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CHALLENGES OF IMPLIMENTING THERMAL POWERPLANT PROJECTS IN KENYA, THE CASE OF KIPEVU III 120 MW POWER STATION, MOMBASA KENYA

BY

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A PROJECT REPORT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF A DEGREE OF MASTER OF ARTS IN PROJECT PLANNING AND MANAGEMENT OF THE UNIVERSITY OF NAIROBI

2012

DECLARATIONS

DECLARATION BY STUDENT

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

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DECLARATION BY SUPERVISORS

This research project report has been submitted for examination with my approval as University supervisor:

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Signature_____Date_____

DEDICATION

This research is dedicated to my parents; Mr. Christopher Kabeyi and Ephamia Nanjala for their commitment to my success in life.

ABSTRACT

The overall objective of this research was to investigate the challenges of implementation of Diesel thermal Power Plant Projects. The objectives of the research were to identify the technical challenges on implementation, establish political and legal constraints, determine financial challenges and identify human resource challenges affecting implementation of diesel power plant projects. Through literature review, it was shown that power projects face challenges like human resource, technical challenges, financing challenges, health safety and environmental challenges as well as political challenges. Data was collected through observation, questionnaires, interviews and document analysis. The researcher targeted 601 individuals who worked on the project as employees of the Contractor, subcontractors and KenGen staff. The project was executed with over 601 personnel from Wartsila and KenGen, subcontractors who included Civicon limited, Central Electrical Ltd, Mulji Devril Ltd, KK Security Services and SKM consultants. Health, safety and environmental issues were addressed though one person died during the platform civil works by Mulji Devril Ltd. KenGen funded the project from funds raised from the public infrastructure bond. Overall the project was successfully executed with the power plant generating up to 119 MW of electricity with auxiliary consumption of 2.1 MW and exporting up to 117 MW of electricity after 15 months of construction and commissioning. The project experienced challenges but were addressed effectively leading to project successful execution. Challenges encountered included the need to carry out environmental impact assessment, project delays due to accidents including death of a worker during the project platform. The project used over 601 people directly working on the project but most of them were employees of subcontractors. The project delayed by three months but was however technically successful in generating the desired power. Due to lack of capacity to run the power plant, KenGen decided to subcontract the power plant to a third party for operation and maintenance. It is recommended that companies should explore various funding opportunities to identify cost effective long term financing for power plant projects while companies should be strategic in human resource planning and development so that their growth plans and human resource plans are in harmony to avoid cases where projects are commissioned and the companies have no capacity to operate and maintain them. The project made use of modular construction which significantly reduced the overall cost and time of implementing the project, a technique that project executors should adopt where possible to manage project cost and time.

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ACRONYMS

ERC	: Energy Regulation Commission
GTCC	: Gas Turbine Combined cycle.
BPST	: Back-Pressure Steam Turbine.
CDM	: Clean Development mechanism
CEST	: Condensing Extraction Steam Turbine.
CHP	: Combined Heat and Power.
HEP	: Hydro Electric Power
HRSG	: Heat Recovery Steam Generator.
IRSEAD	: Institute for Research in Sustainable Development
EPA	: Environment Protection Agency
FERFA	: Foreign Exchange Rate Fluctuations Adjustment
EWGS	: Exempt Wholesale Generator
FOCA	: Fuel Oil Cost Adjustment
GEF	: Global Environment Facility
GHG	: Green House Gas
IEA	: International Energy Agency
IPP	: Independent Power Producer
KPLC	: Kenya Power and Lighting Company
KenGen	: Kenya Electricity Generating Company.
LCPDP	: Least Cost Power Development Plan
MC	: Marginal Cost
NCC	: National control Center

NUG : Non-Utility Generator

PCF : Prototype Carbon Fund

PPA : Power Purchase Agreement

PPM : Parts Per Million

PV : Photovoltaic

REP : Rural Electrification Program

T&D : Transmission and Distribution

TW : Terawatts

UN : United Nations

USA : United States of America

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God bless you all

CHAPTER ONE

INTRODUCTION

1.1 Background of the study

In terms of fuels, 44% of the estimated CO_2 emissions in 2010 came from coal, 36% from oil, and 20% from natural gas. In Kenya, the national installed power capacity is 1,416 MW with hydro contributing 55% (749 MW), hydro contributing and thermal sources account for 33% (441 MW) with geothermal taking 12% of installed power generation capacity. In 2009, overall power demand stood at a high of 1073 MW and this is estimated to grow at 8% annually. Over five year's period, KenGen will expand capacity by 615 MW – Geothermal 318 MW, thermal by 120 MW, Hydro 157 MW and wind 20 MW. From 2013 to 2018, KenGen intends to create a sustainable power growth in Kenya. A 600 MW coal plant is planned by 2013/2014 and wind is expected to expand to a high of 50 MW by then. KenGen initially operated Kipevu I thermal Power Station and Isolated stations of Lamu and Garissa Power Stations. (KenGen, 2011)

The global power production in the year 2000 was 13 TW of primary power from all resources with the US consuming a quarter of this. The production is projected to be 28 TW by 2050. To stabilize at 550 PPM of carbon dioxide (CO_2) we would require 20 TW of carbon free power and 10 TW of carbon free power for 750-ppm concentration. (Lewis, 2000)

With the energy crises in 1974 and 1979 and the gulf war in early 1990s coupled with uncertainty of oil supply and price, sugar-producing countries, particularly those with no local fossil fuel resources, have been showing increasing interest in improving energy efficiency in cane processing with a view to export power to the public grid. The emphasis is thus to extract maximum power from bagasse by efficient use of latent heat of steam and to minimize heat

losses in the flue gases leaving the boilers. To supply to the grid, necessary legal and policy framework has to be put in place. (Kassiap, 2000)

Kenyan energy demand is expected to increase in future as Kenya has the ambition to be a middle income country by the year 2030 as stated in Vision 2030. As a result, Kenya has put in place strategies to achieve this goal. They include, among others, rural industrialization and rural electrification programs. The net result of this effort is increased demand for conventional energy. It is projected that electric power demand in Kenya will reach 2400 MW by 2016. Meeting this increased demand will require heavy investment in energy sector and exploitation of non-conventional energy resources. (GOK, 2004)

1.2. Statement of the problem

According to the International Energy Agency, the latest estimates show that gas emissions from world energy reached record levels in 2010. The high levels are a stark warning to governments to provide strong new progress towards global solutions to climate change. The estimates show that energy related carbon emissions in 2010 were at their highest level in history, following a brief deep in 2009 due to economic impacts of global financial crisis. IEA also estimates that 80% of all projected 2020 greenhouse gas emissions from the power sector are already realized and this is mainly due to diesel power generation. (IEA, 2011)

Therefore whereas diesel power plants offer solutions to power, they offer significant environmental challenges. The diesel power plants also require huge capital investment to realize

the projects. Besides that, the technical nature of the projects requires huge investment in technology and qualified human resource

1.3 Objectives of the study

1.3.1 General Objective

To identify problems hindering execution of thermal power projects in Kenya.

1.3.2 Specific Objectives

1. To identify technical challenges on the implementation of diesel power plant projects.
2. To establish the political and legal constraints to the implementation of diesel power plant projects
3. To determine financial challenges on the implementation of diesel power plant projects
4. To identify environmental and safety challenges on the implementation of diesel power plant projects
5. To identify human resource challenges on implementation of diesel power plant projects

1.4 Research questions and hypothesis

1.4.1 Research questions

1. What are the technical constraints hindering thermal power projects?
2. What are the political and legal limitations to implementation of diesel plant projects?
3. What are the financial challenges to the implementation of diesel power plant projects?
4. What are the environmental and safety challenges to implementation of diesel power plant projects?

5. What are the human resource challenges to the implementation of diesel power plant projects

1.4.2. Hypothesis

1. The project technically succeeded in generating 120 MW
2. There was political interference in the project implementation
3. Safety and environment issues delayed the project implementation
4. Lack of finances delayed the project execution
5. Manpower coordination significantly delayed the project implementation

1.5. Basic assumptions of the study

In this study, it was assumed that the respondents were well informed and gave honest opinions and responses during the survey. It was also assumed that that government policies and procedures were adhered to during the project implementation.

It was also assumed that the contractors and subcontractors were competent and experienced in executing similar capital construction projects and that the staff employed by them were competent and effective at carrying out the project tasks and activities.

1.6 Significance of the study

Oil prices and other fossil fuels continue to be expensive and uneconomical while their supplies are non-renewable with frequent price fluctuations while major renewable energy resources like hydropower continue to diminish. The study is important to all stakeholders in energy subsector

in Kenya, and project designers and power companies involved in management, funding, construction and other related activities in the implementation of thermal power plants. The research findings will help the various stakeholders in the design and implementation stages of thermal power projects and programs that are sustainable and hence leave a positive impact on energy supply.

1.7 Delimitation of the study

This study targets Kipevu III Diesel Power plant owned by KenGen. Employees of KenGen involved in the project, the contractors staff and subcontractor's employees are targeted in this research.

1.8 Limitations of the study

This research faced a few shortcomings at various stages of the research. They included reluctance by industry players to release data that could prove useful but was considered confidential. This includes financial data, and some specifications, weaknesses and strengths of the plant establishment.

Getting authoritative and accurate information on technical and policy could be limited by inaccessibility to the right authorities or personnel. This is because of lack of prior knowledge while some personnel were not willing to be interviewed or give opinions. It was also difficult to access facts on the real situation of thermal power generation in successful countries except what is documented currently in literature. Therefore, the data collected and research methodology as

well as the integrity of data and information made the findings reliable and credible making the research successful in its objectives.

The findings of this study should be interpreted within the limitations of the study. The timing of the study was a limitation because some key stakeholders like the project engineers left the country after the project hand over, the project staff from the side of the contractor and subcontractors had left the country or are no longer with the company and could not be accessed to participate in this research.

Some respondents targeted in the research could not be interviewed or accessed to respond to questionnaires due to time limitations and some were neither keen nor willing to participate out of fear.

1.9. Definition of significant terms

Consultant: This is the person appointed by the employer as the engineer to supervise the works or duly authorized representatives or assignees. He is answerable to the employer.

Contractor: This is the organization that is awarded the the tender to construct and commission the power plant project on the behalf of the employer. In this study, the contractor is Wartsila of Finland.

Employer: This is the party/ organization in the contract who owns the project. The employer in this study is Kenya Electricity Generating Company Ltd (KenGen)

Evaluation: This is systematic and objective assessment of ongoing or completed project activities and structures, programme, designs. This involved comparison of actual project progress and execution plan and targets.

Implementation of projects: This involves carrying out of various related and interconnected tasks and activities as per project execution plan. In this study implementation is defined as the process that involve preparing, deployment, maintaining and use of the final product of the project i.e. electric power. It was identified as feasibility study, project design, tendering, award, project construction, precommissioning, commissioning, project handover, operation and maintenance.

Monitoring: This is systematic collection of data and information on specific indicators in order to provide data and information to stakeholders. In this study monitoring involved systematic analysis of information on project progress and status with the view of improving efficiency and effectiveness.

Political influence: This refers to contributions of elected and non elected political players towards project initiation, selection, design and implementation. In this study, political influence refers to influence of councilors, the government through the ministry of energy, members of parliament and nongovernmental organizations.

Power plant: This is defined as an assembly of equipment, plant and machinery for the purpose of generation of electrical power for supply to the national grid. In this research, the power plant

consisted of six diesel engines, related auxiliaries, six electric power generators, powerhouse building, piping, fuel and water tanks, power transmission lines and switchgears.

Subcontractors: These are parties or companies hired to carry out part of the project activities/works on the behalf of the contractor. They are answerable to the contractor.

Technical capacity: This is the experience and skill level of the implementing staff and adequacy of their numbers, equipment and experience. In this study, technical capacity is availability and adequacy of qualified and experienced personnel as well as necessary equipment to carry out various technical tasks and procedures. Focused are engineers, technicians, machine operators and other skilled workers as well as requisite machines, tools and equipment.

1.10. Organization of the study

The study was organized into five chapters constituting chapter one with introduction to the study, chapter two has literature review, chapter three contains research methodology, chapter four data presentation, analysis and interpretation. Chapter five contains summary of results, discussion of findings, conclusions and recommendations.

In chapter one, the introduction to the study contains the background to the study, problem statement, purpose of the study,, research objectives, research questions and hypothesis, significance of the study, delimitations of the study, limitations of the study, definition of significant terms and the organization of the study report.

In chapter two, literature review is presented with introduction to the literature review, technical challenges to project implementation, political, policy and legal challenges to project implementation, financial challenges to project implementation, environmental and safety challenges to project implementation, human resource challenges to project implementation, the theoretical framework, and summary of literature review.

Chapter three contains research methodology with introduction to the chapter, research design, target population, sample size and sampling procedures, data collection instruments, validity and reliability of research instruments, data analysis, ethical considerations and operational definition of variables.

Chapter four contains data presentation, analysis and interpretation with introduction to the chapter, response rate, respondents characteristics, results for technical technical challenges to project implementation, political, policy and legal challenges to project implementation, financial challenges to project implementation, environmental and safety challenges to project implementation, human resource challenges to project implementation, hypothesis testing and results of hypothesis testing

Chapter five presents summary of results, discussion of findings, conclusions, recommendations, and recommendations for further research and implication of the research on policy, theory and practice.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

In this chapter, literature review of the subject is presented. It consists of the main review, which contain documented data on the subject of project implementation challenges. Specific areas covered are the technical, political, environmental, financial ad human resource challenges of project implementation. Construction projects represent execution a unique set of activities that must take place to produce a unique product. The success of a project is judged by meeting the criteria of cost, time, safety, resource allocation and quality as determined by the owner. The purpose of project management is to achieve goals and objectives through a planned expenditure of resources that meet the projects quality, cost, time, and scope and safety requirements. The construction manager must control, deflect or mitigate the effects of any occurrence or situation that could affect project success. A construction project is a complex array of interdependent activities that some would say is at best organized chaos. The very nature of construction introduces challenges typically not encountered in other industries. The construction manager remains at the mercy of the weather. This fact is particularly troublesome to those engaged in heavy civil work, site development and activities that involve earthwork or other weather sensitive activities. Weather is one of the variables that the project manager cannot control. Besides weather, there are numerous challenges facing today's project manager. Construction issues include workforce considerations, safety, time constraints and changing nature of work. Non construction challenges include legal issues, government regulations, environmental concerns and sociopolitical issues. (Bob, 2005)

2.2.1 Technical Challenges

Electricity generation is the process of creating electricity from other forms of energy.

The fundamental principles of electricity generation were discovered during the 1820s and early 1830s by the British scientist Michael Faraday. His basic method is still used today: electricity is generated by the movement of a loop of wire, or disc of copper between the poles of a magnet.

For electric utilities, it is the first process in the delivery of electricity to consumers. The other processes, electric power transmission, electricity distribution, and electrical power storage and recovery using pumped storage methods are normally carried out by the electrical power industry. Electricity is most often generated at a power station by electromechanical generators, primarily driven by heat engines fueled by chemical combustion or nuclear fission but also by other means such as the kinetic energy of flowing water and wind. There are many other technologies that can be and are used to generate electricity such as solar photovoltaic's and geothermal power.

Centralized power generation became possible when it was recognized that alternating current power lines can transport electricity at very low costs across great distances by taking advantage of the ability to raise and lower the voltage using power transformers. Electricity has been generated at central stations since 1881. The first power plants were run on water power or coal, and today we rely mainly on coal, nuclear, natural gas, hydroelectric, and petroleum with a small amount from solar energy, tidal harnesses, wind generators, and geothermal sources.

