Rules and procedures	Pearson Correlation	0.49	0.26	1	
	Sig. (2-tailed)	0.02	0.11		
Level of awareness	Pearson Correlation	0.39	0.07	0.11	1
	Sig. (2-tailed)	0.04	0.67	0.51	

4.3 Organizational constraints that impede CDM implementation at KenGen

Organizations play a critical role in Implementation of CDM projects. At the inception phase they prepare the project idea note (PIN) and/or Project design document (PDD) and during validation by responding to findings by the independent auditors (DOE). After the registration of the project the organization has the task of implementing the project as stated in the PDD. Monitoring of the information that is required to quantify

the emissions reductions achieved by the project is a key requirement if the CDM project activity is to succeed; the organization is therefore expected to ensure that monitoring is carried out as specified by the CDM procedures and methodologies. The monitoring process entails collection and archiving of all relevant data necessary for establishing GHG sources occurring within the project boundary during the crediting period. Finally the organization has to engage a DOE to carry out verification of its project through an independent review and determination of GHG reductions that have occurred due to the registered CDM project activity during the period.

Organizational constraints within organization like KenGen are therefore expected to impede implementations of CDM. This study has therefore sought to determine if such organization constraints exist within KenGen. The consideration in investment by the company as well as the barriers and challenges being faced by KenGen has been reviewed during this study. The findings discussed below describe the relationships between implementation of CDM projects at KenGen and its organizational constraints.

4.3.1 Company Consideration in its Projects Implementation

According to the findings as depicted by Figure 4.11, 90% of the respondents indicated that clean renewable energy was a consideration in investment decisions by the company. The study has found that KenGen considers renewable energy as a focus for its new KenGen projects with a majority of the study participants (95.2%). This finding demonstrates that KenGen has a potential to benefit from implement CDM projects related to the renewable energy sector.

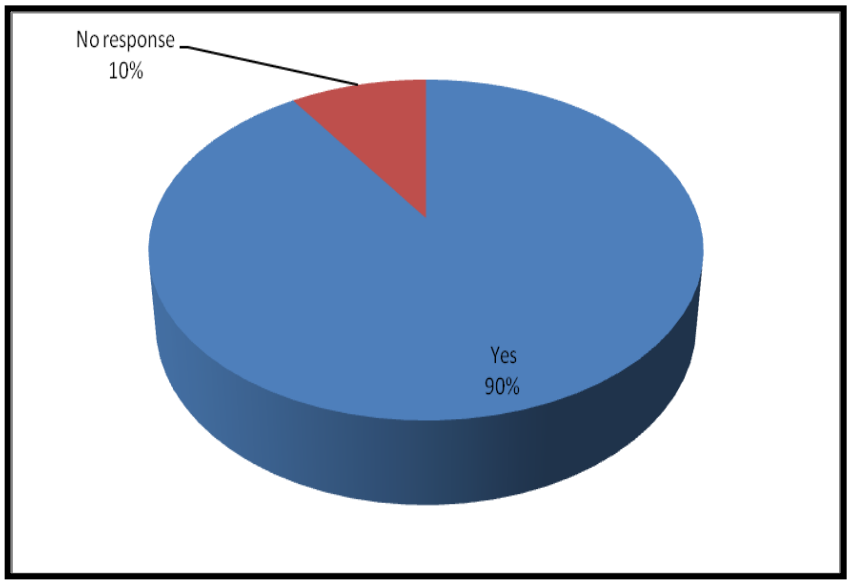

Figure 4.11: **Consideration of clean renewable energy in investment decisions**

4.3.2 Budgetary provision and Management Support

According to the study findings KenGen has made provision of budget within the Environment and CDM department. The department has also assigned the responsibilities for CDM project coordination to a dedicated team of staff with a clear mandate to ensure successful implementation of its CDM Projects. Management support was therefore found as adequate within the organization.

4.4 Challenges related to procedures of the CDM Project Registration

This study attempted to determine the challenges have hindered the implementation of CDM projects as evidenced by the long duration that KenGen projects have taken to get registered. The impacts of rules and procedures in the CDM project registration process is one of the aspects that has been determined in this study as discussed by the results below;

4.4.1 Barriers to CDM Projects Implementation at KenGen

According to the findings detailed in table 4.5, 93% of the respondents indicated that long approval process were important (Most Important and Important) barriers to implementing CDM initiatives for KenGen, 97% of the respondents indicated that lack of adequate internal technical capacity e.g. development of PDD were important barriers to implementing CDM initiatives for KenGen which has been previously identified by Karekezi, *et al*., (2009) that specialized skills requirements have tended to limit the participation of African countries and experts to date in CDM projects.

The findings also indicated that 90% of the respondents considered that complex and tedious CDM procedures were important barriers to implementing CDM initiatives for KenGen, 95% of the respondents indicated that CDM is a non-core business function were important barriers to implementing CDM initiatives for KenGen and 77% of the respondents indicated that lack of awareness on the CDM benefits were critical barriers to implementing CDM initiatives for KenGen, the details of the responses to the barriers are as detailed in Table 4.5.

