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FACULTY OF ENGINEERING & THE BUILT ENVIRONMENT
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An exploratory study on the legitimacy of energy megaproject in South Africa

RESEARCH REPORT

Submitted by

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Supervisor

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31 August 2018

DECLARATION

I hereby declare that this research report is a record of my work conducted under the guidance of Dr. Nthatisi Khatleli.

It is submitted in partial fulfilment of the requirements for the degree of the MSc (Building) in Construction Project Management, at the Faculty of Engineering and the Built Environment, the University of the Witwatersrand, Johannesburg, South Africa.

Furthermore, this research report has not been submitted for any examination or degree in any other tertiary institution.

_____

Peter Moloi

31 August 2018

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I would like to thank God Almighty for giving me the opportunity and strength to realize this milestone.

I wish to express my sincere gratitude to my supervisor, Dr. Nthatisi Khatleli for his untiring guidance and patience through the journey. The completion of this study would forever remain on the horizon without his guidance.

Special thanks to professionals who participated in the study, my colleagues, my family and members of the public who participated in the study.

ABSTRACT

South Africa was hit with a lot of power cuts in the late 2000s as a result of an ageing and underfunded infrastructure. The current government had other priorities which included electrification of the whole communities overlooked by the pre-1994 government. This emphasis meant that investment in power generation was neglected resulting in an infrastructure that was not coping.

The study explored the legitimacy of opting for energy megaprojects as viable option to ease the pressure. It appears as if the approach to massive power generation investment is a trend started in 1923, when the power utility, Electricity Supply Commission Company was established. The motivation behind South Africa's proclivity towards energy megaprojects is pitted against the impact of these projects to the end users in relation to cost and benefit.

A cross-sectional case study approach focusing on multiple cases, which are: Medupi Power Station; Ingula Power Station; and the Sere Energy Farm were adopted in a quest to meet the objectives of the study. The mixed method approach to data collection and analysis has been adopted to realize the research objectives and resolve the research question. Key data collection instruments included surveys directed at the end users of electricity, questionnaires and semi-structured interviews directed at professionals within the energy sector, questionnaires directed at organisations representing workers within the energy sector.

The study found that the energy megaprojects are fundamentally not legitimate projects to resolving power generation and supply challenges in South Africa. The study further found amongst others that the energy megaprojects have negative financial impact to end users and consumers of electricity. This is contrary to one of the key objectives of the Integrated Energy Plan promulgated by the Department of Energy.

The study recommends that reasonably scaled, manageable and responsive energy projects be investigated and possibly adopted to ensuring cost efficiency on energy generation and supply while meeting the key objectives of the Integrated Energy Plan.

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ACRONYMS

ACWP	Actual Cost of Work Performed
BCWP	Budgeted Cost of Work Performed
BRICS	Brazil Russia India China and South Africa
BOT	Build Operate and Transfer
CPI	Cost Performance Index
DoE	Department of Energy
DPME	Department of Planning Monitoring and Evaluation
DVC	Developing Country
FDI	Foreign Direct Investment
FIFA	International Federation Association of Football
GDP	Gross Domestic Products
GFIP	Gauteng Freeway Improvement Project
IEP	Integrated Energy Plan
IRP	Integrated Resource Plan [National Electricity Plan]
IMF	International Monetary Fund
MYDP	Multi Year Price Determination
NEA	National Energy Act
NEPAD	New Partnership for Africa's Development
NERSA	National Energy Regular of South Africa
NDP	National Development Plan
OEM	Original Equipment Manufacturers
OUTA	Opposition to Urban Tolling Alliance
PMBOK	Project Management Body of Knowledge
SADC	Southern African Development Community
SOE	State Owned Enterprise

DEFINITIONS OF TERMS

Job Creation - the provision of new employment opportunities for the unemployed

Localisation – Procurement of products and services that are developed and/or manufactured in South Africa.

Mega Plants – Plants that are built through the megaproject.

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CHAPTER 1: INTRODUCTION

1.1 BACKGROUND

The background to this investigation was triggered by the observation that most capital projects undertaken by the South African government in recent years are enormous in magnitude; complex in nature; the execution period is often longer than initially planned; the capital value expended is often astronomical and way above the initial budgets. These projects are often characterized by strike actions (be it by the civil society or the community at large); the projects are often partially funded by international agencies through sovereign guaranteed loans and grants; and often requires intervention of skilled expatriates to execute.