There are seven fundamental methods of directly transforming other forms of energy into electrical energy:

1. Static electricity, from the physical separation and transport of charge (examples: turboelectric effect and lightning)

2. Electromagnetic induction, where an electrical generator, dynamo or alternator transforms kinetic energy (energy of motion) into electricity
3. Electrochemistry, the direct transformation of chemical energy into electricity, as in a battery, fuel cell or nerve impulse
4. Photoelectric effect, the transformation of light into electrical energy, as in solar cells
5. Thermoelectric effect, direct conversion of temperature differences to electricity, as in thermocouples, thermopiles, and Thermionic converters.
6. Piezoelectric effect, from the mechanical strain of electrically anisotropic molecules or crystals
7. Nuclear transformation, the creation and acceleration of charged particles (examples: betavoltaics or alpha particle emission)

Static electricity was the first form discovered and investigated, and the electrostatic generator is still used even in modern devices such as the Van de Graaff generator and MHD generators. Electrons are mechanically separated and transported to increase their electric potential.

Almost all commercial electrical generation is done using electromagnetic induction, in which mechanical energy forces an electrical generator to rotate. There are many different methods of developing the mechanical energy, including heat engines, hydro, wind and tidal power.

A Diesel power station uses a diesel engine as prime mover for the generation of electrical energy. This power station is generally compact and thus can be located where it is actually required. This kind of power station can be used to produce limited amounts of electrical energy. In most countries these power stations are used as emergency supply stations.

The diesel burns inside the engine and the combustion process causes rotational mechanical energy that turns the engine shaft and drives the alternator. The alternator in turn, converts mechanical energy into electrical energy. This type of electricity generating power station will probably be used a long time into the future, due to a need for reliable stand-by electrical source for emergency situations. However, diesel power plants emit green house gases that pollute the environment and also require frequent servicing.

The packaged combination of a diesel engine, a generator and various ancillary devices such as base, canopy, sound attenuation, control systems, circuit breakers, jacket water heaters, starting systems etc, is referred to as a generating set or a gen set for short.

Ships often also employ diesel generators, sometimes not only to provide auxiliary power for lights, fans, and winches, etc. but also indirectly for main propulsion. With electric propulsion the generators can be placed in a convenient position, to allow more cargo to be carried. Electric drives for ships were developed prior to WW I. Electric drives were specified in many warships built during WW II because manufacturing capacity for large reduction gears was in short supply, compared to capacity for manufacture of electrical equipment. Such a diesel-electric arrangement is also used in some very large land vehicles.

A typical cogeneration system consists of an engine, steam turbine, or combustion turbine that drives an electrical generator. A waste heat exchanger recovers waste heat from the engine and/or exhaust gas to produce hot water or steam. Cogeneration produces a given amount of electric power and process heat with 10% to 30% less fuel than it takes to produce the electricity and process heat separately.

There are two main types of cogeneration techniques: "Topping Cycle" plants, and "Bottoming Cycle" plants. A topping cycle plant generates electricity or mechanical power first. Facilities that generate electrical power may produce the electricity for their own use, and then sell any excess power to a utility. There are four types of topping cycle cogeneration systems. The first type burns fuel in a gas turbine or diesel engine to produce electrical or mechanical power. The exhaust provides process heat, or goes to a heat recovery boiler to create steam to drive a secondary steam turbine. This is a combined-cycle topping system. The second type of system

burns fuel (any type) to produce high-pressure steam that then passes through a steam turbine to produce power. The exhaust provides low-pressure process steam. This is a steam-turbine topping system.

A third type burns a fuel such as natural gas, diesel, wood, gasified coal, or landfill gas. The hot water from the engine jacket cooling system flows to a heat recovery boiler, where it is converted to process steam and hot water for space heating. The fourth type is a gas-turbine topping system. A natural gas turbine drives a generator. The exhaust gas goes to a heat recovery boiler that makes process steam and process heat. A topping cycle cogeneration plant always uses some additional fuel, beyond what is needed for normal operation.

Bottoming cycle plants are much less common than topping cycle plants. These plants exist in heavy industries such as glass or metals manufacturing where very high temperature furnaces are used. A waste heat recovery boiler recaptures waste heat from a manufacturing heating process. This waste heat is then used to produce steam that drives a steam turbine to produce electricity. Since fuel is burnt first in the production process, no extra fuel is required to produce electricity.

In Kenya, Kenya Electricity Generating Company, KenGen is the leading electric power generator in Kenya, producing about 80% of electricity consumed in Kenya. The company uses various sources to generate electricity ranging from hydro, geothermal, thermal and wind. Hydro is leading source, with an installed capacity of 737.3 megawatts, which is about 60% of the country's total installed capacity. It sells power in bulk to Kenya Power and lighting which distributes to consumers

KenGen is now operating in a liberalized market and is in direct competition with independent Power Producers who produce 20% of the country's electric power. KenGen has a workforce of 1,600 staff distributed in 20 different sites where its power plants are located. With its experience, established corporate base and clear Vision, the company intends to maintain leadership in the liberalized electric energy subsector in Kenya and in Eastern Africa Region.

Table 1.1. Hydro and Geothermal Power Stations in Kenya

	STATION	LOCATION	INSTALLED CAPACITY
1	Gitaru	Lower Tana	225 MW
2	Gogo	South Nyanza	2.5 MW
3	Kamburu	Lower Tana	94.2 MW
4	Kiambere	Lower Tana	144 MW
5	Kindaruma	Lower Tana	44 MW
6	Masinga	Lower Tana	40 MW
7	Mesco	Upper Tana	0.38 MW
8	Ndula	Upper Tana	2.0 MW
9	Sagana	Upper Tana	1.5 MW
10	Sosian	Eldoret	0.4 MW
11	Tana	Upper Tana	14.4 MW
12	Turkwel	West Pokot	106 MW
13	Wanjii	Upper Tana	7.4 MW
14	Sondu Miriu	Nyanza	60 MW
15	Olkaria 1	Naivasha	45 MW
16	Olkaria 2	Naivasha	70 MW

Source: KenGen, 2011

Table1.2. Non-Hydro Power Stations

WIND,THERMAL AND DIESEL STATIONS			
1	Kipevu Gas Turbine	Mombasa	60 MW
2	Kipevu I Diesel	Mombasa	75 MW
3	Lamu	Lamu	1.5 MW
4	Garissa	Garissa	2.4
5	Nairobi South	Nairobi	13.5 MW
6	Ngong Wind Station	Ngong	5.45 MW

Source: KenGen, 2011

1.3. Summary of Installed Capacity

	SOURCE	**INSTALLED CAPACITY(MW)**	**PERCENTAGE (%)**
1	Hydro	737.3 MW	73.4%
2	Geothermal	115	11.4%
3	Thermal (diesel)	75	7.5%
4	Gas Turbine	73.5	7.3%
5	Isolated Diesel	3.8	0.38%
6	Wind	5.45	0.035%
	Total	**1004.95**	**100%**

Source: KenGen, 2011

Table 1.4: Projects under Implementation

	PROJECT	CAPACITY	COMMISSIONING DATE
1	Raising Masinga Dam		2011
2	Redevelopment of Tana	30 MW	2010
3	Olkaria II 3 rd Unit	35 MW	2010
4	Kipevu III Thermal Power Plant	120 MW	2010
5	Kindaruma 3rd Unit	32 MW	2010
6	Olkaria IV	100 MW	2011
7	Sangoro	21 MW	2010
8	Olkaria 1 New Plant	70 MW	2012
9	Coal Plant	600 MW	2013
	Total	**1008 MW**	

Source: KenGen, 2011

2.2.2 Political, Policy and Legal Challenges

Socio political pressures have more impact on construction than the past. Political pressures and community involvement affect public and some extent, private sector work. Pressures emanate from adjacent property owners and public at large, including existing businesses, institutions and residences adjusted to the project facility. Civic organizations and community groups have more input into design and construction of public works projects, and greater impact on private work through the land use and planning process. The community has greater input through citizen advisory boards that are engaged during project initiation, design and construction. Today's construction manager has more accountability to the public than previous generations. Increasing the number of stakeholders further complicates an already complex process. Socio political

pressures also stem from NIMBY syndrome (not in my back yard). The NIMBY syndrome

stymies growth and development, and generally hampers project construction. The obstacles caused by NIMBY syndrome typify the challenges facing today's project manager. (Bob, 2005)

According to Sarden (1970), social welfare work in USA began with relief societies, which largely coordinates the giving of alms to the poor. During early years of colonization, British entrusted provincial of most services including education to the missionaries.

In Kenya, community development work began as welfare work and was carried out by the social welfare organization, which was established in 1946 as a section of the administration. Tom Askill as commissioner for community development from 1950-61 headed it. In 1954, the social welfare organization one of the departments newly created ministry of community development. The department remained within this ministry until around the time of independence in 1963.

At the beginning social welfare was concentrated around social community welfare centers or halls .The center were at uplifting the economic and social well being of communities through informed education and social as well as recreational activities .In 1947 twenty-three centers were built followed by twenty-five in 1948.In 1952, the construction of social community welfare centered was over shadowed by community betterment work. The services and facilities provided by the centers including literacy and English classes, library and reading rooms a place for recreation including games and dances, home craft lesson for women film shows. Each center has wireless and people could listen to news. Posters and pamphlets and other educational materials were used for passing information for the local people .In both towns and rural areas, the centers served as meeting places for local peoples and their associations. They were managed

by community development assistants (C DAs) with the help of District Officers – Community Development, (D.O s -CD). (Chitere, 1990).

According to Chitere (1990), third world countries in Africa and elsewhere giving priority to rural development. He adds that community development presents an approach to facilitate the participation of people in development programmes. This community work employing this approach will not do things for the community without involving the members in planning and making decisions.

Popular participation is the active involvement of abroad mass of people in the choice, execution and evaluation of programmes designed to bring about a significant upward movement in their levels of living, (List, 1985).

Participation can be democratic participation or citizen participation. Democratic participation entails citizens being involved in decision making in matters related in their line. Citizen participation refers to establishing a new power base to the community level. At this level, people may gain control to that institution, which were designed to serve them. Participation of the local people development is necessary because of the following reasons:

1) People tent to resist innovation or measures that are impose on them. Rodger and shoemaker (1971) refers to a campaign mounted by Peruvian public health workers to get families in one village to boil water for drinking to overcome disease such as typhoid, which are spread by use of un boiled water .The campaign failed because the community workers failed to understand the socio-cultural and socio-economic conditions more

importantly to get the community to see water boiling as something needed to be done. Rodgers (1971) gives other examples where effort to change agents or agencies were unsuccessful because of their inabilities to understand clients. In one case, an irrigation engineer constructed one hundred wells for irrigation of rice, but soon realized they were not being used villagers viewed the water as artificial and not for their crops.

2) Local's participation permits mobilization, and use of their resource for example bricks, oxen, power, stones local labour and skills. In participation, apart from mobilization, and use of their resources for development, people have a say on allocation and use of their resources for development agencies in their community.
3) Participation permits growth of local capacity, which develops out to the establishment of a partnership between development agencies and community. This takes various forms and includes participation in decision and even training for all partners, the community included.
4) Participation helps to reduce the growth sense of the community disintegration, which comes with weakening of social relationship in society. Rothman (1968) argues that the process of urbanization has destroy mans feelings of belonging to a community. But with participation this will tend to reverse.
5) Participation tends to reduce alienation which prevents members in the family, religious, labour force or voluntary and civic organization (Warren, 1963) From this discussion, it is evidence that there is guaranteed success of a document programmes if the community participates in the planning implementation, monitoring and evaluation process.

Increasing government regulation is another challenge of the challenges facing todays construction manager. Along with increasing environmental and safety laws, the industry is

coming under greater regulation through the construction codes and licensing requirements. The state and local municipalities adopt model codes such as the basic national building Code (BOCA code), Uniform Building Code 2000 (IBC) has now replaced the first three codes. Other important model codes include the National Electric Code (NEC) and life safety Codes by NFPA under ANSI. These codes provide for public safety by establishing minimum construction standards for structural integrity and fire safety. Local building codes are based on of the model codes, but often include modifications that are unnecessarily restrictive. Some local codes are outdated and obsolete and prohibit the use of often superior, cost effective materials and systems. Permitting requirements, contractor licensing laws, and associated cost are also escalating. Quality of code administration is also a concern as are the delays caused by waiting for inspection. Public works projects that receive Federal or State funds are also subject to greater process and administrative regulations. Timely resolution of issues is often entangled in bureaucratic red tape. (Bob, 2005)

Sustainable development is a worldwide aim and on the agenda of many countries; especially the developing and least developed, such as most countries in Africa. After dark eras of slavery and colonialism, Africa is on the road to recovery, with a dream for future peace and prosperity- the African Renaissance. It is a philosophy of hope and optimism for the people in Africa, initiated by the people of Africa. The African Renaissance recognizes the constraints, such us debt crises, underdevelopment and untenable political relations. It proposes principles such us good governance, eradication of poverty, economic recovery, accountability, transparency, and adequate attention to social services, with education the highest on agenda, followed by health services, shelter, water and provision of electricity. One of the aims of African Renaissance is to

mobilize the people of Africa. Over the years, Africa has received foreign assistance, but the Renaissance inspires all Africans to take their destiny into their own hands. (Dixon etl, 2000)

The world today has become a highly litigious society. The number of civil actions is growing at alarming rate. Businesses across the board are at great risk because of liability and other legal implications. Not many industries are exposed to greater risks from legal issues than the construction project industry. Projects are conducted through contractual arrangements that at times result in disputes. Claims and disputes have been steadily on the rise for years.

A claim is a request by the contractor for additional compensation or time extension for occurrences beyond the contractor's control. The contractor must prove entitlement and quantify associated damages. Timely notice of claim upon discovery of impact is required. The owner has a duty to provide adequate, accurate data to bidders and is liable to the contractor when inaccurate data are given, extras develop due to improper design, or design is significantly changed after the contract is signed (constructive change). Change in scope and differing or unexpected site conditions are grounds for a claim. The various types of claims include delay/disruption, extra work claims, acceleration, impossibility-of-performance, defective design (Error or omission), interference, and superior knowledge claims.

The industry continuous to seek less adversarial methods of resolving disputes and settling claims. The motivation is to reduce costs by equitably resolving issues before they escalate to litigation. Alternative dispute resolution (ADR) has been employed with success. ADR methods include negotiation, arbitration, mediation, neutral advisors, and dispute review boards (DRB). ADR has demonstrated great value in resolving issues to the satisfaction of both parties.

However, in some cases litigation is unavoidable. It is usually undesirable, but sometimes the best method for final resolution.

Claims in general are bad for the industry. All parties must work to reduce the frequency and magnitude of claims. The project manager plays a central role in claims avoidance and resolution. Claims avoidance begins in preconstruction phase; a time with the greatest potential to influence cost. A large percentage of claims could be avoided by generating comprehensive, accurate, contract documents. Preconstruction claims avoidance requires intensive document and constructability reviews. Careful consideration should be given to construction means and methods during the design phase. Design should allow construction using the prevailing methods and equipment, specify a level of workmanship consistent with the quality of the project, and not require the constructor to assume responsibility for information that should be furnished by the designer.

Specifications should be simple and straightforward, clearly stating what is expected. The construction managers input during preconstruction reviews are invaluable. The constructor must have a clear understanding of the contract requirements prior to bidding. Keys to avoiding claims during construction include good administrative procedures, open and honest communication and timely trouble shooting. (Bob, 2005)

2.2.3 Financial Challenges

According to Ewing Marion Kanfan Foundation, 2001. To determine, if the program is financially sustainability, ask the following questions:

1) Does the program have diverse funding sources so as not to over dependant on a single fund source?
2) Are there mutual respect, knowledge and integrity between the staff of the program and its donors?
3) Does the program staff communicate with its major donors on an on-going basis to address fiscal or implementation issues or challenges?
4) Does the program attract, create and sustain new resources by continuously seeking potential funding from a variety sources, not only international but also domestic?
5) Are appropriate financial control established and followed within the program?
6) Do independent auditors conduct financial audits and reviews at regular intervals?
7) Are financial crises managed (unpredictable events that are the results of circumstances beyond the control of the management of the program)?
8) Has the program's leadership, as a matter of policy, established a reserved fund sufficient to cover the programs operating expenses for a planned period of time?