Table 4.5: Barriers and Challenges to implementing CDM initiatives for KenGen

Barriers (%) With N = 21	Most important	Important	Un-decided	Not important	Absolutely Not Important
Long Approval Process	69	24	7	0	0
Lack of adequate Internal technical Capacity e.g. development of PDD	74	23	3	0	0
Complex and tedious CDM procedures	67	23	2	1	7
CDM is a non-Core Business Function	55	40	5	0	0
Lack of awareness on the CDM benefits	45	32	10	13	0

The study further sought to find out whether the CDM implementation was resourced and the results showed that department responsible for implementing CDM projects had a budget allocated towards facilitating and promoting CDM projects initiatives. According to the study findings, all the respondents indicated that the department had a budget allocated towards facilitating and promoting CDM Initiatives.

The results above show that organizational constraints have an effect on the implementation of clean development mechanism projects at KenGen. Pearson's correlations analysis was conducted at 95% confidence interval and 5% confidence level

2-tailed similarly found that there was a positive correlation between implementation of CDM projects at KenGen and organizational constraints as shown by a correlation Figure of 0.26 as shown by Table 4.4.

A multiple regression analysis was further conducted to test the influence among predictor variables on the implementation of CDM projects at KenGen using the statistical package for social sciences (SPSS V 17.0) to code, enter and compute the measurements of the multiple regressions. The multiple regressions between implementation of CDM projects and the combined effect of the selected predictors were as detailed in the results showed by Table 4.6;

Table 4.6: Multiple Regression Analysis

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.797	.635	.626	.0614
a. Predictors: (Constant), Organizational constraints, Rules and procedures, Level of awareness.				

The analysis returned an R-Square (coefficient of determination) of 62.6%. The study therefore finds that the changes in the implementation of CDM projects could be attributed to the combined effect of the organization constraints, rules and procedures and level of awareness.

4.4.2 Challenges of implementation of KenGen CDM Projects

According to the study findings as shown in Table 4.7, determination of monitoring requirements (60%), baseline determination (60%), PDD development (60%) comprise of the most critical stages that contributes to the challenges in development and implementation of CDM projects at KenGen. Kreuger (2005) found that the main

constraints that hinder sub-Saharan African countries from benefiting for the CDM initiatives come to a large extend from within the country.

Table 4.7: Challenges relating to implementation of the CDM projects

CDM Implementation Challenges (%) With N =5	Most important	Important	Un-decided	Not important	Absolutely Not Important
PIN Development	0	0	20	40	40
PDD Development	40	20	20	20	0
Feasibility study formulation and "business plans"	20	20	20	40	0
Demonstration of Additionality	20	20	60	0	0
Baseline Determination	20	40	40	0	0
Compliance to requirements of Methodologies	20	20	40	20	0
Determination of Monitoring requirements	20	40	40	0	0
Consultations with the actors	0	40	60	0	0
Economic and financial analysis	0	20	80	0	0

The barriers that inhibited KenGen from being pro-active in implementing CDM projects have also been reviewed during this study and according to the findings as detailed in Table 4.8, the respondents indicated that the long approval process (80%), Complex and tedious CDM procedures (80%) and lack of adequate Internal technical Capacity e.g. development of PDD (60%) are the critical factors inhibiting KenGen from being pro-active in implementing CDM projects. Fleshman (2007**)** indicates that many African governments and environmentalists consider the CDM's rules as favouring pollution-reducing projects rather than those that could help Africa cope with climate changes, such as irrigation schemes, soil conservation and flood-control programmes. KenGen being in the energy sector would therefore be expected to benefit from the CDM process however the long approval process (80%), complex and tedious CDM procedures (80%) and lack of adequate internal technical capacity (60%) still affect the successful implementation of CDM projects.

Table 4.8: Inhibiting factors to KenGen pro-activeness in implementing CDM projects

Inhibiting Factors to KenGen's CDM Pro-activeness (%) With N =5	Most important	Important	Un-decided	Not important	Absolutely Not Important
Lack of funds	0	0	40	40	20
Long Approval Process	60	20	0	20	0
Lack of adequate Internal technical Capacity e.g. development of PDD	0	60	40	0	0
Complex and tedious CDM procedures	0	80	20	0	0
CDM is a non-Core Business Function	0	40	40	20	0
Lack of awareness on the CDM benefits	0	20	40	0	40

The study findings as shown by Figure 4.12 identified that on average Complex and tedious CDM procedures (80%), Lack of adequate Internal technical Capacity (65%) and long approval process (50%) as the main challenges that affected the process of validation and registration of KenGen's CDM projects at Olkaria II, Tana, Kiambere and Ngong Wind Power plants. At Olkaria II Expansion Project the study identified complex and tedious CDM procedures (100%), lack of adequate internal technical capacity (80%) and long approval process (60%) as the challenges with significant impact on the Validation and Registration. Tana Redevelopment Project rated complex and tedious CDM procedures (60%), lack of adequate internal technical capacity (60%) and long

approval process (60%) as the challenges with significant impact on the Validation and Registration.