According to the World Investment Report (2016), South Africa remains inherently a developing country. South Africa is amongst the top 20 beneficiaries of the Worlds Foreign Direct Investment (FDI) for the years 2014/2016 (The World Investment Report, 2016). It is a member of: the African Union; the United Nations; the World Group of 20 Countries; the union of the developing countries known as Brics (Brazil, Russia, India, China and South Africa); the Commonwealth Countries; and forms part of the Southern African Development Community (SADC).

The South African history is one of a country divided socially and economically. In its current political set up it is fairly new constitutional democratic country. According the Statistic South Africa' Community Survey (2016), the population of the country stood at 55 653 654 people as at August 2016.The HIS report titled country monitor – South Africa (2016) state that South Africa has the bigger, most developed economy in the African Continent and that it is often referred to as the engine of growth for the rest of Africa.

According to the IHS report titled *Country Monitor South Africa* (2016), South Africa's GDP for the past 5 years to December 2016 was US$ 345.64 billion on average. An in-depth analysis of the country's GDP data published by Statistics South Africa shows that on average, the Country's GDP grew by 2.14% over the past ten years to December 2016 (Stats. SA, 2016). The report further depicts that the highest GDP growth was attained in the year 2007 and stood at 5.4%.

Notwithstanding these accolades, South Africa, like most developing countries, remains entangled with socio-economic challenges which are inherently embedded in its historical realities and the prevailing economic conditions. The infrastructure backlog runs into trillions of Rands, which births plethora of service delivery protests; there is high level of unemployment and job opportunities are scarce. The unemployment rate stood at 26.7% as at the end of 2016 (Stats SA, 2016), the GDP contracted to a low 0.3% at the end of the fourth quarter 2016 (Stats SA, 2016).

There is an acute shortage of basic infrastructure to enable efficient provision of service delivery and support economic growth. These include adequate highways to ease traffic and to enable economic development, adequate water and sanitation systems to ensure an improved quality of life, sufficient educational centres of excellence to improve innovation and support development, and most importantly, the reliable and stable energy supply to support economic development and improve the quality of life for all.

South Africa's Energy Crises

South Africa experienced what has since been called the "economic boom" between the years 2004 and 2007. Stats SA GDP Publication (2007), shows that the economy expanded by an average growth rate of 4.5% for the period between 2004 and 2007. It is during this period that the country secured the bid to host the FIFA World Cup tournament. On the energy front, the country experienced the initial energy shortage and this lead to the rolling out of the initial waves of power supply rationing commonly known as "load shedding".

This created pandemonium as it affected both the individual electricity consumers and the businesses alike. These events prompted the then President, Thabo Mbeki to make the following statement:

"The national emergency represented by the current power outages poses the challenge and presents the opportunity to the entirety of our nation to give concrete expression to the call we have just made for all of us to unite in action and act in unity to keep our country on course. This must say to all of us that we are indeed in a period of challenges, but surmountable challenges. And precisely because it is a period of challenges, it is also an era of opportunity!

Sure, the problems here are serious; overcoming them will require ingenuity, especially in energy efficiency and energy saving, as well as the development of alternative power

supplies. But if all of us can forge strong partnerships to tackle the situation, we will all come through – I hope relatively unscathed .This is not a time for finger pointing, but for working together in finding solutions. This having been said, it is however also necessary that we take this opportunity to convey to the country the apologies of both the Government and Eskom for the national emergency which has resulted in all of us having to contend with the consequences of load shedding. I would also like to thank all citizens for their resilience and forbearing in the face of the current difficulties." Thabo Mbeki [2008 State of the Nation Address]

To maintain and improve economic growth, it is inevitable that South Africa had to improve the generation and supply of electricity. The government's investment in very large energy projects since the year 2007 is to a greater extent attributable to the power generation and supply crises experienced at the height of economic growth in the years 2004 and 2007.