In order for a program to be truly sustainable over a long period of time, it needs to have:

1) Clearly defined realistic goals and objectives
2) High availability and delivery of services or products.
3) Impact and outcomes that are highly valued by key stakeholders.
4) Leadership and staff that is constantly competent.
5) Ability to engage in multi-sectoral partnerships.

6) Eagerness to interact with affinity organization.

7) A positive image that is recognized by the public.

8) Transparency and accountabilities.

9) An enabling legal, political and social environment.

10) Diversify renew streams.

As seen from above, sustainability is really about what goes on within a program, how it carries on its work and the quality of its relationships with a variety of stakeholders and how it is perceived.

The Reserve Bank of Australia in its June 2011 policy meeting noted that "Capacity constraints would result in delays or cancellation of some projects in earlier stages of planning". The rating agency, Fitch, expects funding to become more difficult as projects continue to face cost increases and timetable over-runs. Capital projects comprise a significant percentage of company spend and require particular focus to on budgets schedules and execution. Of the companies that reported project overruns publicly between October 2010 and March 2011, the average overrun was 71% of the original project cost estimate. These are not restricted to any geography or commodity but seem to be fairly evenly distributed. This would be indicative of the overall and mutual challenges facing many large projects. After accounting for outlaying data points, analysis results clearly indicate the consequences of underperforming projects and the material complexity and risk. High performing companies are responding to these challenges with a focus on the integrity of stage-gated delivery and early intervention, an addition to deployment of the

robust project controls and maturity of project, program and portfolio delivery practices. (Ernest & Young, 2011)

2.2.4. Environment and safety Challenges

The impact of the environmental issues on execution of construction projects has been escalating since 1970's. Today owners and constructors are bound to clearly defined duties and liabilities regarding the environment. Nearly all segments and sectors of the industry are affected by one or more environmental issues. Strict regulations, permitting requirements and enforcement are designed to protect human health and natural environment. Failure to comply with environmental regulation can result in project delay or termination, disqualification from future work opportunities, fines, civil action, and even criminal prosecution. It is paramount that construction managers have full knowledge and understanding of environmental regulations and permit requirements. Environmental concerns that impact construction include erosion and sedimentation control, wetlands and parklands, leaking underground storage tanks, contaminated soil, lead paint removal, asbestos, hazardous waste, and dust control and noise. All this concerns increase the organization's risk, which must be addressed and effectively managed. Ignorance is no excuse and can place the project, owner, contractor and the project manager in jeopardy. (Bob, 2005)

Safety remains an ongoing concern for the construction manager. Construction by nature is inherently dangerous with a high degree of hazard and risk. The toll of construction accidents is

high in terms of both cost and human suffering. Accidents add tremendous burden of needless and avoidable expense. Financial loses pale when compared to bodily injury and death, and resulting human, social impacts. Insurance protects the contractor from certain direct expenses, but accidents also involve substantial costs that are not insurable, referred to as hidden or indirect cost. Direct costs include medical cost and compensation while indirect costs include: time lost from work by injured party, loss in earning for the family, diminishing quality of life for injured party, loss of efficiency by breaking up crew, cost to train new employees, damage to tools and equipment, loss of production, cost incurred by delays, failure to meet contract demands, overhead costs, administrative costs of investigation and reports, increased insurance premiums, loss of future projects due to adverse publicity, cost of fines and many others. (Bob, 2005)

Energy-related carbon-dioxide (CO_2) emissions in 2010 were the highest in history, according to the latest estimates by the International Energy Agency (IEA).

After a dip in 2009 caused by the global financial crisis, emissions are estimated to have climbed to a record 30.6 Gigatonnes (Gt), a 5% jump from the previous record year in 2008, when levels reached 29.3 Gt. In addition, the IEA has estimated that 80% of projected emissions from the power sector in 2020 are already locked in, as they will come from power plants that are currently in place or under construction today. “This significant increase in CO_2 emissions and the locking in of future emissions due to infrastructure investments represent a serious setback to our hopes of limiting the global rise in temperature to no more than 2ºC,” said Dr Fatih Birol,

Chief Economist at the IEA who oversees the annual World Energy Outlook, the Agency's flagship publication.

Global leaders agreed a target of limiting temperature increase to 2°C at the UN climate change talks in Cancun in 2010. For this goal to be achieved, the long-term concentration of greenhouse gases in the atmosphere must be limited to around 450 parts per million of CO_2-equivalent, only a 5% increase compared to an estimated 430 parts per million in 2000.

The IEA's 2010 World Energy Outlook set out the 450 Scenario, an energy pathway consistent with achieving this goal, based on the emissions targets countries have agreed to reach by 2020. For this pathway to be achieved, global energy-related emissions in 2020 must not be greater than 32 Gt.This means that over the next ten years, emissions must rise less in total than they did between 2009 and 2010.

"Our latest estimates are another wake-up call," said Dr Birol. "The world has edged incredibly close to the level of emissions that should not be reached until 2020 if the 2ºC target is to be attained. Given the shrinking room for manœuvre in 2020, unless bold and decisive decisions are made very soon, it will be extremely challenging to succeed in achieving this global goal agreed in Cancun."

In terms of fuels, 44% of the estimated CO2 emissions in 2010 came from coal, 36% from oil, and 20% from natural gas. The challenge of improving and maintaining quality of life for people in all countries while limiting CO_2 emissions has never been greater. While the IEA estimates that 40% of global emissions came from OECD countries in 2010, these countries only

accounted for 25% of emissions growth compared to 2009. Non-OECD countries – led by China and India – saw much stronger increases in emissions as their economic growth accelerated. However, on a per capita basis, OECD countries collectively emitted 10 tonnes, compared with 5.8 tonnes for China, and 1.5 tonnes in India. (IEA, 2011)

One of the most influential definitions of the term "sustainable development" is that of the World Commission on Environment and Development. In its 1987 report, entitled Our Common Future ("The Brundtland Report"), sustainable development is defined as development that- "…meets the needs of the present without compromising the ability of future generations to meet their own needs." (Beckenstein et al, 1996:9)

The International Council for local Environment Initiatives (ICLEI) emphasizes environmental, social and economic concerns as three distinct but interrelated, components of sustainable development: "Sustainable development is a programme to change the process of economic development so that it ensures a basic quality of life for all people, and protects the ecosystems and community systems that make life possible and worthwhile." (Van der Merwe & Van der Merwe, 1999:5)

There are three interrelated elements in most definitions. Firstly, the core objective of sustainable development is optimizing human welfare. Welfare includes income and material consumption, along with education, health, equality of opportunity and human rights. The second objective is that all physical and economic activity should be compatible with surrounding biosphere. This

element focuses on non-renewable resources, and emphasizes that these resources should not be used at a rate that exceeds the rate at which they can be substituted by sustainable renewable resources. Thus there should be no net degradation of the wide range of indispensable services provided by natural environment. The third element is equitable distribution of bio-spherically compatible improvements in human well-being, both today and tomorrow. Sustainability in this context implies both intergenerational equity and intergenerational equity. Human betterment on the part of any group should not come at the expense of other groups today or generations in future (Beckenstein et al, 1996:10).

Sustainable development is, however, a concept that could be abstract and hard to relate to priorities and problems of people in places where the environment, economy and community have suffered from neglect, poverty, industrial decline, unemployment-summarized in policy- makers jargon as “social exclusion”. According to Groundwork, a British action network that connects environmental management and regeneration to economic and social renewal at local level, sustainable development should not only address new technologies, reform in affluent economies, and the protection of natural environments; it should also address social equity, and it should include activities to improve the prospects and quality of life for the worst off communities, run-down industrial economies and urban environments (Carley & Christie, 2000:197)

Keeping in mind all these views on sustainable development, it is probable that sustainable development is on the agenda of every country in the world. The priority and intensity are likely to depend on the state of development and are usually labeled as developing or developed. The

United Nations classification system subdivides the third world into three groups, the "least developed", the non-oil exporting "developing nations" and petroleum- rich members of the Organization of Petroleum Exporting Countries (OPEC) (Todaro, 2000:30). In Africa, most of the countries fall in the developing or least developed category. It is however, necessary to be wary of over-generalization and to keep in mind that there are vast differences between countries and sub regions in Africa- in terms of population density, natural resources and availability of technology. Thus when looking at the development of a country such as South Africa, it is necessary to look at aspects such as its geographical location, the continent it is part of, its government, and its people (Stewart et al, 1992:54)

According to Lawrence (2002) the principle of sustainable development was soon acclaim worldwide by a great many government, international agencies and non- governmental organization. Acclaim for the principal however has not led to agreements on how to design or to implement sustainability policies and project. Some of disagreement is a that group and organization whose current practices do not meet minimum criteria for economic or environmental sustainability oppose the new sustainability mandates, which would require them to change their ways.

The United Nations Commission on environment and development report (1987) says that although major interest is at stake, the debate on sustainability is not simply a bargaining game. Sincere advocate of sustainability in development, academic experts, policy maker and manager often disagree on the best way to turn sustainability in to set of practical guideline for designing and implementing policies, programs and projects.

Vandera (2000) takes a strong view of sustainability. Vandera argues that a market economic that seeks only to maximize profit and capital accumulation will inevitably fail to meet human needs or protect nature. Vandera sets up a choice between developments that seeks to maximize returns to capital and development that takes place within the limits of the motive economy.

Herman (1990) says that it is possible to have sustainable growth. While some observers would take the argument one step further and claim that a sustainable economy represents nothing else than a higher social order concerned with future as with our own and more focused on health of the planet and poor than on material acquisition and military might.

Slow (1999), argues that growth is necessary and inevitable and that the resources substitution and human ingenuity can prevail. An article in science by Kenne Arrow etl (2001), elaborate on the ways in which the forces of economic and environmental protection inevitable clash as we seek sustainability in the development process.

According to Harvey (2002), the role, pace and discontinuities of technological change make it more rather than less likely that economic and social welfare growth will be potentially compatible with sustainability. The international Programme of management and Development (IPMD, 2002), states that sustainability is least understood as a product of science intensive policy debates, as the sustainability pyramid indicates, levels and definitions of sustainability in any sector, at any level in any part of the world ought to reflect a reconciliation of ecological, economic, social, political and humanistic forces and concerns.

Sustainable Development is development that lasts. The terms sustainable development was brought into common use by the world commission on environment (The Brundland commission in our common future (1987). According to Jack Boyson of international Youth Foundation (2003), as resources become more limited and demand increases, the topic of how to sustain a program are of utmost importance .The pathway of moving a program towards sustainability is not an easy one. There are no quick solutions and it

takes a contented, deliberate effort to achieve sustainability.

1.) Benefits sustainability-

The confirmation of benefits that result from the same delivery of a program .The source of these benefits may change i.e. government takes over from an NGO as the service provider but the benefit is still available of demand.

2.) Programmatic/institutional sustainability.

This sustainability involves building internal capacity of a program by attracting competed leadership and staff and developing the technical competences and being entrepreneurial flexible and adaptable to changing internal and external conditions.

3.) Political sustainability.

Involves gaining government and community support and participation in the program; networking and collaborating with other affinity organization; and engaging in multi- sectoral partnership.

Programs that are successful at sustainability use strategic planning to understand where there are, where to go, how they will get there and how they are making progress. Such program has answers to four key questions about financial sustainability.

1) Where is the program now in terms of its financial sustainability? What are the challenges and opportunities to becoming more financially sustainable?
2) Where does the program want to be and how long will it take? What are it goals to achieves greater financial sustainability?
3) What needs to be done to reach the programs desired future?
4) How will the program monitor its progress as it works towards its desired future?

Many program managers in developing or transitional economy countries have discovered to their dismay that the relatively high levels of funding coming into their countries may not last indefinitely. There challenge is to mobilize as much as possible from international donors before the funding evaporates, while at the same developing domestic funding sources, reducing cost and earning income.

The single most important strategy to financial sustainability to develop variety of source of income to ensure that a program is less dependent on a limited number of sources. This does not mean going from 100% bilateral aid funds to 100% corporate funding; which is really another type of dependency.

2. Build sustainability into project and program structure.

Specific projects can be sustainable if you can survive and prosper beyond the company's involvement. This not likely to happen unless the community takes active interest into continuing the project. Sustainability can be build into the project by

i) Build and support community organization. This builds the community capacity to take over the project.

ii) Diversify financing sources for the projects so as to create a board base on people interested in maintaining a program and a broader way of funding sources.

iii) From partnerships with other organizations, try to work with other organizations that have the sources, technical capacity and will continue projects. Partners include; local government, national government, agencies, aids organizations and established civil society organization with a local presence.

It's also important to develop a plan for sustaining a community development program as a whole. Some options for sustaining a program include;

a. Building an endowment – set aside money to build a small endowment program

b. This will provide some funds for program to continue beyond the life of the donor.

. c. Raise outside funds for the operations as a whole or to fund specific programmes.

d. Raising local funds-turn to other business organizations and individuals in the area to raise money to continue the program.

The specific suggestion above can help a company to move towards participatory community development program. It is extremely important however for the organizations to incorporate concern for participation and sustainability into all of the decision-making related to community development. Both are the key concerns throughout the process of engaging in community development program.

Sustainable development is a buzzword found in much environmental and some economics literature these days. Certainly the idea of sustainable development has become increasingly popular in the contemporary world. New books on sustainable development have been appearing with increasing rapidity since the United Nations Conference on Environment and Development (the Earth Summit) held in Rio de Janeiro, Brazil in June of 1992, and the number of articles appearing in professional journals has been expanding at what seems to be an exponential rate.

The questions are what is all the fuss about? What is sustainable development anyway? And more importantly, why does sustainable development matter?

The word sustainable comes to us from the foresters of the 18th and 19th century in Europe. At the time much of Europe was being deforested, and the foresters became increasingly concerned since wood was one of the driving forces in the European economy. Wood heated homes, built homes and factories, became furniture and other articles of manufacture, and the forests that provided the wood were central to romantic literature and ideas.

Forests were best harvested from an economic standpoint using clear-cutting techniques. This meant that the loggers moved into a tract of forest and removed all of the trees in the tract. But the forests that grew back after clear-cutting did not always provide the wood fiber needed for the European economy. The foresters, and especially the German foresters, in response to this crisis developed scientific, or sustainable, forestry. The idea at the time was simple. If enough trees were planted to replace the wood provided by the trees that were harvested every year, and the growth rate of the entire forest was scientifically monitored to ensure this happened, then the

forest would be sustainable. It would always grow enough wood fiber to replace the wood fiber lost to harvesting.

Thus, in this original idea, sustainable means that as a resource is used, it is replaced by growing additional amounts of the resource. In the modern context of the word, sustainable, this is a difficult context because there are many resources, such as oil or iron ore, that cannot be grown. Still, these resources, like the trees in Europe's forests, are finite. If all the oil is extracted, there will not be any more oil. Still, if humanity is to survive with a civilization for another 1,000 years, we are still going to need to heat our homes and fulfill many of the same purposes that oil now fulfills.

The word development, at least as it is used in the phrase sustainable development, has a different history. During the cold war the United States needed to respond to the Communist challenge in the Third World that said that communism would bring with it a new standard of living. Walt Rostow, a prominent U.S. government official and economist, developed a competing ideology that he called economic development. Under the Communist model societies that staged a revolution against the proletariat and threw off the shackles of capitalism would begin a transformation that would lead to economic equality between all people. All of the wealth of a nation could then be used to raise the standard of living and well-being of all the people within that society. The attractiveness of this model to the poor people of the Third World is obvious. It promised masses of people a significantly better way of life.

Rostow's answer to this challenge was that it was the civilized world's task to economically develop the Third World. Rostow, and then the U.S. government and the governments of Western Europe and Japan, believed that all the civilized world had to do was to prime the economic pump of capitalism in the Third World, and just like a real pump, when enough dollars were inserted into an economy, the Third World economy would take off. This would eventually result in a better standard of living, a developed rather than a developing society, and a world safe for democracy and capitalism. Thus, according to this model, the poor would be much better off in the long run by embracing democracy and capitalism. If the Third World country would remain anti-communist, they would receive foreign aid, at some point in the future, take off and become equal to the economies of Western Europe, the U.S. and Japan.