At Kiambere Optimization Project the study found that the factors that affected the Validation and Registration of KenGen CDM Projects are complex and tedious CDM procedures (80%), lack of adequate internal technical capacity (60%) and long approval process (40%) while at the Ngong Wind Project the study identified complex and tedious CDM procedures (80%), lack of adequate internal technical capacity (60%) and long approval process (40%) as the challenges with significant impact on the Validation and Registration.

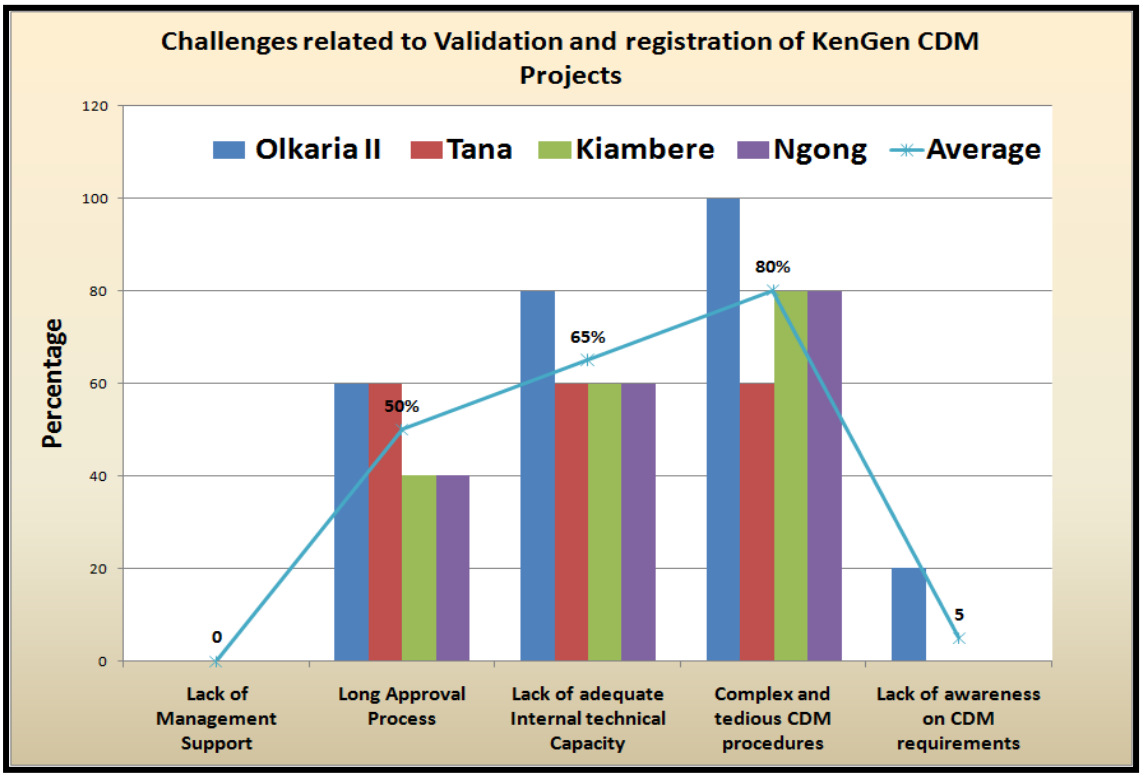

Figure 4.12: Challenges of KenGen CDM Projects Validation and Registration

The ANOVA results found the probability value of 0.0001 ($p < 0.05$) with a mean square of 3.13 which indicates that the model is statistically significant in explaining the influence of organizational constraints, rules and procedures and level of awareness on

implementation of CDM projects considering that the P-value is less than .05 at the 95% level of confidence. The F critical at 5% level of significance was 2.96 since F calculated is greater than the F critical (value = 2.83), this shows that the overall model was significant.

Table 4.9: ANOVA results of the regression analysis between implementation of CDM projects and predictor variables

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	12.236	3	3.132	2.958	.0001
	Residual	92.936	73	.668		
	Total	115.081	76			
a. Predictors: Organizational constraints, Rules and procedures, Level of awareness.						
b. Dependent Variable: Implementation of CDM projects.						

The regression coefficients analysis as shown by Table 4.10 has established that taking all factors into account (rules and procedures, level of awareness and organizational constraints) constant at zero implementation of CDM projects will be 4.84. The findings presented also show that taking all other independent variables at zero, a unit increase in rules and procedures would lead to a 0.66 increase in implementation of CDM projects. Further, the findings shows that a unit increases in level of awareness would lead to a 0.47 increase in implementation of CDM projects. In addition, the findings show that a unit increase in organizational constraints would lead to a 0.349 increase in implementation of CDM projects. Overall, organizational constraints had the least effect on implementation of CDM projects and rules and procedures had the highest effect.

Considering that the P-value is less than .05 at the 95% level of confidence for the three variables as shown by Table 4.10 (0.03, 0.01 and 0.03) it means that the model is

statistically significant in explaining the influence of the level of awareness, procedures and organizational constraints on implementation of CDM projects at KenGen.