Eskom (2008) announced that South Africa would commission three new additional mega -plants in the form of Medupi, Ingula and Kusile as the first power stations since the dawn of democracy. The analysis of South Africa's fleet of energy plants promulgated by Eskom (2017) informs us that 92% of the total power generation in South Africa is generated through energy mega plants. Mega-plants are by definition the product of megaprojects. Eskom (2007) state that fleet of power plants that existed prior to the current build programme, were commissioned before 1994, under the apartheid government. This revelation supports the notion that energy megaproject in South Africa are almost regarded as the default projects when decisions on energy projects are taken.

Most of these very large energy projects are characterized by array of challenges, which include schedule overrun, cost overruns, labour unrest, technical complexities, contractual disputes, skills shortage challenges, community and civil society rebellion at times. Flyvberg et al. (2014), Warrak (1993); Altshuler and Luberoff (2003) are in concurrence that megaprojects are susceptible to budget, schedule overrun and benefit shortfall.

Ansar et al. (2014) strongly advises against investment in megaprojects by developing countries. Ansar et al. (2014) argues that developed countries, with a high per capita income are best suited to undertake megaproject than developing countries. Ansar et al. (2014) assert that energy megaprojects are susceptible to cost and schedule overruns. International Rivers Network (2018) is of the view that megaprojects are capable of

plunging countries into a spiral of international debt, which consequently lead to impoverishment and stagnation of basic infrastructure.

1.2 PROBLEM STATEMENT

South Africa after 1994 neglected investing on new power generation capacity. This led to non-coping infrastructure in the late 2000s. In order to ease the bottleneck in the power supply capacity, the country opted for mega project route to ameliorate its energy challenges. The legitimacy, viability and sustainability of this solution has not been properly interrogated.

1.3 RESEARCH AIM

The aim of the study is to establish whether the energy megaprojects are a legitimate intervention to meet the current energy problems in South Africa.

1.4 RESEARCH QUESTION

What is the legitimacy of undertaking energy megaproject as a viable intervention to meet the current energy problems in South Africa?

1.5 RESEARCH OBJECTIVES

1.5.1 To investigate the motivation behind undertaking the energy megaprojects

1.5.2 To investigate the economic impact of energy Megaproject to energy consumers in South Africa.

1.5.3 To investigate the economic benefits derived from the implementation of the energy megaproject vis-à-vis localization of major equipment

1.5.4 To investigate the economic benefits derived from the implementation of the energy megaproject vis-à-vis Job creation

1.5.5 To conduct a comparative analysis of capital cost per megawatt between the power generation megaproject and the ordinary small – scale power generation projects

1.6 RESEARCH SUB-QUESTIONS

- What were the motivations behind undertaking energy megaproject in South Africa?
- What is the direct cost impact of energy megaproject to the South African energy consumers?

- What economic benefit has local businesses derived out of the implementation of the energy megaproject in comparison to the foreign firms?
- How many direct jobs have been created during the construction phase of the energy megaprojects?
- How does a capital cost per megawatt of megaproject power generation plant compare to that of the ordinary, small-scale power project?

1.7 RATIONALE

There is notably a very limited literature on megaproject phenomenon in South Africa. This study delves into the world of megaprojects with a specific focus on the energy megaprojects. This is prompted by the observation of the government's capital expenditure programme on energy megaproject. The energy megaproject are chosen as a viable interventions to strengthen the generation and supply of electricity.

South Africa has experienced an acute shortage of stable power generation and supply capacity challenges over the past decade. In a quest to increase power generation and supply capacity, South Africa, through its State owned power utility company, has embarked on a capital expenditure program on energy megaprojects. According to Eskom (2008) the build program is financed through a mixture of private funding, and international funding through sovereign guaranteed loans.

Warrak (1993) regards megaprojects as projects that are susceptible to cost and time overrun. They are regarded as projects that are inherently risky. Flyvbjerg (2014) introduced the Iron law of megaproject upon analysis of considerable number of megaproject in the developed countries. Flyvberg Iron Law of Megaproject (2014) concluded that megaprojects are: *"Ov*er *budget, over time, over and over again* (Flyvbjerg, 2011). This seeks to suggest that success in the megaproject will forever remain in the horizon. Flyvberg (2011) asserts that megaprojects are susceptible to failure when time, cost and benefits are used as a measure of success. If as evidence indicates, approximately one out of ten megaproject is on budget, one out of ten is on schedule, and one out of ten delivers the promised benefits, then one in one thousand projects is a success (Flyvbjerg, 2011).