Thus, development, in the context of sustainable development, means that the Third World's economies will become equal to the developed world's economies. This, in turn, will alleviate poverty and suffering in poor countries and make the world more equitable for all human beings.

There are a number of important antecedents to Our Common Future, the report by the United Nation's Brundtland Commission (1987) that marks the beginning of the sustainable development concept that has generated all the literature and recent commentary. Divergent economic theorists like E.F. Schumaker of Britain, environmentalists like Barry Commoner and Lester R. Brown, population analysts like Paul Ehrlich, politicians like Willy Brandt of what was then West Germany and Jimmy Carter of the United States, discussions within the United Nations and United Nations agencies, and a number of environmental organizations spread throughout the world all played roles in formulating ideas that became part of the Brundtland Commission's message. But even though many of the concepts of sustainable development

existed before Our Common Future was published, the Commission's report, appearing in 1987, started the process of making sustainable development an important issue on the world stage.

The Commission identified a number of "common challenges" facing the earth: Population and human resources, food security, species and ecosystems, energy, industrial development, and urbanization. In the context of these challenges they discussed international environmental problems, what successes had been registered in trying to address those problems, the scope and nature of the environmental problems still facing the world community, and the role of the world's economic systems in developing solutions to these problems and providing long-term relief for what they perceived to be the related problems of poverty and underdevelopment.

In the process of describing these challenges and proposing potential policy directions the world community could take to address the problem they had identified, the Commission presented and defined the phrase, sustainable development (World Commission on Environment and Development, p43). "Sustainable development requires meeting the major needs of all and extending to all the opportunity to satisfy their aspirations for a better life." However, "living standards that go beyond the basic minimum are sustainable only if consumption standards everywhere have regard for long-term sustainability" (World Commission on Environment and Development, p44).

Thus, sustainable development, as a concept, has two primary pillars: Economic development and the consumptive use of the world's natural resources in ways that are sustainable. We have to consume, in other words, with the realization that resources are finite, and part of our job as

human beings is to preserve the human future on this planet into a limitless future. In this concept of the limitless future, the Commission also called for what it termed "equity and the common interest." The Commission declared that "ecological interactions do not respect the boundaries of individual ownership and political jurisdiction." Nor has the local nature of human interaction with the environment been confined, as the result of the creation of ever more sophisticated technologies, to local environmental effects. "Rapid growth in production has extended it [production] to the international plane, with both political and economic manifestations. To the Commission "the enforcement of common interest often suffers because areas of political jurisdiction and areas of impact do not coincide" (World Commission on Environment and Development, pp. 46-47).

In addition, the Commission continues, there is currently an inequitable distribution in resource consumption:

The search for common interest would be less difficult if all development and environment problems had solutions that would leave everyone better off. This is seldom the case, and there are usually winners and losers. . . 'Losers' in the environmental/development conflicts include those who suffer more than their fair share of the health, property, and ecosystem damage costs of pollution (The World Commission on Environment and Development, p. 48).

This inequitable distribution is of increasing concern because, "as a system approaches ecological limits, inequalities sharpen," and "hence, our inability to promote the common interest in sustainable development is often a product of the relative neglect of economic and social

justice within and amongst nations" (The World Commission on Environment and Development, p. 49). In other words the winners in the battle to consume from the earth's many commons create a dilemma for those who recognize the need for sustainable use since efforts to preserve the commons' various assets, as the system approaches ecological limits, increases both economic and social injustice "within and amongst nations."

The Commission then outlined a series of "strategic imperatives," or "critical objectives," inherent in their concept of sustainable development. These included;

1 reviving growth;
2 changing the quality of growth;
3 meeting essential needs for jobs, food, energy, water, and sanitation;
4 ensuring a sustainable level of population;
5 conserving and enhancing the resource base;
6 reorienting technology and managing risk; and
7 Merging environment and economics in decision making (World Commission on Environment and Development, p. 49).

Generally, as Michael Carley and Ian Christie have pointed out, there have been two primary responses to the Commission's sustainable development initiative, along with many variants on common themes. One approach calls for continued economic growth with the growth made more environmentally sensitive "in order to raise living standard globally and break the link between poverty and environmental degradation," and the other calls for radical changes in the world's economic order (Carley and Christie, p. 42).

A good example of the reactions of those calling for economic growth with environmental responsibility is the report, "Choosing a Sustainable Future," released by the National Commission on the Environment. The report begins with a warning that "if America continues down its current path, primarily reacting to environmental injuries and trying the repair them, the quality of our environment will continue to deteriorate, and eventually our economy will decline as well." Then the report's message is presented:

If, however, our country pioneers new technologies, shifts its policies, makes bold economic changes, and embraces a new ethic of environmentally responsible behavior, it is far more likely that the coming years will bring a higher quality of life, a healthier environment, and a more vibrant economy for all Americans (National Commission on the Environment, 1993, p. xi).

In other words, if we keep our heads, recognize the seriousness of the environmental crisis, and then act boldly to meet the various challenges of that crisis, we can not only turn around the quality of the environment, but we can keep a vibrant economy as well. We do not have to choose between an environmentally healthy and economically robust nation. We can have it all. We are smart enough, have the ability to develop enough new technologies, and can change our behaviors enough to confront all the problems facing us and create the optimal solutions.

A more radical approach to sustainable development was published by Lester W. Milbrath in a book entitled Envisioning a Sustainable Society, released only two years after publication of Our

Common Future. Calling for: an end to the idea of a growth economy, an end to the culture that always accepts scientific advancement as a positive good, and the beginning of a society that learns its way to an infrastructure designed for sustainability, among other proposals, Professor Milbrath begins his last chapter by saying that anyone who calls for a massive transformation of society is bound to be an impractical dreamer. I am calling for people to transform the most basic of all relationships, their relationship to nature. The changes I have proposed will surely be difficult to adopt. Yet, modern society's only choice is to change (Milbrath, 1989, p. 352).

Both Milbrath's dreams and the work of the National Commission on the Environment are idealistic and formed from an intellectual, rather than an observation, base. Much of the sustainable development literature has similar flaws. Milbrath's thesis that "modern society's only choice is to change" is repeated over and over again in a multitude of ways in the literature. The authors catalog the planet's or nation's or region's environmental ills in substantial detail, then they culminate the case they have built, using statistics, charts, graphs, scientific research, and sometimes social science or anthropological research, by concluding that the environment's deterioration is guaranteed to continue and that this fact makes change, whether it is within a more conservative, mainstream approach such as that presented by the National Commission on the Environment, or a more radical structure such as presented by Milbrath, inevitable. We are in trouble, and something positive must be done.

After, and in the midst of the literary ferment arising from the Brundtland Commission report, including some powerful, deep ecology work by poets and essayists like Wendell Berry and Gary Snyder and novelists and essayists like Edward Abbey, the Earth Summit was proposed and planned by the United Nations. Called the United Nations Conference on Environment and Development (UNCED), it was held from June 3rd through June 14th in 1992 in Rio de Janeiro, Brazil. One hundred and fifty nations sent representatives, 1,400 non-governmental organizations were in attendance, 8,000 journalists covered the event, and thousands of Brazilians attended one or more sessions. At the same time a major gathering of non- governmental organizations conducted what was billed as "The Global Forum" only 40 kilometers from where the Earth Summit was meeting.

The major accomplishments of UNCED centered around the creation of United Nation's organizations formed either at the Summit or as the result of the process of preparing for the conference. The most important of these bodies is the Sustainable Development Commission that was given the task of furthering the work of creating sustainable development policies and procedures throughout the world. Other bodies were created out of "conventions" passed at the Summit on climate change and biodiversity. These particular organizations are to be dedicated to developing scientific and technical advice related to the development and implementation of international treaties. The basic ideas are that treaties entered into by the world's nations should, in the future, make sure that treaty provisions do not contribute to climate changes that have the potential to harm life on the planet earth and should help protect the planet's biodiversity. The

Planet Earth Council and the Business Council for Sustainable Development were also created as the result of the Summit.

In addition to the UN organizations created, the Summit also considered and adopted treaties on climate change and biodiversity and a non-binding statement of forest principles. The treaty on climate change was signed at the Conference, but the treaty on biodiversity was resisted by the United States government until Bill Clinton became President, after which the biodiversity treaty was completed, although it has still not been ratified by the U.S. Senate. The non-binding statement on forest principles was signed at the conference (Haas, Levy, and Parson, 1992).

The Summit also adopted the Rio Declaration that includes 27 principles. These principles, though very general, are especially significant since they represent a series of difficult-to-reach compromises between industrialized and developing countries. Much of the developing world feels that the industrialized countries have used up the world's environmental resources in their pursuit of development and now wish to protect what environmental resources are remaining at the expense of the possibility of economically improving the lot of poor nations. These principles, then, provide a framework for the world's diplomats in their efforts to improve both environmental and economic conditions around the world. The Rio principles included:

a state's sovereign right to exploit its own resources in accordance with its own policies, without harming the environment elsewhere (principle 2); the right to development (principle 3);

environmental protection as an integral part of development (principle 4); sustainable development that requires reducing 'unsustainable patterns of production and consumption' and that promotes 'appropriate demographic policies' (principle 8); access to information and citizen participation (principle 10). . .and the polluter pays principles, including the internalization of costs and the use of economic instruments (principle 16) (Parson, Haas, and Levy, 1992, p. 12).

The major question that has to be asked about the Rio principles is whether they are substantive enough to lead to any significant changes in the world's approach to either environmental or economic conditions. In the end the world's governments are still centered on the concept of national sovereignty. Thus, inevitably, each nation-state will interpret the Rio principles in light of their national interest rather than in the earth's interest. The principles are general in nature because that was the only way the diplomats could convince a large enough set of signatories to affix their signatures to the final document. Therefore, even though the principles are significant, their long-term success at improving conditions on the ground, in the air, and in water is yet to be determined.

After the Earth Summit the literature and discussions about sustainable development exploded. Newspapers, business magazines, science journals and magazines, popular magazines, television, radio, and a host of other forums and conferences centered on a discussion of sustainable development. In some parts of the world, such as in New Zealand, sustainable resource management concepts designed to improve the environment while, at the same time, helping

New Zealand meet economic goals, were adopted into new legislation (Robertson, 1993). The first stirrings of a national sustainable development policy in the United States were also felt when President-elect Bill Clinton declared in December of 1992 that "our future depends on maintaining a sustainable environment, and in so doing we can create economic opportunity" (Appenzeller, 1993).

The major point to be derived from reading the literature critical of the idea of sustainable development is that this is a movement that is more ethereal than concrete. There are a lot of discussions about the pending doom of biosphere if the environment is not protected more vigorously and efficiently than in the past in the pro-sustainable development literature. There is a call for economic and resource equity between the peoples currently living on the earth and between living generations and unborn generations. But, as the critics are pointing out, there is a lot of fuzziness that does not make the concept of sustainable development concrete. The word sustainable, as Temple points out, has become a buzz word that is used to the point of distraction. What does it really mean? Does it mean that resources must be protected at all cost? Should they be protected to the seventh generation, as would be the position of many Native Americans in the United States? Or, as the Menominee Indian Tribe of Wisconsin contends, should resources be protected forever? And which resources should be protected? Are we really going to try to live without oil or a whole host of useful mineral resources? What, exactly, does sustainable mean in the context of sustainable development?

Equally difficult questions can be raised about the word, development, in the sustainable development context. The Brundtland Commission appears in Our Common Future to want to primarily improve the economies of the Third World so that the living standards of those living in countries mired in poverty can be raised to a more acceptable level. Development in Europe, Japan, the United States, and in places like Korea, Taiwan, Thailand, and other rising economies, has a much different meaning. Neo-classical economists like Milton Friedman believe passionately that the free market demands that all people in all places at all times have the right to improve their economic well being. In his book, Free to Choose, written with his wife Rose Friedman, is the declaration that the two ideas of human freedom and economic freedom working together came to their greatest fruition in the United States. Those ideas are still very much with us. We are all of us imbued with them. They are part of the very fabric of our being. But we have been straying from them. We have been forgetting the basic truth that the greatest threat to human freedom is the concentration of power, whether in the hands of government or anyone else. We have persuaded ourselves that is safe to grant power, provided it is for good purposes.

Fortunately, we are waking up. We are again recognizing the dangers of an over governed society, coming to understand that good objectives can be perverted by bad means, that reliance on the freedom of people to control their own lives in accordance with their own values is the surest way to achieve the full potential of a great society (Friedman and Friedman, p. 297).

Are the great societies, as the Friedmans describe them, ready to limit their consumption, their pursuit of economic and human freedom, in order to guarantee equity between either current populations or future generations if that is a necessary pre-requisite of achieving the ideal of

sustainable development? Can the idea of economic freedom be maintained in a sustainably developed society? A society that can sustain its use of natural resources and the environment forever? Or is the whole idea of sustainable development a buzz-word pipe dream conjured up by idealists who fail to realize that the world and humankind are realities?

The work of the idealists like Milbrath is both entertaining and a dead end road. The entertainment value derives from the power of speculations about the future. But in the end fiction, although it may give insights into realities, cannot resolve the conflicts and contradictions that are part of both the human and the earth's condition. No blueprint of Shang- gri-la will bring Shang-gri-la into existence. No road map to Shang-gri-la will lead to the creation of paradise. The task of those who believe that the idea of sustainable development is more than a pleasant fiction is to construct a model of sustainable development based upon the characteristics of an observable model, even if the model is incomplete in that it is not as fully sustainable or as fully developed as the proponents of the sustainable development concept would desire. The value of such a model is that it can be used to eliminate some of the fuzziness surrounding the idea of sustainable development and can also be used to encourage policies and practices that can, really, lead to a more sustainable developed world.

2.2.5. Human Resource Challenges

As in the case of any business, people are a construction organizations greatest resource. Construction depends on knowledge and skills of people planning and executing the work. The quality of this important resource: people, is what distinguishes one team or company from another. Having talented management in place to guide and direct operations is crucial. Obviously, having an adequate number of skilled and unskilled workers to perform the work is a bare necessity. Finding and recruiting sufficient number of skilled, talented people is becoming increasingly difficult. There are several factors contributing to this problem. Construction is typically viewed as being one of the least desirable industries in which to work. Surveys among the youth in USA show construction by at the bottom of the list of professions that they would enter. Construction is by nature dangerous, dirty, hard work. Other industries or professions offer preferred work environments that are cleaner, safer and generally more desirable. Consequently there is a severe shortage of bright, talented people willing to work in construction. (Bob, 2005) According to the International Financial Corporation (2002), investing in people: sustaining communities through improved business practices, participation and sustainability are critical elements in creating successful community development programs. Measures include:

i) In cooperation stakeholders hence building participation into program structure and facilitate active participation of community members of the board. This include

ii) Holding board meetings at times and location, which do not conflict with community and other responsibility.

ii) Holding board members in the primary language of the community or one that is widely spoken or at the very least, have available an interpreter for those who don't understand the dominant language especially for vulnerable group.

iii) Offering community members training in planning, budgeting and program management.

iv) Make effort to include underrepresented or vulnerable groups include women within community as board members.

a. Besides utilizing a board of directions for in cooperation participation into community development program, other methods include:

b. Participation in the program mission statement to help reinforce a participatory approach to community development.

c. To set up advisory report for specific projects which include beneficiaries, staff and local stakeholders to be in charge of managing project or serve as forum for community inputs.

d. Create a formal channel to address complaints, criticisms, commendations or constructive advice so that all shareholders should know where top go for criticisms, or advice and there should be some easily accessible and transparent process by which the program responds to criticism or advices by individuals and groups.