Table 4.10: Regression coefficients implementation of CDM projects and the variables

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	4.84	0.52		4.31	0.000
	Level of awareness	+0.47	0.23	0.24	3.35	0.03
	Rules and procedures	+0.66	0.16	0.63	3.26	0.01
	Organizational constraints	+0.35	0.19	0.15	3.38	0.03
a. Dependent Variable: Implementation of CDM projects						

The relationship between variables and implementation of CDM projects at KenGen was also analysed using Chi – Square. The analysis looked at the relationship between Organizational constraints, Rules and procedures, Level of awareness and implementation of CDM projects at Kenya Electricity Generating Company. The statistical relationships were as shown by Table 4.11.

Table 4.11: Chi-Square tests results on relationship between challenges and implementation of CDM projects at Kenya Electricity Generating Company

Chi-Square Tests			
	Value	Df	Asymp. Sig. (2-sided)
Pearson Chi-Square	38.32	9	.001
Likelihood Ratio	39.18	9	.000
Linear-by-Linear Association	10.52	1	.001
N of Valid Cases	38		

The Chi –Square results as indicated in the Table 4.11 above showed that the chi-squared test statistic is 38.32 with an associated p of 0.001 (P<.05). The P value of 0.001 is statistically significant in explaining the influence of the variables on implementation of CDM Projects considering that the P-value is less than .05 at the 95% level of confidence. The results therefore show that there is a relationship between implementation of CDM projects and organizational constraints, procedures and level of awareness. This finding has been confirmed by similar studies by Ichihara and Uchida, (2014) which found that the International level carbon market barriers and International CDM policies and rules are major barriers.

4.4.3 Approval of KenGen CDM Projects by NEMA

The designated national authorities (DNA's) are organizations assigned by the national governments the role of approving proposed CDM projects and ensuring that the projects contribute to sustainable development. Obtaining host country approval is a critical step in the CDM project cycle; without it, a project is not eligible for the CDM. This approval is provided in writing through a Letter of Approval that confirms that the

host country has ratified the Kyoto Protocol, the host country's participation in the CDM is voluntary and confirmation that the project contributes to the host country's sustainable development (UNFCCC, 1997).

The Kenyan DNA role has been assigned to NEMA. From the study NEMA was found to be supportive of the CDM process with majority of the respondents (60%) in the four KenGen's CDM projects indicating that NEMA was supportive of the CDM process. The approvals of KenGen CDM projects according to the study took between 0 – 3 months after request as detailed in Figure 4.13.

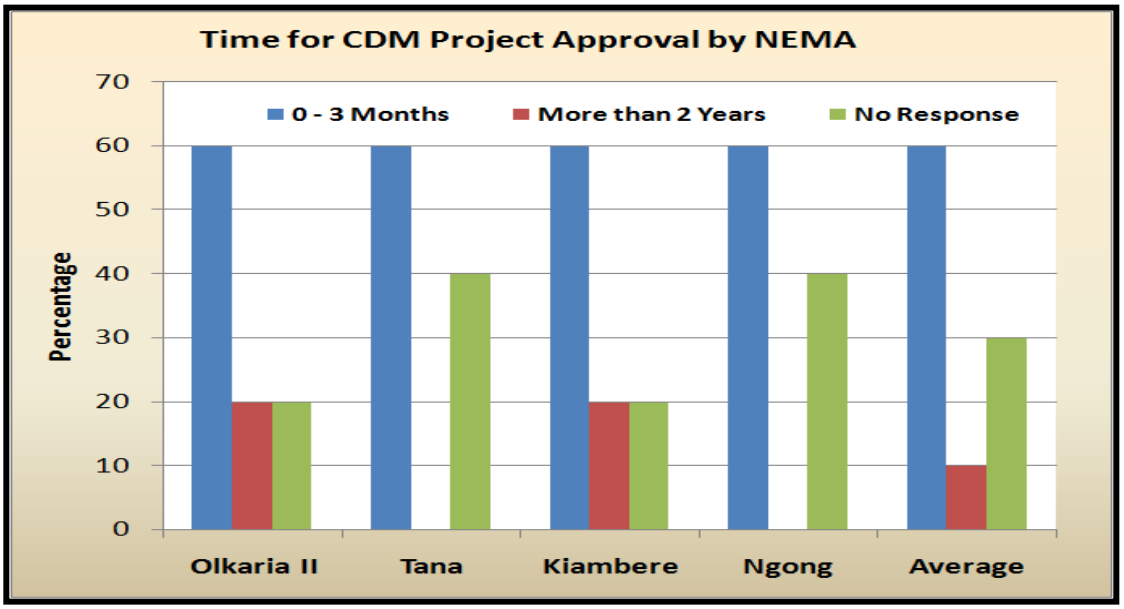

Figure 4.13: NEMA's support for KenGen CDM process

The duration is a shorter period compared to the duration it takes to register KenGen CDM projects which is an average of 1,307 days from start of public comments to registration (UNFCCC, 2014). The finding therefore indicates that NEMA has supported the implementation of KenGen CDM projects although other researchers had indicated that DNA's lack clear guidelines in their decision making partly due to inadequate staffing (Ellis & Kamel, 2007).