The energy megaprojects being implemented in South Africa resembles all the signs of conformity to the Iron law of megaproject. The costs of Medupi project is said to have spiralled to R 150 billion, double the initial estimate (Winkler, 2015). This observation necessitates the question as to why decisions are taken to pursue projects that show all the

signs of disastrous performance. This study attempted to answer this question with a deliberate intent to formulate a systematic understanding of the legitimacy of energy megaproject in South Africa.

The studies further sought to examine the performance of energy megaprojects against the objectives of the Integrated Energy Plan (IEP) and the benefits derived out of the implementation of the energy megaprojects. It sought to depict the benefits or lack thereof, of investing in the energy megaprojects.

The findings of this study may to a reasonable extent prove useful in the future decision making process on energy generation projects in South Africa.

1.8 CONCEPTUALISATION

The megaprojects are synonymous with disruption, industrial development and economic growth. They are attractive to governments and international funding agencies as a result of their envisaged multi-faceted benefits to the communities, businesses and governments.

1.8.1 What is Megaproject?

A project is a temporary endeavour undertaken to create a unique product, service, or result (PMBOK, 2004). PMBOK (2004) states that the project has the beginning and the end, and that it is temporary. “Mega” on the other hand refers to something that is “very large” according to the Oxford dictionary (2010). Based on these facts, one may simplistically deduce that megaproject refers to “Very Large projects”.

The phrase, “Very large projects” in it-‘self-present challenges of interpretation from one person to the other. Due to this reality, it became apparent and necessary for the pioneers of this developing field of study to provide a narrowed and definitive explanation of the concept of megaproject. Flyvbjerg (2014) states that, the usage of the phrase “mega” in reference to very large projects emanates from the period before the World War II. Flyvbjerg (2014) states that million dollar projects where referred to as megaprojects in a period before the World War II. Flyvbjerg (2014) further states that the biggest projects then were valued at around One Million US dollars. “Mega” is the term that has stuck to describe very large projects and programs in general (Flyvbjerg, 2014).

Megaprojects involve the creation of structure, equipment, prepared development sites, or a combination thereof (Altshuler et al, 2003). Altshuler et al. (2003) further states that the megaprojects are physical, very expensive and public. Flyvbjerg (2014) on the other hand defines megaprojects as projects that are large-scale, complex ventures, takes many years to develop and build, involve multiple public and private stakeholders, are transformational, and impact millions of people.