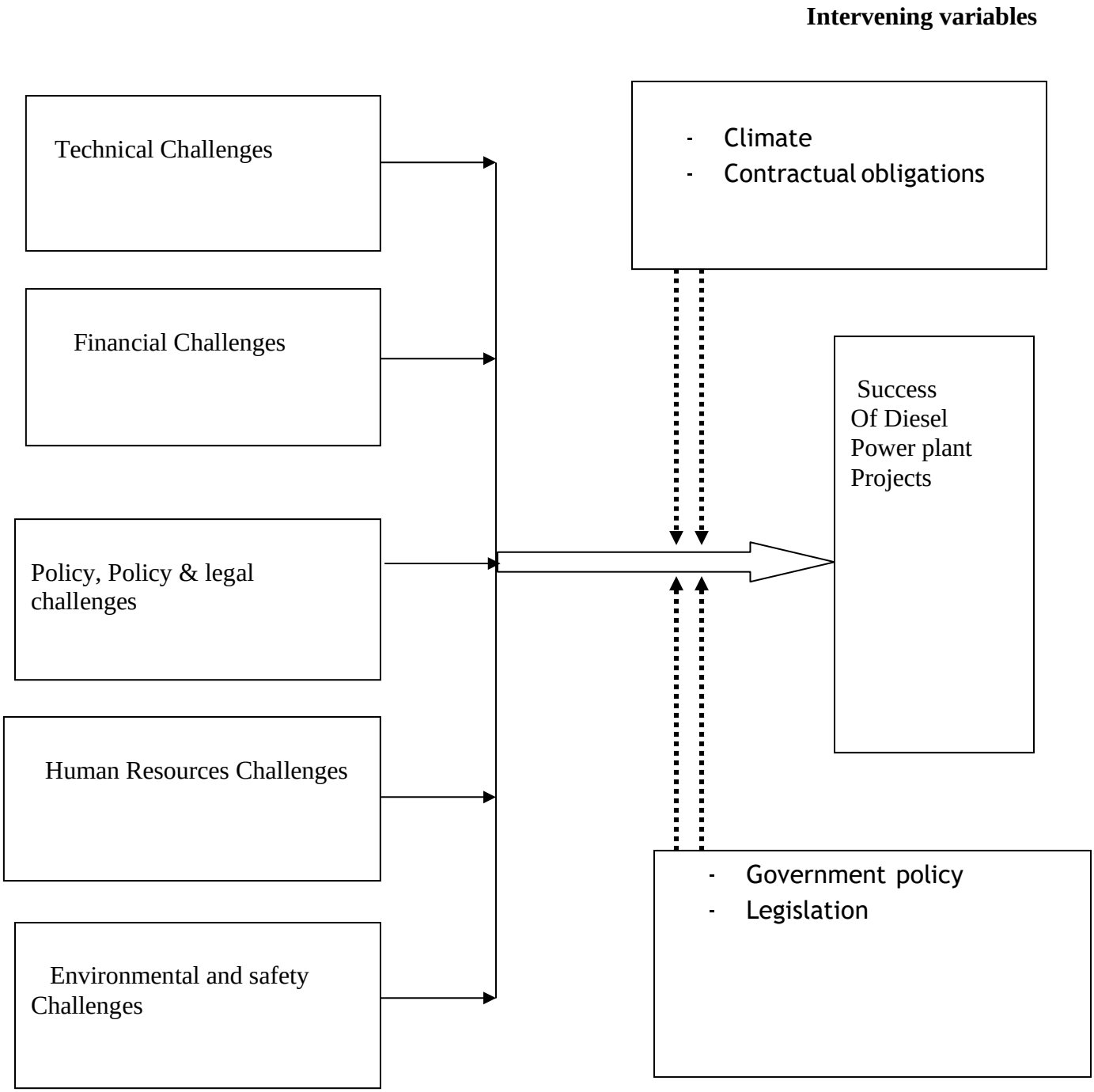
e. Create a staff that values participation by including responding to community feedback and eliciting participation as a significant part of job description of community development staff, and choose staff in part for their commitment to participation.

f. Build and support community organizations. This means training individual to participate effectively and building skills and capacity of partner community organizations.

2.3. Theoretical Framework

According to Bob Muie (2001), various factors determine or influence the success of projects as illustrated bellow in the logical framework.

Figure. 1.
THEORETICAL FRAMEWORK



i) Political interference in terms of government imposing its plans on KenGen which is a parastatal regardless of the company's strategic plans.

ii) Availability of financiers for multibillion shilling projects is a challenge facing thermal power plants since they need billions of shillings to complete.

iii.) Lack of qualified and experienced project manpower

iv.) Environmental laws currently require that before a project is carried out, environmental impact assessment must be carried out and the stakeholders must be consulted.

v.) Technically, execution of diesel power plant projects require the use of qualified and experienced professional in project planning and management, civil engineering, structural engineering, mechanical and electrical engineers some required skills are hard to find.

2.4 Summary of literature review

From the main review, it is evident that in Kenya, the government coordinated the community development activities before independence. It ensures the implementation of the programmes and therefore catered for their sustainability. The community was less involve in this activity.

All the researchers and authors quoted agreed in principle that projects must be sustainable and that participation of the stakeholders in decision-making, planning and implementation of the projects and programmes is necessary if success has to be achieved. It is evidence from the literature review that effort has been made in the past to understand the concept of project success. There are numerous challenges facing today's project manager. Some are new in the industry, and some are centuries old. Many of these challenges are a direct result of project activities, while others a result of indirect, peripheral activities. A number of challenges are not construction issues but must be addressed by the construction manager or the project manager to

ensure project success. Some of the construction issues include workforce considerations, safety, time constraints and the changing nature of work. Non construction challenges that the construction manager face that are part of the business landscape include legal issues, government regulations, environmental concerns and socio-political pressures. It is critical that the construction manager understands the demanding realities that he or she faces in planning and control of construction operations.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter duels on methodology adopted by the researcher in this study in quest to attain prescribed research objectives. The Chapter comprises of research design, the target population, data collection instruments and the data analysis techniques to be used to establish the challenges of implementing thermal power projects. Both primary and secondary data was collected as used with both qualitative and quantitative techniques used in the analysis of data.

3.2 Research design

The research design used in this study was descriptive survey. The nature of the study required both qualitative and quantitative data. This design was selected because of its simplicity in the methods of data which the study used. According to Mugenda and Mugenda (2000), qualitative research is limited to producing data in form of statements or words rather than numbers while quantitative research procedures produces quantifiable and numerical data. This research sought both qualitative and quantitative information from a wide range of participants involved in the implementation of Kipevu III power plant project.

In this research, a study of Kipevu III power plant project was carried out. Kothari (2004) is emphatic that a case study is a powerful form of qualitative analysis that involves a careful and complete observation of social unit which may be a person, a thing, an institution, a cultural group or even an entire community. The researcher finds the position taken by Kothari

appropriate for use in this study because there is need for high in-depth analysis of challenges of executing thermal power projects. Therefore this research is descriptive survey.

3.3. Population and sample size

This study targeted the project staff for Kipevu III who were involved in the project planning and construction, the operation staff who carried out the commissioning and the current operation and maintenance staff of Kipevu III power Station. About 601 personnel of the contractor, sub-contractors and employer were involved in the construction phase while 21 operation staff of kenGen carried out the commissioning of the power station. The power plant after commissioning has a staff force of 60 personnel working in various departments. The researcher sampled 30 respondents for questionnaire, 15 respondents for interview and 10 project documents for analysis.

3.4. Sampling techniques

The researcher sampled respondents from the different groups involved the project namely the contractor, subcontractors, KenGen project staff, the plant commissioning staff and Kipevu III power plant employees. Each of these groups has its own unique experiences and challenges. Therefore purposive sampling technique was used. According to Paula etl, 2001, purposive sampling is one in which, the person who is selecting the sample tries to make the sample representative depending on opinion or purpose thus being the representation subjective.

3.5 Data collection instruments

The study made use of both primary and secondary sources of data. The primary data was collected from employees by using both structured (close ended) and unstructured (open ended) questionnaires. The secondary sources involved review of a variety of documents in order to gain more insight into the project at hand. This included review of articles and journals, archival documents, reports and other published and unpublished materials, project plans and designs.

The study used questionnaires, interviews, observations, literature/manuals review, and study in the data collection.

3.5.1 Questionnaire

In this research, structured questionnaires were used with both open ended and closed questions i.e. dichotomous and multiple-choice questions. Open-ended questions were used to elicit opinions, personal suggestions and observations without limiting the respondents while closed questions were used to guide or assist respondents in understanding the questions and scope while making analysis simple and focused. The questions used were general and simple and were sent to respondents by email, by hand and also through contact persons at Kipevu III and I. The researcher personally administered questionnaires to respondents who were not based at Kipevu I and Kipevu III power stations. The questions sought for data and information on issues of policy, governance, technology and sustainability in the energy and sugar sub sectors including their capacity and challenges.

3.5.2 Interviews

Interviews were used to collect data for this research. Personal interviews were held with project officers and engineers involved in the project planning and execution. Other officers targeted for interview included representatives of various stakeholders in the project like oil companies, the Kenya Refineries Ltd, Kenya Pipeline Company and others involved in Kipevu III power Station project execution. Structured interviews were held with responsible officials involved in the implementation of the project.

The objective of using interviews was to capture as much information as possible on the budget preparation, implementation and control system and challenges and also for clarification of various unclear issues raised by respondents in questionnaires.. Open-ended questions were used as an interview guide that allowed for further probing of the respondents on any issues relevant to the study. Where person-to-person interviews failed or was not practical, telephone interviews will be held to collect data from targeted interviewees or their representatives. Telephone interviews will also be used to seek clarification on issues raised in the course of interview and schedules undertaken as well as response to questionnaires that were not very clear and needed clarification.

3.5.2.1 Schedule Method

Data for this research was also be collected using schedules in which a proforma containing set of questions were prepared and filled in by the researcher and research assistants on the behalf of respondents. To facilitate adequate and accurate data and information, the schedules were sent to respondents in advance except where it was not possible.

3.5.4 Observation Method

This study was project site oriented and relied heavily on respondents who directly participated in the project implementation. On the other hand, the project was a physical entity and all physical parameters are observable and hence could be verified. A number of respondents had official reports and communications as well as activity and incident reports and photographs. The researcher also was a participant in the project implementation and participated in several construction tasks, progress meetings and power plant commissioning as a commissioning engineer for the employer. The observation method was used to collect technical data concerning the facilities and machineries in the power plant project. Observations undertaken was be both structured and unstructured and was generally non participant and uncontrolled since it was not possible to join in the actual doing of the jobs due to the technical and practical nature of the project execution and management and the research was carried out after the project commissioning and handing over to the owner.

Structured observations were used to collect information on makes or models of plant machines & equipment, capacity and operation of cogeneration equipment or facilities i.e. boilers, steam turbines and generators/alternators while unstructured observations were used to confirm data given out in interview, questionnaires and schedules as a means of testing reliability of the data collected.

3.5.5. Document Analysis

This method involved the use of project reports, documents and communication to analyze the project execution challenges. This included project progress report, technical specifications, environmental impact assessment reports and environmental project audit reports for the project.

3.6. Validity and reliability

3.6.1. Validity

According to Allen etl. (1979), Validity is defined as the extent to which the instruments measure what they purport to measure. Effective validity studies not only demand the integration of multiple sources of evidence, but also must continually take place over time i.e. a measure cannot be deemed valid in a simple instance or study. Rather, multiple studies must be implemented over different samples and the collection of validity evidence must cover specified areas (Crocker & Algina, 1986; Gregory, 1992; Messic, 1995). On the other hand, repeatability or stability over time reliability, may be measured with the test-retest method, whereby the same scale or measure is administered to the same respondents at two separate points in time (Zikmund, 2003 pg 300)

3.6.2. Reliability

Reliability is defined as the extent to which a questionnaire, test, observation or measurement procedure produces the same results on repeated trials. In short, it is the stability or consistency of scores over time or across raters.

To ensure reliability and validity of data, the research instruments were subjected to expert opinion of supervisors and the questionnaires, interview and other instruments were administered on five selected candidates with a view of measuring reliability before the process was rolled up fully to other respondents.

3.7 Data collection procedure

Questionnaires were administered personally by the researcher and through research assistants and also by postage while interviews were carried out for specific officials who carried out specific roles in the project implementation for example the project consultant, the safety officer, project engineers and project manager.Observations of operations and facilities for thermal power generation were done personally and through research assistants to establish the capacity and nature of power generating equipment so as to establish in general the challenges of execution of thermal power projects and way forward.

Machine/equipment operation and maintenance manuals were used for confirming/verification of the accuracy of information and also to collect any other relevant data not captured through other data collection methods like questionnaires and interview. The researcher and three research assistants did the data collection exercise. References to the project literature were made through document analysis. Documents studied included the contracts, technical specifications, minutes of progress meetings and official communication mails.

3.8 Data analysis and presentation techniques

The data collected was analyzed, tabulated, presented and interpreted within the limits of the research objectives. Computations were done to establish relative proportions and percentages of quantitative parameters from data collected. Through hypothesis and research questions, specific findings and conclusions were made by the researcher.From the data analysis, conclusions and suggestions were made on the challenges encountered in the implementation of Kipevu III power plant project projects are implemented effectively and efficiently.

The data and information collected was summarized, tabulated and interpreted using descriptive techniques. The results were then presented in form of tables and bar charts to give illustrative presentations of qualitative parameters analyzed in the research.

3.9. Ethical considerations

The researcher sought permission from the municipal council Kenya Electricity Generating Company Ltd. For authority to conduct research. The respondents were informed about the purpose of the study and the need for them to participate. The identity of respondents was kept confidential by the researcher. Only data obtained from respondents was used in the analysis.

3.10 Operational definition of variables

Table 3.1 is a summary of operational definition of variables. Column 1 consists of objectibves which measure the corresponding variable in column 2. The indicator of variables is in column 3, the measurement scale of the indicator is in column 4 and type od data analuysis in column 5.

Table. 3.2. Operational definition of variables

Objectives	Variables	Indicators	Scale	Data analysis
To identify technical challenges	-Technical capacity -Skills	-equipment available and used -project performance	Ordinal	Variance, standard deviation Hypothesis testing
To establish political and legal constraints	-Political influence	-political demands	Ordinal	Probability Hypothesis testing
To determine financial challenges	-Payments for services and materials	-Actual payment Amount and time	Ordinal	Mean Hypothesis testing
To establish environmental and safety challenges	Incidents	-Accidents -Incident	Ordinal	Mean Hypothesis testing
To identify human resource challenges	Project Personnel	Qualifications Experience	Ordinal	Mean Hypothesis testing

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATIONS

4.1. Introduction

In this Chapter, data collected in the study is presented and analyzed. The data was analyzed to establish the accuracy and completeness. Information was collected on the implementation of Kipevu III project, activities undertaken, challenges and methodologies used while executing the project.

4.1.1 Response to questionnaires

The research distributed 30 questionnaires and the response was as follows in table 4.1

Table 4.1: Response rate questionnaires

PARTICULARS		**NUMBER**	**PERCENTAGE**
Questionnaires issued		30	100%
1	Questionnaires returned	18	60%
2	Questionnaires not returned	12	40%
TOTAL		**30**	**100%**

From the table, 80 questionnaires were issued of which 55 representing 68% were returned by respondents and 12 representing 40% were not returned by the respondents were not returned.

4.1.2. Response rate to interviews

The interview targeted the following officials involved in the project execution

i.) Project execution manager (KenGen)

ii.) Chief Engineer, Thermal Projects (KenGen)

iii.) Senior engineer, Thermal Projects (KenGen)

iv.) Kipevu III Construction Manager (Wartsila)

v.) Kipevu III project Manager (Wartsila)

vi.) Project Safety Officer (Warsilar)

vii.) Kipevu III Project Engineers (Mechanical, Electrical and Civil Engineer from KenGen)

viii.) Commissioning Manager (Wartsila)

ix.) Kipevu III Commissioning Engineers from KenGen (Mechanical, Electrical and civil project engineers)

x.) Project consultant

The response for the interview was as follows:

Table 4.2.: Response to interview

PARTICULARS		**NUMBER**	**PERCENTAGE**
1	Interviews done	5	33.3%
2	Interviews sought but not done	10	66.7%
TOTAL		**15**	**100%**

From table 4.2, out of 15 interviews sought, 10 of them representing 66.7% were successfully done. Five could not be done as expected.