CHAPTER FIVE

CONCLUSIONS AND RECOMENDATIONS

5.1 Conclusions

The objective of this study was to identify the challenges of CDM implementation at KenGen. CDM implementation is a catalyst for enhancing sustainable development potential especially in the power sector. In order to meet this broad objective the study sought to determine the level of awareness with regard to procedures of the CDM, KenGen's organizational constraints that impede the implementation of Clean Development Mechanism projects and the challenges faced by KenGen in relation to the rules and procedures of the CDM process in the CDM projects registration process.

The study findings identified low awareness levels among key persons in relation to KenGen's CDM projects with regard to specific CDM implementation requirements namely; quality assurance/quality control, calibration of measuring equipment, record control and data backup. This has an impact on the success of the CDM projects given that CDM is a regulated market mechanism that requires the highest level of compliance to established procedures. The CDM projects are verified independently by DOE's and lack of understanding of requirements would lead to delays in completion of the CDM project process when specific requirements are not verifiable at the time of the audit.

On the organization front the study has found that KenGen considers renewable energy as a focus for its new KenGen projects as part of mitigation and adaptation to climate change as evidenced by the consideration of clean renewable energy in investment decisions by the company.

According to the study findings, KenGen has made provision for budgetary resources within the Environment and CDM department. The department has also assigned the responsibilities for CDM project coordination to a dedicated team of staff with a clear mandate to ensure successful implementation of its CDM Projects. Management support

was therefore found as adequate within the organization. It was however noted among the project implementation teams that CDM is considered as a non core process (i.e. its not part of the power generation).This creates a barrier to successful implementation of KenGen's CDM projects since its not given the seriousness the project deserves as evidenced by the potential to provide additional revenue to the organization.

The study also considered the challenges posed by rules and procedures in the CDM process. The study findings identified complex and tedious CDM procedures, lack of adequate internal capacity and the long approval process as the three main challenges at the development stage of KenGen CDM projects. At the monitoring phase, knowledge of specific project requirements to be monitored has been identified as a weakness. This is a critical stage that determines whether the verification process will be successful leading to payment for the emission reduction and needs to be addressed by KenGen. The support of the regulatory body responsible for CDM approval in Kenya (NEMA) was positively reported by the respondents with the KenGen CDM projects getting approval within three months which is a shorter period compared to the duration it takes to register KenGen projects at an average of 1,307 days.

Pearson's correlations analysis conducted at 95% confidence interval and 5% confidence level 2-tailed has found that there was a positive correlation between implementation of CDM projects at KenGen and organizational constraints with a correlation figure of 0.26, implementation of CDM projects and rules and procedures of the CDM process in the CDM projects registration process with a correlation figure of 0.48 and correlation value of 0.39 for implementation of CDM projects and level of awareness. The implementation of CDM projects had a positive correlation value of 0.390 with level of awareness. The Chi –Square test shows a statistic of 38.32 with an associated p of 0.001 ($P<.05$). The ANOVA results similarly found the probability value of 0.0001 ($P < 0.05$) at the 95% level of confidence. The P value of 0.001 is statistically significant in explaining the influence of the organizational constraints, rules and procedures and level

of awareness on implementation of CDM Projects considering that the P-value is less than .05 at the 95% level of confidence. R-Square (coefficient of determination) analysis similarly demonstrated that 62.6% of the changes in the implementation of CDM projects could be attributed to the combined effect of the organization constraints, rules and procedures and level of awareness. This study therefore concludes that organizational constraints, rules and procedures and level of awareness have an effect on the implementation of clean development mechanism projects at Kenya Electricity Generating Company.

Based on this analysis the null hypothesis is rejected and it's therefore concluded there are challenges that affect the implementation of clean development mechanism projects at Kenya Electricity Generating Company.

5.2 Recommendations and way forward

5.2.1 Policy Recommendations

KenGen is placed at the pivotal role in Kenya being the single largest electricity generator to contribute to mitigating the challenges of climate change by successfully implementing renewable energy projects that can move our country to a low carbon development trajectory while at the same time benefiting from CDM revenues.

The study findings have identified weaknesses that once addressed will enable KenGen improve its CDM processes. The first area that is recommended for improvement is the awareness levels on some Key parameters that impact on the success of the CDM process. It's recommended that the organization should put in place measures to address the awareness level by employees on aspects of the CDM process especially the employees involved in the CDM project implementation. Secondly to enable the success of its CDM projects, its recommended that KenGen should provide of appropriate training since the study found that majority of its project teams had not undergone any CDM specific training and yet this forms a key pillar in implementation of CDM

projects. Thirdly sensitization of the project implementation teams on the potential benefits should be enhanced to create a common understanding of the impact of the CDM process in contributing to sustainable development while at the same time providing additional revenue to the Company. This will enable the teams feel that CDM is a core business process that generates revenue to the Company that is additional to the traditional revenue from energy sales.

Lastly the internal technical capacity within the CDM implementation team with respect to the rules and procedures that govern the implementation of CDM Projects needs to be enhanced to ensure successful monitoring of KenGen's CDM projects which will go a long way in enabling the Company to get the requisite verification in a shorter period as well as payments.