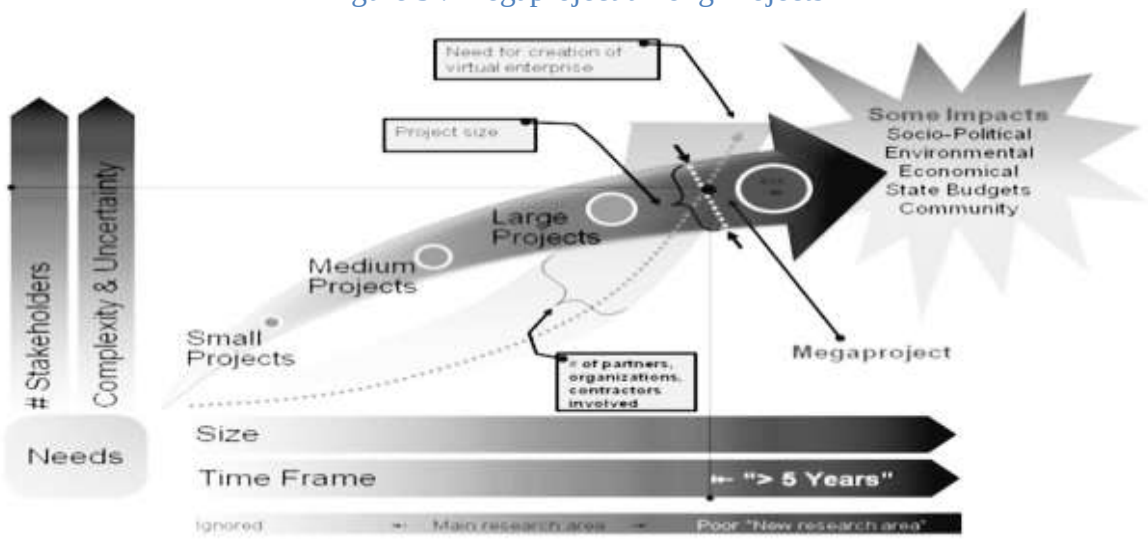
The other vital element of megaproject is the cost involved in the development and execution of the project. Altshuler et al. (2003) partially narrowed the definition of megaproject as being projects that amounted to at least US$ 250 million in inflation –adjusted 2002. It would as a result be reasonable to deduce that these projects would presently amount to US$ 327 million. Flyvbjerg (2014) on the other hand refers to megaprojects as projects that cost at least US$1 billion. This definition is supported by Van Marrewijlk et al. (2008) who state that the project that cost greater than US$1 billion or 0.01% of the GDP is regarded as a megaproject.
The limitation of the definition to include a monetary value presents difficulties across various authorities and perception. Altshuler et al. (2003) acknowledges this reality by qualifying that the notwithstanding the monetary value of the project, the megaprojects are fundamentally an expression of public authority. According to Altshuler et al. (2003), a project that causes disruption, attracts public interest and partially funded by the state may be regarded as a megaproject even though it does not reach the US$1 billion dollar threshold.

The megaprojects as a project amounting to at least US$1 billion may be accurate if assessed from a global vantage point and not intra-country. This view is supported by Warrack (1985) who argues that the US$1 billion criterion may not necessarily depict the definition of megaproject. US$100 Million project could constitute a megaproject (Warrack (1985). Warrack (1985) considers the following as key elements and characteristics of megaprojects: joint sponsor; public policy; uniqueness; indivisibility; time lags; remoteness ; social-environmental impact; market impact; risk; and financing difficulty.

The definitions given by the authors as discussed above have certain common elements that is, the projects involve state funding and that they attract public interest and takes long time to execute. Although the authors do not express similar views in terms of the project costs, the common perception is that the projects are generally expensive to undertake.

In most instances, megaprojects are commissioned through creation of virtual enterprises (Zidane et al., 2012). These enterprises are created as special purpose vehicles to ensure seamless delivery of these complex projects. Zidane et al. (2012) developed a representation of the various types of projects as depicted in figure 1 below.

Figure 5 : Megaproject among Projects



Source: Zidane et al (2012)

The sketch above depicts that the level of complexity, uncertainty, involvement of stakeholders, and the duration of the project increases proportionally with an increase in the size and scope of the project.

Warrack (1985) assertion that a US$100 Million project may be regarded as a megaproject on one geographic location and a normal project on another is to a certain extend valid. However, the definition adopted for the purpose of this study takes into account the context of South Africa as the developing country and its GDP value of US$294.8 billion (World Bank, 2016) relative to the developed countries. This definition emanates from a review of literature and various viewpoints of previous researchers on the subject and will be applied to avoid ambiguity.

A definition of megaproject for the purpose of this study is informed primarily by concurrence between Flyvbjerg (2014), Zidane (2012) and Van Marrewijlk et al. (2008) that Megaproject are projects that amount to at least US$1 billion. Accordingly, megaproject for the purpose of this study refers to a project that is physically large, scientifically complex; cost at least US$1 billion, the duration must at least be 5 years to complete, causes economic

and social disruption, is partially or wholly funded by the state and the benefits are extended to the public.

1.8.2 Defining Legitimacy in the context of the Study

Suchman (1995) defines organisational legitimacy as a generalised perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions. Suchman (1995) emphasises that legitimacy flourishes on a basis of relationship between an entity and the affected stakeholders.

Oxford Dictionary (2008) defines legitimacy as the ability to be defended with logic or justification. Logic is defined as reasoning conducted or assessed according to strict principles of validity (Oxford Dictionary, 2008).