Of the 15 officials targeted for interview only 5 were reached for interview representing 33.3%. Most of the officials from the contractor's side could not be reached because they left the country after the project commissioning and handing over. The rest could not be reached due to time while others were not positive about being interviewed. A total of 66.7% targeted respondents could not be interviewed.

4.1.3. Document Analysis

The researcher examined several project related documents as a means of data collection. This included project progress reports, technical manuals and instructions.

The response to the document analysis was as follows in table 4.3

Table 4.3: Table of research documents accessed

PARTICULARS		**NUMBER**	**PERCENTAGE**
1	Documents accessed	10	66.7%
2	Documents not accessed	5	33.3%
TOTAL		**15**	**100.0%**

The researcher sought for 15 documents related to the project as listed above for observation and analysis. Only 10 of the 15 documents sought were found and accessed and they include the project progress reports, minutes of progress meetings, accident and incident reports, operation

reports, project hand over reports, project design manuals and plant commissioning reports. This represented 66.7% of the targeted documents.

The following reports and documents were not accessed for analysis: project financing documents, operation and maintenance contract documents, the construction contract between Wartsila and KenGen, subcontracts between Wartsila and subcontractors and contact between, project staff records and the environmental impact analysis report. This represented 33.3% of the targeted documents.

4.1.4. Summary of data collection

The data collection can be summarized as follows:

Table 4.4: Summary of responses during data collection

		ISSUED	DONE	% OF TOTAL	NOT RECEIVED	% OF NOT RECEIVED
1	Questionnaires issued	80	55	68.0%	25	32.0%
2	Interviews	15	5	33.3%	10	66.7%
3	Documents	15	10	66.7%	5	33.3%
	TOTAL	**110**	**65**	**55%**	**27**	**45%**

From table 4.4, it is observed that the researcher issued 30 questionnaires of which 12 we received back, 15 interviews were sought and only 5 were done while 15 project documents were sought and 10 were accessed. From the table 4.4 , it is also noted that a total of 45 respondents were targeted for questionnaire and interview while 15 document types were targeted. The

success rate was 55% and out of 60 targets, 33 targets were accessed and used in data collection hence analysis by the researcher.

4.2. Technical challenges

Kipevu III project being a technical project in nature encountered a number of technical issues or challenges right from conception, project design, construction and commissioning. Whereas the contractor s a specialist in engine design and manufacturer, it does not have the necessary capacity for auxiliaries which among others include radiators, fuel treatment equipment. The employer KenGen on the other hand does not have experienced personnel to install, commission, operate, and maintain the new plant. This therefore called for close cooperation and assistance from the suppliers, contractor, subcontractors and consultants to ensure the project was successfully executed through all the stages.

4.2.1. Project Description

The project had the following specifications and references as summarized in table 4.4 below

Table: 4.5. Project Specification and referencing, Source, Wartsila 2009

	PARTICULARS	**DESCRIPTION**
1	Employer/owner	Kenya Electricity Generating Company Ltd
2	Project Name	Kipevu III Power plant Project
3	Product type	Stationary Power Plant
4	Power plant Configuration	7x Wartsila 18V46
5	Project Number	P0900527, QUOTATION, Q09006861
6	Project Type	Power Generation

From table 4.5 , the project is a stationary power plant for power generation consisting of seven Wartsila V type engines of 18 cylinders each

4.2.2. Engine Technical Specifications

Table 4.6: Engine Technical Specifications, Wartsila 2009

	PARAMETER	SPECIFICATIONS
1	Configuration	V-Engine
2	Number of Cylinders	18
3	Cylinder bore	460 mm
4	Stroke	500 mm
5	Speed	500 rpm
6	Mean piston speed	9.67 m/s
7	Mean Effective Pressure	24.3 Bar
8	Compression Ratio	15.8:1
9	Swept Volume per cylinder	96.4 dm^3
10	Number of Inlet Valves	2 Per cylinder
11	Number of outlet Valves	2 per Cylinder
12	Direction of Rotation	Clockwise
13	Engine Length	13.580 m
14	Width	5.347 m
15	Height	5.488 m
16	Weight	237,000 Kg

From table 4.6, it is established that the power plant involved installation of 7 V-engines of weight 237 tonnes and run at a constant 500 revolutions per minute.

4.2.3 Technical assistance

4.2.3.1 Technical assistance during the installation

Data collected showed that Wartsila send technical advisory personnel to provide technical assistance during the installation of equipment supplied by Wartsila. Suppliers for equipment not supplied by Wartsila like ABB Ltd and Alborg for exhaust gas boilers send their on technical staff for installation of their equipment. The contractor sent the following technical advisory staff during installation

Table 4.7. Technical Advisors seconded by contractor during installations

	PERSONNEL	**NUMBER**
1	Mechanical Advisor	1
2	Electrical Advisor	1
3	Civil Advisor	1
4	Site Manager	1
5	Site Security	1
6	Health and Safety Officer	2
7	Security Officer	1
TOTAL		**8**

From Table 4.7 above, the contractor seconded 8 personnel to work as advisors during the installations stage of project execution.

4.2.3.2. Technical assistance during testing and commissioning

Wartsila sent technical advisory personnel to provide technical assistance during pre-commissioning, testing and commissioning of equipment supplied by Wartsila. The technical advisory personnel together with KenGen personnel prepared and implemented the necessary programmes.

The following personnel were seconded during project commissioning

Table 4.8: Technical Advisors seconded by contractor during project commissioning

	PERSONNEL	**NUMBER**
1	Mechanical	1
2	Electrical	1
3	PLC programming services	1
4	Commissioning Engineers	2
TOTAL		**5**

From table 4.8, the contractor seconded 5 advisors during project commissioning

4.2.3.1 Technical challenges encountered

The project encountered the following technical challenges

	Challenges	**Cause**
1	Lack of welders	The building industry has lost welders to other industries like manufacturing
2	Lack of professionals for operation and maintenance of new power plant	-KenGen did not plan for the project well in advance in preparation for the new project
3	Lack of special cranes	-The building and construction industry has nt invested in some special cranes due to low demand -High capital requirements -Inadequate financial incentives
4	Poor/incorrect design	-Inadequate information at design time -Changes in layout and design requirements
5	Incorrect capacities some equipment and machines	Poor equipment selection by the designers
6	Plant oversensitive to system frequency hence station blackouts under unstable grid conditions	Poor selection of plant safety parameters by designers
7	Incorrect wiring	Poor workmanship by subcontractor wiring staff

4.3. Political and legal challenges

Political challenges involved the satisfaction of various interests by politicians and government as well as the community around the project. From data collected, it was established that the project was initiated by the government through the ministry of energy and KenGen was called upon as a government parastatal to implement the project in line with the set targets in terms of power plant capacity and operational characteristics.

Legally, as a parastatal, the project execution was required to follow the regulations as stipulated in the public procurement act. As an energy project, the EMCA act also required that the project underwent an environmental impact assessment. With open public participation.

The community demanded that the local should be given preference as far as employment was concerned during and after the project construction. Stakeholders in energy, environment and oil sector wanted representation in the project execution. To satisfy this, a project execution committee consisting of all key stakeholders was instituted. They held monthly meetings during the project period.

Respondents interviewed stated in principle that although Kipevu III was a government initiated project, there was no interference from the government during the project execution. All government agencies involved like NEMA (National Environment Monitoring Authority), ERC (Energy Regulation Commission) played a supportive role in project

4.4. Financial challenges

From data and information gathered it is evident that Kipevu III power plant project was financed 100% by funds from the public infrastructure bond which was oversubscribed at the Nairobi Securities market. Therefore the project did not encounter any cash flow problems. No interruptions in project execution were attributed to finance causes. From project documentation, the contractor severally expressed satisfaction with rate of payments which were described as timely.

A number of variation orders were made which resulted into increased project cost above the contract price. However all this was within limits of available funding because the company made sufficient provisions for project cost variations.

Therefore, the project can be said to have been executed well financially as no financial constraints were realized but any party.

4.5. Environmental and safety challenges

The project encountered a number of challenges on health, safety and environmental issues which were addressed to ensure timely and safe project execution. Deliberate effort was made to guarantee safety of workers and equipment during and after project construction, commissioning and operation.

4.5.1. Environment, Health and Safety Issues

The project involved an environmental impact assessment carried out in the year 2009 by NEMA (National Environment Monitoring Authority) licensed environmental officers. The project was then issued by an environmental license after a positive environmental impact assessment.

The following measures were taken to manage a safe, healthy and secure project site

i.) To manage safety and environmental challenges, monthly health and safety audits were carried out to monitor and evaluate the site health, environmental issues

ii.) Food hawkers/sellers were sensitized on health issues

iii.) The project was under 24 hour security surveillance from a contracted private Security Company and regular armed security patrols by police officers

iv.) Clean water was installed at the project site to ensure workers use clean water

v.) All hazards were marked by means of yellow tape and dangerous sites or activities isolated

vi.) X-ray tests were carried out at night when most project staff had left the site while passersby were alerted by security personnel and warning advertisements

vii.) The site had ambulance services throught the project construction and commissioning with qualified medical personnel to attend to injured personnel and offer first aid and transfer to hospital

4.5.2. Environmental, Health as Safety Challenges encountered

The project encountered the following

The following challenges were realized health, environment and safety challenges

i.) Cases of theft of project materials and equipment vandalism

ii.) One person died during the platform work after the wall being reinforced collapsed after heavy rainfall

iii.) Congested toilets due to large numbers of project personnel on site

iv.) The project recorded over 20 cases of near misses

v.) Accident related delays were realized as personnel were injured and project team forced to analyze the incidents as a policy requirement

vi.) High noise levels were recorded during the entire project construction and commissioning period due to project activities

vii.) Increased food demand led to increased food vendors on site who were carrying out open air cooking hence increased health risks

4.6. Human resources challenges

4.6.1: Project Staffing

The project main contractor was Wartsila Finland and therefore was the main supervisor in the project execution. The company used its Indian project office to execute the project but with direct supervision from the Head office in Finland which sent supervisory team on site. The company subcontracted the main jobs to Civicon Ltd for all mechanical jobs, Mulji Devril Ltd for all civil works, Central Electricals Ltd for Electrical work. The overall supervision and quality control was retained by the main contractor, Wartsila and KenGen the employer through

SKM as the project consultant and engineer. Each subcontractor hired and seconded their own staff to the project and they used their own or hired equipment and machinery but the construction materials were supplied by Wartsila as the main contractor.

The general project staffing was as follows:

4.6.1.1 Wartsila Manpower level

The main contractor who was Wartsila had the staffing level as shown in table 4.8 below

Table 4.9: Wartsila Manpower Levels during the project

	DESCRIPTION	HEADS
1	Construction Manager	1
2	Site Manager	1
3	Site Engineer	1
4	Administrative Officer	1
5	Civil Section Manager	1
6	Civil Supervisors	1
7	Mechanical Section Manager	1
8	Electrical Supervisors	1
9	PLC Engineer	1
10	Health and Safety (HSE) Engineer	2
11	Logistic Manager	1
12	Site Assistant	1

13	Storekeeper	1
14	HVAC Engineer	1
15	Commissioning Manager	1
16	Assistant Commissioning Manager	1
17	Commissioning Engineer-Mechanical	3
18	Commissioning Engineer-Electrical	3
19	SCADA Engineer	1
20	GIS Supervisor	1
21	Electro/mechanical Supervisor	1
22	HV Cable terminators	3
TOTAL		**34**

From the table 4.9 above, it is observed that Wartsila which was the project contractor had 34 employees stationed on site to carry out different technical assignments during project execution.

4.6.1.2 Central Electrical Ltd.

Central electricals Limited provided electrical and instrumentation wiring for the project on behalf of Wartsila. They had staffing levels as shown in table 4.8 below

Table 4.10: Staffing Levels by Central Electricals Ltd.

	DESCRIPTION	HEADS
1	Site Manager	1
2	Electrical engineer	1
3	Quality Officer	2
4	Foreman	5
5	Storekeeper	4
6	Safety Officer	2
7	Electrician	32
8	Fitters	11
9	Office assistants	5
10	Helpers	14
11	Drivers/crane operators	3
12	Welders	2
13	Carpenters	1
14	Casual labour	37
TOTAL		**120**

From the table 4.10, it is established that Central Electricals Ltd, which was subcontracted by Wartsila to carry out electrical and instrumentation wiring had a total of 120 employees of which 37 were casuals and the rest technical personnel.

4.6.1.3 Mulji ltd.

Mulji was subcontracted by Warstilla to carry out civil works in the project. To execute the civil works, Mulji Ltd had the following staffing levels as shown in table 4.9. below

Table 4.11. Staffing Levels by Mulji Deveril Ltd.

	Description	**Heads**
1	Site manager	1
2	Site engineer	1
3	Chief foreman	1
4	Site Supervisor	6
5	Surveyor	1
6	Carpenter	8
7	Carpenter Helpers	12
8	Reinforcement Fitter	10
9	Reinforcement Helpers	15
10	Mason	4
11	Masonry work Helper	8
12	Unskilled labour	28
13	Fitter	1
14	Fitter Helper	1
15	Welder	1
16	Security Guards	4
17	Safety Officer	1
18	AC Technician	6
19	Ceiling workers	3
TOTAL		**112**

Mulji had a total work force of 112 employees involved directly in executing Kipevu III project of which 28 were unskilled workers.

4.6.1.4 Civicon Limited Employees

Civicon Limited was subcontracted by Wartsila to execute mechanical works on its behalf. To execute its role, Civicon used the following personnel levels as shown in table 4.10 below to execute the tasks

Table 4.12. Civicon Ltd staffing levels

	Description	**Heads**
1	Site manager	1
2	Engineers	2
3	Supervisors	3
4	Foremen	10
5	Storekeeper	4
6	Safety Officer	3
7	Fitters	80
8	Welders	31
9	Riggers	9
10	Helpers	84
11	Pipe Fitters	8
12	Operators	12
13	Scaffold and erector	17
14	Quality Control	8
15	Auto electrician	2
16	Mechanics	3
17	Electrician	3
	TOTAL	**280**

From table 4.10 above, it is noted that Civicon used 280 personnel to directly execute the project mechanical engineering tasks. Of these personnel 84 workers who worked as helpers were unskilled workers.

4.6.1.5. KenGen Employees and Consultants

KenGen was the project owner or employer for Kipevu III project. To execute its mandate of monitoring and evaluation and commissioning, it used the staffing levels summarized in table 4.11 below.

Table 4.13:KenGen and consultants staffing levels

	Description	**Heads**
1	Project Consultants	2
2	Project Civil Engineer	1
3	Project Electrical Engineer	1
4	Project Mechanical Engineer	1
5	Commissioning Engineer- Mechanical	5
6	Commissioning Engineer- Electrical	3
5	Commissioning Technicians- Electrical	3
6	Commissioning Technicians - Mechanical	4
7	Plant Operators	8
8	Site office Secretary	1
9	Office Assistant	1
TOTAL		30

From table 4.13 above, it is noted that KenGen seconded 30 personnel to the project of which 2 were consultants from SKM and the rest were KenGen employees from project execution and operations and maintenance.