5.2.2 Recommendations for Further Research

The research has shown that Kenya has a potential to gain from the global intervention to utilize the green energy technology to mitigate against the impacts of Climate Change if only the constraints from within are addressed. Kenya as a country should in future prepare early including having adequate technical capacity if we are to benefit from new global initiatives geared towards combating the challenges of climate change. Based on the research work a detailed study on adoption of new initiatives including the new market mechanism expected to be adopted in 2015 and NAMA's which is currently ongoing should be carried out to ensure that Kenya does not lag behind in its implementations' as was the case with CDM.

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APPENDICES

Appendix 1: Letter of Approval to carry out research

JOMO KENYATTA UNIVERSITY
OF
AGRICULTURE AND TECHNOLOGY

INSTITUTE OF ENERGY AND ENVIRONMENTAL TECHNOLOGY

P.O. BOX 62000, NAIROBI, KENYA. Tel: (067) 52251/52711/52181-4, Fax: (067) 52164 Thika, Email: director@ieet.jkuat.ac.ke

January 17, 2014

TO WHOM IT MAY CONCERN

RE: METTO JAMES KIPCHUMBA (REG. NO. EET30-0728/2011)

The above named person is a student at Jomo Kenyatta University of Agriculture and Technology undertaking a Master of Science degree in Environmental Legislation and Management (MSc. ELM) with our Institute - IEET.

He enrolled for the programme in May 2011 and has so far completed his coursework quite successfully and has concluded his thesis proposal entitled; **'Investigation of the *Challlenges Facing the Implementing of CDM Projects at KENGEN*'**. He is now embarking on his data collection so that he can compile his master thesis.

To this end, any form of assistance or support that would help him achieve his goals or successfully complete his project work would be greatly appreciated.

Thank you.

PROF. R. KINYUA
DIRECTOR, INSTITUTE OF ENERGY AND ENVIRONMENTAL TECHNOLOGY

Our Ref: **STAFF/KENGEN/JMM/jn**

Date: **28th January, 2014**

KenGen
Kenya Electricity Generating Company Ltd.
Stima Plaza, Kolobot Road, Parklands
P.O. Box 47936 - 00100 Nairobi, Kenya
Telephone: 254-20-3666000 Fax: 254-020-2248848
Website: www.kengen.co.ke

METTO JAMES KIPCHUMBA

Dear Sir,

REF: MSC-ELM PROGRAM RESEARCH PROJECT
METTO JAMES KIPCHUMBA EET30-0728/2011– JKUAT

This is to confirm that management has duly authorized you to collect research data from KenGen staff for pursuance of your MSC-ELM programme at Jomo Kenyatta University of Agriculture and Technology.

You are hereby advised to treat the information given as strictly confidential and to use it only for academic purposes.

Through this note, KenGen staff have been requested to give you maximum support as you collect the data.

You will also be expected to avail a copy of your Research Project to the management.

Yours faithfully
For: KENYA ELECTRICITY GENERATING CO. LTD.

JOHN MAINA
HUMAN RESOURCES MANAGER

Appendix 2: Questionnaire on KenGen's Environmental Policy Matters

CONFIDENTIAL

Questionnaire No……..

INVESTIGATION OF THE CHALLENGES FACING THE IMPLEMENTATION OF CLEAN DEVELOPMENT MECHANISM PROJECTS AT KENYA ELECTRICITY GENERATING COMPANY

Introduction:

I am an MSc Student at Jomo Kenyatta University of Agriculture and Technology currently working on my research study for a master's degree course in Environmental Legislation and Management. This study is aimed at establishing the challenges of implementing CDM projects at KenGen. The information given shall be treated with confidence and shall be used only for this research.

Kindly fill in the information as accurately as possible seek clarification for any part or whole of information not understood. You are free to give additional information related to this topic or decline to respond to any part or entire questions without having to explain your reasons.

Please give the most accurate answer to each question based on your experience.

a) Biographical details of the Respondent

1. Name

2. What is your current position in the organization

3. Age bracket

   18 - 30 ☐ 31 – 40 ☐ 41 – 50 ☐ 51 - 60 ☐

4. Gender

   Male ☐ Female ☐

5. Highest Educational/Professional Qualification

   High School Certificate ☐ Diploma Certificate ☐ Higher National Diploma ☐ Degree Certificate ☐ Masters Certificate ☐ PHD Certificate ☐

6. Please indicate your business area/area of operations within the Company

   Head Office ☐ Olkaria ☐ Tana ☐ Kiambere ☐ Ngong Wind ☐

7. For how long have you been working with the Company in years

   Less than 10 ☐ 10- 15 ☐ 15-20 ☐ 20 – 25 ☐ More than 25 ☐

b) Policy Matters

1. Does KenGen have a Climate Change Policy/Strategy?

   Yes ☐ No ☐

2. Does KenGen have a CDM Policy?

   Yes ☐ No ☐

3. Is clean renewable energy a consideration in investment decisions by the Company?

   Yes ☐ No ☐

4. Are you aware of the process of CDM project registration and its benefits to KenGen?

   Yes ☐ No ☐

5. Have you undergone any CDM related training?

   Yes ☐ No ☐

6. Is renewable energy a focus for new KenGen projects as part mitigation of and adaptation to climate change?

   Yes ☐ No ☐

7. What do you believe are the barriers to implementing CDM initiatives for KenGen i.e. what factors do you believe inhibits KenGen from being pro-active in implementing / initiating CDM projects? (Please tick as many as you want and rank them from 1 to 5, with 1 being the most important)