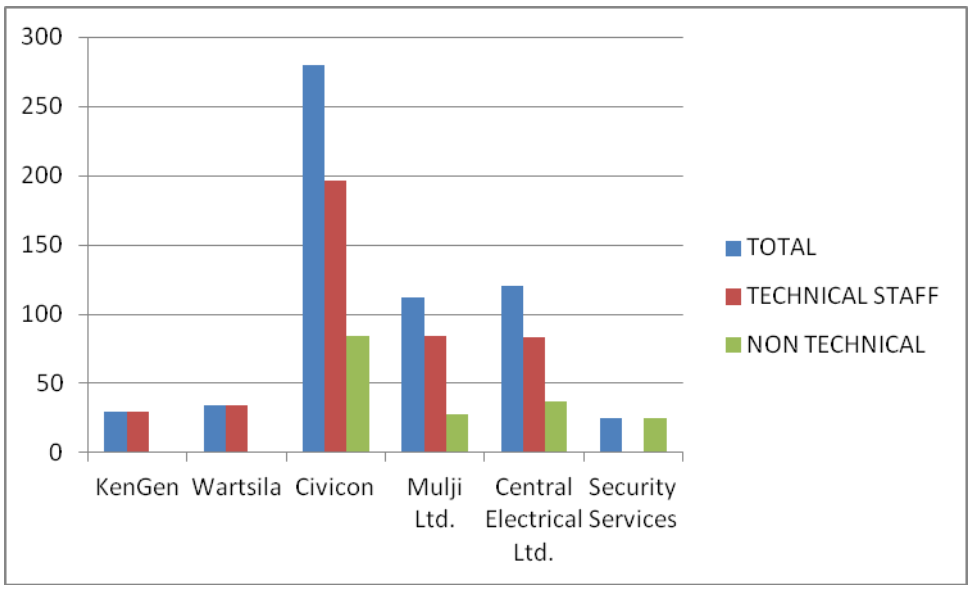
4.6.1.6. Project staffing summary

The project staffing levels are summarized in table 4.12 below

Table 4.14: Summary of project staffing levels

	COMPANY	TOTAL	TECHNICAL STAFF	NON TECHNICAL
1	KenGen	30	30	0
2	Wartsila	34	34	0
3	Civicon	280	196	84
4	Mulji Ltd.	112	84	28
5	Central Electrical Ltd.	120	83	37
6	Security Services	25	0	25
TOTAL		**601**	**427**	**174**

Figure 3:Technical versus nontechnical staff for project s



From the statistics in figure 3, it is evident that 601 people worked directly on the project during construction and commissioning of Kipevu III Power plant project with most of them being skilled personnel from the contractor i.e. Wartsila, Subcontractors i.e. Mulji Devril Ltd, Civicon Ltd and Central Electrical Limited. Civicon which carried out mechanical engineering works supplied most of the workers while the contractor, Wartsila had the smallest work force of 30 personnel involved directly in construction and commissioning of the project.

4.7. Hypothesis Testing

4.7. 1. Technical capacity

1 Null hypothesis N0= The project succeeded in generating 120MW

N1=The power plant did not generate 120MW therefore was technically unsuccessful

N0=120

N1<120

Table. 4.15: hypothesis testing for technical capacity

	ACTUAL GENERATION	**PLANED GENERATION**	**VARIANCE**
Engine 1	17.0	17.15	0.01
Engine 2	16.8	17.15	0.01
Engine 3	16.8	17.15	0.01
Engine 4	17.0	17.15	0.01
Engine 5	16.9	17.15	0.00
Engine 6	16.9	17.15	0.00
Engine 7	17.1	17.15	0.04
TOTAL	**118.5 MW Mean=16.9 MW**	**120 MW Mean=17.15 MW**	**0.08**

Standard deviation (σ) = 0.28

t- statistic=16.9-17.15)/0.28/√7

=-0.25/0.11=-2.3

From t tables, for (7-1)=6 degrees of freedom at 5% significance level

T_c=1.943

Since -2.3 is less than -1.943, the test statistic does not fall in the rejection area. We fail to reject and conclude that there is insufficient evidence to suggest that the capacity of the engines is less than 17.15 each or 120 MW for the whole plant. Therefore it is not possible to conclude that the project was technically successful in attaining the capacity of 120MW.

4.7.2 Political and legal challenges and implementation of projects

Null Hypothesis N0: There was no political interference in the implementation of the project

N1: There was political interference in the implementation of the project

Ho <50%

H1>50%=0.5

Table 4.16: Hypotheisis testing for political challenges

Target group	population	NO. of respondents	Pooled sample proportion	Politics affected implementation
KenGen and SKM	30	10	0.18	3/10
Wartsila	34	5	0.09	0/5
Civicon	280	10	0.18	6/10
Mulji	112	12	0.22	4/12
Central electrical	120	15	0.27	3/15
KK security	25	3	0.05	2/3
TOTAL	**601**	**55**	**1.00**	**18/55**

In this case, level of significance used is 95% with one tailed test, z_c is 1.645

P=18/55= 0.32

p =.50

z=0.32-0.5/√0.5 (1-0.5)/55=-0.18/0.067

=-2.68. We see that -2.68 does not lie in the rejection zone/region, hence we fail to reject the null hypothesis. There is insufficient evidence to reject the null hypothesis.

4.7.3. Financial challenges and implementation of projects

N0= The project implementation was affected by financial challenges

N1= The implementation of the project was affected by financial challenges

No>0.5

N1<0.5

Table 4.17: Hypothesis testing for financial challenges

Target group	Population	Sampled size	Pooled sample proportion	Finance affected implementation
KenGen and SKM	30	10	**0.18**	**1/10**
Wartsila	34	5	**0.09**	**1/5**
Civicon	280	10	**0.18**	**8/10**
Central electrical	112	12	**0.22**	**5/12**
Mulji Devril	120	15	**0.27**	**5/15**
KK security	25	3	**0.05**	**0/3**
TOTAL	**601**	**55/601**	**1.00**	**20/55**

P=20/55=0.36

P =0.5

z=P-p/√pq/n

=0.36-0.5/√0.5 (1-0.5)/55

=-0.14/0.067=-2.09

Since we are using 95% level of significance, with one tailed test, z_c is =1.645. We see that -2.09 does not lie in the rejection region, hence we fail to reject the null hypothesis. There is insufficient evidence to make a conclusion about the null hypothesis.

4.7.4. Environmental and safety challenges and implementation of thermal projects

N0= Environment and legal challenges affected implementation of the project

N1=Environment and legal challenges affected the implementation of the project

No>0.5

N1<0.5

Table 4.18: hypothesis testing for environment and safety challenges

Target group	Population	Sampled size	Pooled sample proportion	Safety affected implementation
KenGen	30	10	0.18	4/10
Wartsila	34	5	0.09	1/5
Civicon	280	10	0.18	3/10
Mulji Ltd.	112	12	0.22	11/12
Central Electrical Ltd.	120	15	0.27	5/15
Security Services	25	3	0.05	3/3
Totals	**601**	**55**	**1.00**	**27/55**

P=27/55=0.49

P =0.5

z=P-p/√pq/n

z=0.49-0.5/√0.5 (1-0.5)/55

=-0.01/0.067

=-0.15

For 95% level of significance z =1.645

We see that -0.15 does not lie in the rejection region; hence we fail to reject the null hypothesis.

There is insufficient evidence to make a conclusion about the null hypothesis.

4.7.5. Human resource challenges and implementation of thermal projects

N0= The implementation of the project was affected by human resource challenges

N1=The project implementation was not affected by human resource challenges

No>0.5

N1<0.5

Table 4.19:Hypothesis testing for human resource challenges

Target group	Total population	Sampled	Pooled sample proportion	Human Resource affected
KenGen	30	10	0.18	9/10
Wartsila	34	5	0.09	3/5
Civicon	280	10	0.18	7/10
Mulji Ltd.	112	12	0.22	6/12
Central Electrical Ltd.	120	15	0.27	8/15
Security Services	25	3	0.05	2/3
Total	**601**	**55**	**1.00**	**35/55**

P=35/55 =0.63

p = 0.5

z=0.63-0.5/√0.591-0.5)/55

=0.13/0.067==1.97

For 95% level of significance, z_c=1.645

Therefore we reject the hypothesis. So there were significant human resource challenges to the implementation of the project.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS CONCLUSSIONS AND RECOMMENDATTIONS

5.1. Introduction

This Chapter presents a summary of the findings of the study, conclusions, limitations faced and recommendations from the study and suggested areas for further research.

5.2. Summary of findings and discussions

This case study was carried out to determine challenges of executing Kipevu III diesel power plant project by Kenya Electricity Generating Company Ltd. A population of personalities involved in the planning, construction, commissioning and operations of the power plant was sampled. Project specific documents were also analyzed. An interview guide was used to collect views and opinions from project staff and stakeholders, and responses were analyzed and presented. Questionnaires were also issued to respondents by mail and in person.

All interviewees concurred that that KenGen as a company does not have enough trained and experienced technical staff needed to run a diesel power plant efficiently and effectively. It is because of this that the power plant was subcontracted to Wartsila East Africa to operate and maintain the plant for a 10 year renewable contract..

Technically, Kipevu III power project was executed by experts from India, Finland and United Kingdom. The project engineer was SKM from UK, The contractor was Wartsila Finland but the project was executed by Wartsila, India who executes Wasilla Finland projects in Asia and

Africa. The engines and auxiliaries from Kipevu III are the latest in the market and particularly the V- engines of capacity 17.1 MW which are the largest engines used in power generation in Kenya. The project execution lacked special cranes needed for construction of the tall stack and the relevant crane had to be hired from China. Whereas Civicon Ltd which was subcontracted to carry out mechanical installations had many cranes at its disposal, but did not have cranes needed to install stacks that are more than 80 Meters tall and no company in Kenya had the same.

The project developer adopted modular construction techniques. Wartsila modular design concept enabled the plant to be optimized for specific needs of power generation plant, utilizing standard units and components. Prefabrication of auxiliary units allowed for testing of equipment and reduced costs of installation and time on site. Most jobs that normally are done on site were done at the factory and sub assembled modules and parts transported to project site for installation.

As far as project safety is concerned, the project experienced one fatality or death during the ground leveling phase. The construction phase did not experience any death but a number of near misses and lost time was encountered during construction, pre-commissioning and commissioning phases. Safety was not given a serious attention during the first phase of the project which consisted of the platform work.

Financially, the project got its funding from the PIBO (Public Infrastructure Bond) which was issued at the Nairobi Securities market. Therefore, the employer had money at its disposal to pay

for the project work. From the project progress reports, the contractor is quoted showing satisfaction with payments from the employer, KenGen.

The main legal and political issues were addressed during the environmental Impact Assessment which was carried out before the project commenced. The locals wanted to be employed during and after the project execution. Consequently most light non-technical jobs were given to locals. The locals however generally were not comfortable with heavy manual jobs and such jobs were given to non-locals. All other issues concerning the environment and political issues were addressed during regular stakeholders meetings.

As far as human resources is concerned, the project key personnel were expatriates while skilled personnel like MIG welders were not readily available leading to project delays and schedule changes. There were no challenges with getting manual labourers and therefore all manual jobs were executed successfully on time. These included digging trenches, foundations and handling carrying small loads and site security services. Issues of poor workmanship also came up with cases of poorly executed jobs like welding, fabrication, wiring and poor finishes. These cases were however corrected during precommissioning and commissioning phases of the project execution. Overall the project involved more than 601 personnel working directly during the project construction.

Whereas Wartsila was the main project contractor, most manpower and all project equipment used in the project came from subcontractors namely Civicon for mechanical works, Mulji Devril for civil works, Central Electricals for electrical and controls installations, KK Services

for site security. Overall project supervision was carried out by SKM consultants on the behalf of KenGen and Wartsila as the contractor who had the contractual obligations with KenGen. This brought the challenge in supervision because the contractor had to deal with workers who were not his employees.

5.3. Conclusions

The outcome of the study showed that Kipevu III power plant project was successfully constructed commissioned and handed over to KenGen but was subcontracted to Wartsila East Africa on an O& M contract due to lack of capacity on the side of KenGen to efficiently operate the power station.

The project was completed 3 months below schedule hence a time delay of 30%

The project execution had a training component both on site and at the contractors manufacturing facilities in Finland hence capacity building was incorporated in the project preparing KenGen staff for operation and maintenance of the power plant.

Whereas Warsila was the main contractor; it was shown that Civicon Ltd carried out mechanical engineering works. Other services that were subcontracted were electrical wiring, installation of transformers and the GIS and switchgears, pipework, lagging of pipes and tanks

The project stakeholders were fully involved in the project namely Kenya Pipeline Company, Kenya Oil Refineries Ltd, Oil Companies Kenya power Company. The stakeholders in oil

industry selected one of their own to represent them in project monitoring and evaluation and issuance of relevant permits to works.

Whereas the project was generally well executed to commissioning and project handing over, KenGen as the employer was ill prepared to operate and maintain the power plant forcing the company to subcontract the plant to a third party.

The project was fully commissioned and handed over to KenGen in March 2011 some 3 months later. Hence the project overall delay was 25%. The overall power production capacity at time of commissioning was 18.1 MW per engine hence a combined output of 119 MW power and overall auxiliary consumption of 2.1 MW.

5.4. Recommendations

In this section, various recommendations are made in order to enhance or guarantee successful execution of diesel power plant projects. Based on this study, the following recommendations are made:

It is the responsibility of any government as a matter of policy to develop a strong, well qualified and trained human resource. Therefore the Government of Kenya should encourage investors to acquire heavy construction equipment like cranes some of which in this project were hired from abroad impacting negatively on the project schedules and costs involved. This can be through incentives like tax holidays.

The project experience serious shortages of skilled MIG (Metal Inert Gas Welders) and specialized crane drivers. Training institutions should come up with special skills training to ensure that the construction industry has necessary skills like MIG welders while employers should strive to retain trained and skilled manpower so that they don't change careers or move to other industries where they cannot be accessed when their expertise is needed.

There is need to ensure complete and exhaustive technology transfer from expatriates to local engineers and technicians. All key project execution roles were carried out by the consultants on the behalf of KenGen and the contractor's staff during the entire period of project design and execution with KenGen as the employer maintaining a low profile non-technical function of project monitoring and evaluation. Even during precommissioning phase, KenGen had not yet attached its operations and maintenance staff. Upon commissioning and handing over, the expatriates who played key roles all left the country and with KenGen ill prepared to handle the project decided to subcontract the power plant to a third party for operations and maintenance meaning even in future, the capacity of the company will not have improved to handle even bigger future challenges. Project owners should be strategic enough to continuously improve on their capacities to execute, operate and maintain technical projects.

Companies should exhaust all possible available project financing opportunities with sufficient grace period to finance capital intensive power projects. Kipevu III power plant was financed by funds from a successful public infrastructure. The company started paying for the interest on the capital just six months after the bond issuance well before the project completion. Whereas the financial viability of this project is yet to be established and communicated, indications are that

the project may not be quite cost effective due to relatively high interest on capital and high operation and maintenance costs due to subcontracting of the power plants operations and maintenance functions.

Companies should develop strategic human resource management policies to ensure that their human resources are prepared to handle current and future investments. KenGen commissioned its first diesel power plant namely Kipevu I in 1999 but by March 2011 after completion of Kipevu III power plant, the company did not have well trained and experienced technical personnel to take over the new Kipevu III power plant. This forced the company to subcontract the power plant to a third party for operation and maintenance. Companies should harmonize current operation and maintenance needs with future investment plans and develop the right human resource base to handle current and future challenges.

The employers and contractors should develop mutually beneficial partnerships in project execution to minimize conflict and enhance transparency in projects execution. During Kipevu III execution, progress meetings were tension packed with the two main parties disagreeing and often maintaining hard positions. Whereas this could be a tool in negotiations, it in the long term works against the spirit of partnership. The project owners and contractors should be encouraged to develop the spirit of give and take for the sake of long-term beneficial partnerships in project execution. The contractors and project owners or employers should not work as adversaries with short term interests.

5.5. Suggestions for further study

Kipevu III power station was financed by funds from the very successful Public Infrastructure Bond which was oversubscribed at the stock market. Further research is recommended to establish the execution of the operation and maintenance contract. The findings of these studies cam provide basis for enhanced project financing from public infrastructure bonds and also the adoption of operation and management contracts for diesel power plants in Kenya and elsewhere.