   Scale 1: Most Important 2: Important 3: Undecided 4: Not Important 5: Absolutely Not Important

			Rank
a	Lack of funds		
b	Long Approval Process		
c	Lack of adequate Internal technical Capacity e.g. development of PDD		
d	Complex and tedious CDM procedures		
e	CDM is a non-Core Business Function		
f	Lack of awareness on the CDM benefits		

Thank you for your time and cooperation

Appendix 3: Questionnaire for KenGen's Environment and CDM Team

CONFIDENTIAL

Questionnaire No……..

INVESTIGATION OF THE CHALLENGES FACING THE IMPLEMENTATION OF CLEAN DEVELOPMENT MECHANISM PROJECTS AT KENYA ELECTRICITY GENERATING COMPANY

Introduction:

I am an MSc Student at Jomo Kenyatta University of Agriculture and Technology currently working on my research study for a master's degree course in Environmental Legislation and Management. This study is aimed at establishing the challenges of implementing CDM projects at KenGen. The information given shall be treated with confidence and shall be used only for this research.

Kindly fill in the information as accurately as possible seek clarification for any part or whole of information not understood. You are free to give additional information related to this topic or decline to respond to any part or entire questions without having to explain your reasons.

Please give the most accurate answer to each question based on your experience.

a) Biographical details of the Respondent

1. Name

2. What is your current position in the organization

3. Age bracket

   18 - 30 ☐ 31 – 40 ☐ 41 – 50 ☐ 51 - 60 ☐

4. Gender

   Male ☐ Female ☐

5. Highest Educational/Professional Qualification

   High School Certificate ☐ Diploma Certificate ☐ Higher National Diploma ☐ Degree Certificate ☐ Masters Certificate ☐ PHD Certificate ☐

6. Please indicate your business area/area of operations within the Company

   Head Office ☐ Olkaria ☐ Tana ☐ Kiambere ☐ Ngong Wind ☐

7. For how long have you been working with the Company in years

   Less than 10 ☐ 10- 15 ☐ 15-20 ☐ 20 – 25 ☐ More than 25 ☐

b) Challenges related to implementation of CDM Projects

1. Which of these aspects from the CDM cycle were the most problematic during implementation of the CDM projects (Please tick as many as you want and rank them from 1 to 5, with 1 being the most important)

Scale 1: Most Important 2: Important 3: Undecided 4: Not Important 5: Absolutely Not Important

			Rank
a	PIN Development		
b	PDD Development		
c	Feasibility study formulation and "business plans"		
d	Demonstration of Additionality		
e	Baseline Determination		
f	Compliance to requirements of Methodologies		
g	Determination of Monitoring requirements		
h	Consultations with the actors		
i	Economic and financial analysis		

2. Do you think that the implementation of the CDM projects could contribute to each of the following Sustainable Development Indicators
(Please rank them from 1 to 5, with 1 being Strongly Disagree, 2 being Disagree, 3 being Neutral, 4 being Agree and 5 being Strongly Agree)

	Sustainable Development – Indicator	**Rank**
a)	Reach the Millennium Development Goals	
b)	Reduce poverty	
c)	Diminish social inequalities	
d)	Improve local community livelihood	
e)	Increase the overall population living standards	

3. Does your department have a budget allocated towards facilitating and promoting CDM Initiatives?

Yes ☐ No ☐

What do you believe are the barriers to implementing CDM initiatives for KenGen i.e. what factors do you believe inhibits KenGen from being pro-active in implementing / initiating CDM projects? (Please tick as many as you want and rank them from 1 to 5, with 1 being the most important)

Scale 1: Most Important 2: Important 3: Undecided 4: Not Important 5: Absolutely Not Important

			Rank
a	Lack of funds		
b	Long Approval Process		
c	Lack of adequate Internal technical Capacity e.g. development of PDD		
d	Complex and tedious CDM procedures		
e	CDM is a non-Core Business Function		
f)	Lack of awareness on the CDM benefits		

c) Validation and Registration of KenGen CDM Projects

What factors affected the Validation and Registration of KenGen CDM Projects i.e. what factors do you believe inhibits KenGen from registering CDM projects? (Please tick as many as you want and rank them from 1 to 5, with 1 being the most important)