5.6. Implications on policy, theory and practice

This study is expected to make impacts on existing organizational policy, theory and practice. Organizations implementing capital projects will draw from four challenging areas encountered in executing Kipevu 111 power plant project and accordingly adjust their policy frameworks to miligate against the risks involved in executing thermal power plant projects. This study will enable companies view thermal power projects as a potential business to enhance their efficiency and competitiveness. In practice, the results of this study will help KenGen and other firms especially in power generation by pointing out pitfalls encountered in execution of capital projects from loan capital. The management should identify challenges not cited in this study and set up mechanisms of dealing with those challenges.

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APPENDICES

1.0. Letter of transmission

2.0. Questionnaires

3.0. Project Master Work plan

4.0. Project Precommissioning and commissioning work plan

5.0. Project progress reports

6.0. Project photographs

7.0. Technical manuals

APPENDIX 1
LETTER OF TRANSMITAL

Moses J.B. Kabeyi
P.O Box 99815, Mombasa
June, 2012

Dear Sir/Madam

REF: DATA COLLECTION

I am a final year student pursuing Masters of Arts in Project Planning and Management at the University of Nairobi, School of Continuing and Distance education , Mombasa campus carrying out a research project on the challenges of implementing thermal power plant projects, a case study of Kipevu III power station, Mombasa County in Kenya. As such, this questionnaire is to obtain some data that is relevant to this research.

I request you to participate by being one of my respondents in getting information. All the information provided herein will be confidential and findings are for the purpose of this study only. In case you wish to get a report of the survey findings you can contact me on 0722964181 or my supervisor Dr. Moses Otieno on 0721246929.

With regards

Moses J.B. Kabeyi
L50/60682/2010

APPENDIX 2

RESEARCH QUESTIONNARE

1. Who came up with the idea of Kipevu III power plant project?

   ---

2. Who designed the project and how was he selected?

   ---

3. Which department in the company was involved in the design and planning of the project?

   ---

4. What activities did you undertake during the project design and planning?

   ---

5. Did you experience any problems or challenges during the project design and planning?

   ---

6. If yes, what were the problems encountered?

   ---

7. How were they solved?

   ---

8. Was the Environmental impact assessment carried out?

   ---

9. If so, when and how was it carried out?

   ---

10. How was the project funded?

---

11. What other funding opportunities did you have?

---

12. Was the funding adequate and cost effective?

---

13. In your own opinion, do you think the funding used was the best option for the project?

---

14. What was the cost of the project?

---

15. Who were the project contractors and how were they selected?

---

16. How were the contractors and subcontractors managed during the project construction?

---

17. When did construction start?

---

18. Did you encounter any challenges during the power plant construction?

---

19. If so, what were they?

How were the challenges addressed?

---

20. What was the project structure?

---

21. How were environment, health and safety issues managed?

---

22. In your own view, was the structure and project administration effective?

---

23. When was the project commissioned?

---

24. Who did the commissioning?

---

25. When and how was the project handed over?

---

26. What problems did you experience after handing over?

---

27. What are the causes of problems encountered after handing over if any?

---

28. In your own view, what lessons did you learn from Kipevu III power plant project?

---

29. What recommendations do you make for successful execution of diesel powerplant projects?

APPENDIX 3

KIPEVU III POWERPLANT WORK PLAN

KIPEVU III WORK SCHEDULE		Baseline	
KIPEVU-III POWER PROJECT, OFFSHORE SERVICES TRACKING	**4514.7**	**27-Nov-09**	**21-Jan-11**
PROJECT MILESTONES			
Readiness of HFO/LFO Tap-In from Kipevu-I	0	8-Oct-10	8-Oct-10
Readiness of HFO/LFO Tap-In from Refinery	0	8-Oct-10	8-Oct-10
LV Feeder to Switchgear	0	1-Oct-10	1-Oct-10
Shut down for Hook up with Kipevu-I	8	1-Dec-10	10-Dec-10
CIVIL CONSTRUCTION :	**1849**	**27-Nov-09**	**21-Jan-11**
Power House	**287**	**5-Feb-10**	**1-Nov-10**
Genset Foundations	56	5-Feb-10	1-Apr-10
Flooring	49	2-Apr-10	20-May-10
DG building column erection	28	21-May-10	17-Jun-10
DG building wall erection	42	18-Jun-10	29-Jul-10
DG building roof erection	35	18-Jun-10	22-Jul-10
Fixing of door/Windows	21	12-Oct-10	1-Nov-10
Erection for HVAC system for power house	56	25-Aug-10	19-Oct-10

Utility block	**266**	**12-**	**24-**

		Mar-10	**Nov-10**
Cable cellar/column Foundation	70	12-Mar-10	21-May-10
Utility block column/roof erection	42	21-May-10	2-Jul-10
Utility block wall erection	42	18-Jun-10	29-Jul-10
Erection for HVAC system for utility block	42	15-Oct-10	24-Nov-10
Sanitary/Plumbing installation	42	30-Jul-10	9-Sep-10
Fixing of door/Windows	28	10-Sep-10	7-Oct-10
Storage tank area	**203**	**5-Feb-10**	**2-Sep-10**
HFO Storage tank foundation	35	5-Feb-10	11-Mar-10
HFO Day tank foundation	42	12-Feb-10	25-Mar-10
LFO Day tank foundation	42	12-Feb-10	25-Mar-10
Flooring for storage tank farm area	42	18-Jun-10	29-Jul-10
Bunding around the storage tank farm	42	23-Jul-10	2-Sep-10
Fuel Treatment House	**70**	**2-Apr-10**	**10-Jun-10**
Flooring	42	2-Apr-10	13-May-10
FTH building column/ roof/Wall erection	21	14-May-10	3-Jun-10

FTH building / Door/ Window erection	7	4-Jun-10	10-Jun-10

GIS Substation	**133**	**14-May-10**	**23-Sep-10**
Cable cellar/column Foundation	28	14-May-10	10-Jun-10
Flooring	28	11-Jun-10	8-Jul-10
GIS building column/roof erection	21	9-Jul-10	29-Jul-10
GIS building wall erection	21	30-Jul-10	19-Aug-10
Erection for HVAC system for GIS	28	20-Aug-10	16-Sep-10
Fixing of door/Windows	7	17-Sep-10	23-Sep-10
Workshop/ Chemical sotrage/Guard house	**119**	**27-Sep-10**	**21-Jan-11**
Foundation	42	27-Sep-10	8-Nov-10
Superstructure	77	9-Nov-10	21-Jan-11
Administration building	**120**	**20-Sep-10**	**21-Jan-11**
Foundation	35	20-Sep-10	25-Oct-10
Superstrcuture	50	26-Oct-10	31-Dec-10
Erection for HVAC system for Admin building	14	3-Jan-11	14-Jan-11
Sanitary/Plumbing installation/Finishing	21	3-Jan-11	21-Jan-11
Miscellaneous Foundation	**651**	**27-Nov-09**	**19-Jan-11**
Stack foundation	84	19-Feb-10	13-May-10

Day tank farm	63	12-Mar-10	13-May-

			10
Cable Trench	21	19-Mar-10	20-May-10
Fire water/Treated water tank foundation	21	27-Nov-09	17-Dec-09
Pipes/pipe support foundation	35	14-May-10	17-Jun-10
Charge air filter Platform	21	18-Dec-09	7-Jan-10
Boiler/Duct support foundation	14	8-Jan-10	20-Jan-10
Step Up transformers	63	21-May-10	22-Jul-10
Auxiliary Transformers	49	21-May-10	8-Jul-10
Containers foundation	14	20-Aug-10	2-Sep-10
Transfer pump house	28	23-Jul-10	19-Aug-10
Foundation for LFO/HFO piping from Kipevu-I	28	23-Jul-10	19-Aug-10
Foundation in Kipevu-I switchyard	42	6-May-10	16-Jun-10
Excavation for HV cabling to Kipevu-I	28	18-Jun-10	15-Jul-10
Drain/Oily water collecting sump	56	3-Sep-10	28-Oct-10
Roads and Parking	56	29-Oct-10	22-Dec-10
miscl. Civil works	28	23-Dec-10	19-Jan-11
Civil work completion	0	21-Jan-11	21-Jan-11

INSTALLATION-MECHANICAL	**1407**	**18-Mar-10**	**13-Nov-10**

Tanks fabrication & erection	**532**	**18-Mar-10**	**24-Sep-10**
HFO Storage tank fabrication/erection	147	18-Mar-10	11-Aug-10
HFO Day Tank fabrication/erection	119	22-Apr-10	18-Aug-10
LFO Day Tank fabrication/erection	119	29-Apr-10	25-Aug-10
Fire Water Tank fabrication/erection	70	24-Jun-10	1-Sep-10
Shop Fabricated tanks- Erection	28	3-Jun-10	30-Jun-10
Hydrotesting of tanks	21	16-Aug-10	3-Sep-10
Insulation/Cladding	28	30-Aug-10	24-Sep-10
Stack erection	**147**	**14-May-10**	**26-Aug-10**
Frame erection	98	14-May-10	19-Aug-10
Silencer erection	14	17-Jun-10	1-Jul-10
Flue duct erection	35	23-Jul-10	26-Aug-10
Erection-Common Auxiliaries	**84**	**18-Jun-10**	**12-Oct-10**
Radiators Erection	28	23-Jul-10	19-Aug-10
Fuel treatment House equipments	14	18-Jun-10	1-Jul-10
Fire/Foam system container	7	21-Sep-10	27-Sep-10

Boiler erection	21	22-Sep-10	12-Oct-10

Compressors/Air bottle	14	30-Jul-10	12-Aug-10
Piping/Pipe support Fabrication/Erection	**301**	**17-Jun-10**	**8-Oct-10**
Pipe supports fabrication/erection	42	24-Jun-10	5-Aug-10
Piping inside FTH	14	30-Jul-10	12-Aug-10
Piping inside tank farm areas	42	17-Jun-10	29-Jul-10
Piping between Kipevu-I & Kipevu-III	49	20-Aug-10	8-Oct-10
Piping from Refinery	28	10-Sep-10	8-Oct-10
Piping between tankfarm area & Power house	56	9-Jul-10	2-Sep-10
Firefighting system Piping	70	21-Jul-10	28-Sep-10
Erection- Exhaust & charge air system	**133**	**18-Jun-10**	**19-Oct-10**
Charge air filter platform erection	35	18-Jun-10	22-Jul-10
exhaust gas duct supports	28	16-Jul-10	12-Aug-10
exhaust gas boilers supports	28	25-Aug-10	21-Sep-10
Charge air filter erection	7	23-Jul-10	29-Jul-10
Ducting fabrication/Erection	35	15-Sep-10	19-Oct-10
Power house	**210**	**30-Jul-10**	**13-Nov-10**
Pipe rack fabrication/erection	21	30-Jul-10	19-Aug-10

Auxiliary unit installations	28	30-Jul-10	26-Aug-

			10
Genset Installation	35	21-Sep-10	25-Oct-10
Maint platform fabrication/Erection	42	5-Oct-10	13-Nov-10
Ducting Fabrication/Erection	42	21-Sep-10	1-Nov-10
Piping inside power house areas	42	20-Aug-10	30-Sep-10
INSTALLATION-ELECTRICAL	**1001.5**	**9-Jul-10**	**10-Dec-10**
Main switchgear	**24.5**	**16-Jul-10**	**10-Aug-10**
MV-Switchgear Installation	24.5	16-Jul-10	10-Aug-10
Station service system installation	**16**	**16-Jul-10**	**6-Sep-10**
Low voltage switchboard	7	10-Aug-10	17-Aug-10
Station auxiliary transformer	7	16-Jul-10	22-Jul-10
Black start unit & enclosures	2	3-Sep-10	6-Sep-10
Cable ladder and cabling-MV,LV, Control	**182**	**9-Jul-10**	**30-Sep-10**
Power plant area	49	30-Jul-10	16-Sep-10
Utility block	49	30-Jul-10	16-Sep-10
Outside area	70	9-Jul-10	16-Sep-10
Interface cables	14	17-Sep-10	30-Sep-10

Step-up Transformer	**98**	**24-Aug-**	**9-Nov-10**

		10	
Transformer Erection	63	24-Aug-10	2-Sep-10
HV disconnector	7	3-Sep-10	9-Sep-10
HV cable termination	28	13-Oct-10	9-Nov-10
GIS Substation	**126**	**25-Aug-10**	**2-Nov-10**
GIS cubicles	56	25-Aug-10	19-Oct-10
Control panels	28	25-Aug-10	21-Sep-10
HV cable termination	42	22-Sep-10	2-Nov-10
Cable Ladder & Cabling-HV	**63**	**11-Aug-10**	**12-Oct-10**
GIS to Kipevu-I	42	11-Aug-10	21-Sep-10
Step Up to GIS	21	22-Sep-10	12-Oct-10
Earthing	**42**	**6-Aug-10**	**14-Sep-10**
Inside Power house	28	17-Aug-10	14-Sep-10
Offsite Area	14	6-Aug-10	19-Aug-10
Panel erection	**23**	**30-Jul-10**	**23-Aug-10**
DC system	7	30-Jul-10	5-Aug-10
Control panels for DG sets + Synchronising panel	14	6-Aug-10	19-Aug-10

WOIS/WISE	2	20-Aug-10	23-Aug-

			10
Electrification	**371**	**16-Jul-10**	**14-Oct-10**
Lighting	84	16-Jul-10	7-Oct-10
Fire detection	77	30-Jul-10	14-Oct-10
Telephone system	70	23-Jul-10	30-Sep-10
CCTV	70	23-Jul-10	30-Sep-10
Station clock	70	23-Jul-10	30-Sep-10
Interconnection with existing sub-station	**36**	**3-Nov-10**	**10-Dec-10**
HV cable termination	28	3-Nov-10	29-Nov-10
Structure/CT/VTs/Bus bar modification	4	1-Dec-10	6-Dec-10
Hook- Up	4	7-Dec-10	10-Dec-10
Operation & Maintenance manuals	**20**	**24-Jun-10**	**21-Jul-10**
Operation & manintenance manuals compilation	20	24-Jun-10	21-Jul-10
Dispatch to customer	0	21-Jul-10	21-Jul-10
COMMISSIONING ;	**257.2**	**3-Sep-10**	**21-Jan-11**
Mechanical Precommissioning	**81.2**	**3-Sep-10**	**23-Nov-10**
Pipe Pressure Tests/Pickling/Flushing	49	3-Sep-10	21-Oct-10

Auxiliaries commissioning	18.2	25-Oct-10	10-Nov-10
System tuning	14	11-	23-

		Nov-10	Nov-10
Electrical Precommissioning	**115**	**1-Oct-10**	**10-Dec-10**
LV-SWG pre-/commissioning	13	1-Oct-10	14-Oct-10
Electrical Panels Energising	11	14-Oct-10	25-Oct-10
MV-SWG pre-/commissioning	21	14-Oct-10	3-Nov-10
Genset PLC pre-/commissioning	21	14-Oct-10	3-Nov-10
Engine Instrumentation Calibration	21	4-Nov-10	23-Nov-10
GIS pre-commissioning	14	20-Oct-10	2-Nov-10
Step-up transformer pre-commissioning	14	10-Nov-10	22-Nov-10
Pre-commissioning of Interconnection with existing sub-station	0	10-Dec-10	10-Dec-10
Commissioning	**26**	**23-Nov-10**	**17-Dec-10**
Engine Starts and stops	12	23-Nov-10	5-Dec-10
Checking of the safety devises with running engine	7	6-Dec-10	10-Dec-10
Checking of syncronising - ready for loading	7	13-Dec-10	17-Dec-10
Test At completion	**35**	**20-Dec-10**	**21-Jan-11**
Performance test	14	20-Dec-10	31-Dec-10
Reliability test	21	3-Jan-11	21-Jan-11
Take Over of the Works*	0	21-Jan-11	21-Jan-11

APPENDIX 4

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KIPEVU III PRECOMMISSIONING AND COMMISSIONING PLAN


Workshop
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Exhaust
Ducting
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WORK IN
PROGRESS


Site view
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