Scale 1: Most Important 2: Important 3: Undecided 4: Not Important 5: Absolutely Not Important

a) Olkaria II Expansion Project

			Rank
a	Lack of Management Support		
b	Long Approval Process		
c	Lack of adequate Internal technical Capacity		
d	Complex and tedious CDM procedures		
e	Lack of awareness on the CDM requirements		

b) Tana Redevelopment Project

			Rank
a	Lack of Management Support		
b	Long Approval Process		
c	Lack of adequate Internal technical Capacity		
d	Complex and tedious CDM procedures		
e	Lack of awareness on the CDM requirements		

c) Ngong Wind Project

			Rank
a	Lack of Management Support		
b	Long Approval Process		
c	Lack of adequate Internal technical Capacity		
d	Complex and tedious CDM procedures		
e	Lack of awareness on the CDM requirements		

d) Kiambere Optimization Project

			Rank
a	Lack of Management Support		
b	Long Approval Process		
c	Lack of adequate Internal technical Capacity		
d	Complex and tedious CDM procedures		
e	Lack of awareness on the CDM requirements		

d) Approval of KenGen CDM Projects by NEMA

1. Is the Kenyan Designated National Authority (DNA) – NEMA supportive of the CDM process?

   Strongly Disagree ☐ Disagree ☐ Neutral ☐ Agree ☐ Strongly Agree ☐

2. How long did the DNA project approval take for the following CDM Projects?

   a) Olkaria II Expansion Project

      0 – 3 Months ☐ 3 - 6 Months ☐ 6 Months – 1 Year ☐ 1- 2 years ☐

      More than two years ☐

   b) Tana Redevelopment Project

      0 – 3 Months ☐ 3 - 6 Months ☐ 6 Months – 1 Year ☐ 1- 2 years ☐

      More than two years ☐

   c) Ngong Wind Project

      0 – 3 Months ☐ 3 - 6 Months ☐ 6 Months – 1 Year ☐ 1- 2 years ☐

      More than two years ☐

d) Kiambere Optimization Project

0 – 3 Months ☐ 3 - 6 Months ☐ 6 Months – 1 Year ☐ 1- 2 years ☐

More than two years ☐

Thank you for your time and cooperation

Appendix 4: Questionnaire for KenGen's Operations Team

CONFIDENTIAL

Questionnaire No……..

INVESTIGATION OF THE CHALLENGES FACING THE IMPLEMENTATION OF CLEAN DEVELOPMENT MECHANISM PROJECTS AT KENYA ELECTRICITY GENERATING COMPANY

Introduction:

I am an MSc Student at Jomo Kenyatta University of Agriculture and Technology currently working on my research study for a master's degree course in Environmental Legislation and Management. This study is aimed at establishing the challenges of implementing CDM projects at KenGen. The information given shall be treated with confidence and shall be used only for this research.

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Please give the most accurate answer to each question based on your experience.

a) Biographical details of the Respondent

1. Name

2. What is your current position in the organization

3. Please tick your age bracket

18 - 30 ☐ 31 – 40 ☐ 41 – 50 ☐ 51 - 60 ☐

4. Please tick your gender

Male ☐ Female ☐

5. Please indicate your highest Educational/Professional Qualification

High School Certificate ☐ Diploma Certificate ☐ Higher National Diploma ☐ Degree Certificate ☐ Masters Certificate ☐ PHD Certificate ☐

6. Have you undergone any CDM related training

Yes ☐ No ☐

7. Please indicate your business area/area of operations within the Company

Head Office ☐ Olkaria ☐ Tana ☐ Kiambere ☐ Ngong Wind ☐

8. For how long have you been working with the Company in years

Less than 10 ☐ 10- 15 ☐ 15-20 ☐ 20 – 25 ☐ More than 25 ☐

b) Impact of Level of awareness with regard to Procedures of the CDM on Project Implementation and Monitoring

1. Are you aware of KenGen CDM/Climate Change Policy/Strategy?

   Yes ☐ No ☐

2. Please indicate the type of CDM Project implemented in your area of Operations

   Hydro Power ☐ Small Hydro Power (Less that 35 MW) ☐ Geothermal ☐ Wind ☐

3. Have you been Involved in the CDM process

Yes ☐ No ☐

4. If yes please indicate your role in the development/implementation of the CDM project

   PDD Development ☐ Project Implementation ☐ Project Monitoring ☐

   Quality Assurance ☐

5. Please rate how important each of the following factors influenced your involvement with the CDM project development and implementation

   Scale 1: Most Important 2: Important 3: Undecided 4: Not Important 5: Absolutely Not Important

	Motivation factors	**Rank**
a)	Training on CDM Requirements	
b)	Involvement in the Project development	
c)	Involvement in the Project Operations	

4. Please rate your level of awareness with regard to the following CDM project requirements. Rank them from 1 to 5, with 1 being low and 5 as high

		Rank
a)	Project Monitoring Requirements	
b)	Compliance to requirements of Methodologies	
c)	Quality Assurance and Quality Control requirements	
d)	Calibration of measuring equipment requirements	
e)	Reporting and Record Control including data backup requirements	

Thank you for your time and cooperation

Appendix 5: Publication and Conference Presentation

Metto, J. K, Njogu, P. M and Gatebe, E, (2015), Challenges facing implementation of clean development Mechanism projects at Kenya Electricity Generating Company (KenGen): *Prime Journal of Social Science (PJSS); ISSN: 2315-5051.* ***4(1)*** *pp 946-952*

Metto, J. K., (2015), Implementing Clean Development Mechanism Projects at KenGen; Challenges and Opportunities: *Proceedings of the KenGen G2G Technical Seminar, Nairobi, Safari Park Hotel., July 08-10, 2015*