Patel et al. (2005) state that organizational legitimacy is controlled by those outside the organization and thus relies on the organization maintaining a union of loyal stakeholders who have legitimacy determining power. Legitimacy is required to enhance stability (Suchman, 1995); ensure survival (D'Aunno and Zuckerman, 1987); and secure viability (Barnet, 1997) [Patel et al., 2005].

In the context of the study, the legitimacy of opting for energy megaproject as a viable intervention for energy supply challenges in South Africa is investigated. Key to this is the impact of the decisions and actions by the State pertaining to energy megaprojects to end users.

The Integrated Energy Plan (IEP) should ideally be used as a frame work upon which the performances of energy projects are assessed. The IEP sets-out eight key objectives on ensuring energy security. These objectives as promulgated in the IEP (2012) are as follow:

- Ensure security of energy supply
- Minimize cost of energy
- Promote Job Creation and Localization
- Minimize Environmental Impacts
- Minimize Water Consumption
- Diversify Supply sources

- Promote Energy Efficiency
- Promote Energy Access

To the extent that these objectives are prioritized and achieved through the implementation of the energy megaprojects, the decisions to commission the energy megaprojects will prove to be legitimate. In the event that these objectives are not achieved, the legitimacy of the energy megaprojects would prove questionable and consequently invalid.

For the purpose of this study, the following will be observed and assessed on the basis of the identified cases. The legitimacy of energy megaprojects will be tested on the basis of these factors. These factors partly inform the broad objectives of this study. The factors to be observed are as follow:

- Minimization of the cost of energy
- Promotion of Job Creation
- Promotion of Localization
- The cost of generating a megawatt from the energy mega-plant versus the cost of generating a megawatt through the ordinary projects.

It follows that a positive outcome derived on the basis of these objectives would point to the legitimization of the energy megaprojects. It must however be noted that factors stated above would be analysed in the context of this study and the interpretation thereof would form part of the analysis.

1.9 ETHICAL CONSIDERATIONS

One of the key purposes of this research is to improve and expand knowledge in the field of energy megaprojects. In a quest to improve an understanding into the phenomenon of energy megaprojects, one must guard against causing harm to organizations and individuals within the energy sector and the broader society.

Ethical considerations come into play at three stages of a research project, namely:

- when participants are recruited;
- during the intervention and/or the measurement procedure to which they are subjected; and
- In the release of the results obtained (Welman and Kruger, 1999).

To ensure that no harm is caused to participants and the public at large, one must ensure that only the information obtained through legitimate means is used. This relates to the adoption and usage of information from reliable sources in line with the objectives of the study. To this extent, confidentiality agreement has been concluded with all participants where a pledge has been made not to disclose the information obtained.

In the main, the information that is in the public domain have been relied upon and used as a basis to guide this study. Such information has been used by virtue of it being in the public domain. A record of all participants is to be kept confidentially for a period of five years. This information will be shredded and disposed upon the lapsing of this period.

1.10 DELIMITATION OF THE STUDY

The study is limited to the energy megaprojects being implemented in South Africa. No distinction is made on the technology or source of energy per se. The study is not intended to make a distinction on the preferred method and technology for power generation but rather focuses on the scale of the project undertaken to generate power.
It cuts across renewable, hydro, coal fired, and other power generation plants. In particular, the study is not aimed at comparing the renewable energy plants to the conventional coal plants but rather to analyse the costs and benefits of commissioning large scale energy projects for energy generation.

1.11 LIMITATIONS OF THE STUDY

The study focuses on the period from 2005 to 2017. As a result, the assessment of the performance of the energy megaprojects will be limited to this period.

This is informed by the fact that the events that led to investment decisions in energy megaprojects occurred in the years preceding 2007. The demand and consumption of electricity grew exponentially between the years 2005 and 2007 (Eskom *Integrated Financial Statement*, 2007). Stats.SA (2005) report that South Africa's GDP grew at an average rate of 4.5% between the years 2005 and 2007. These two phenomena lead to generation challenges that culminated into a rolling out of load shedding in the year 2008.

The focal point of the study starts from the year 2005 onwards. The period beyond 2017 will not form part of this study due to time constraints to complete this research.

Only projects commissioned by the State utility Company will be considered.
The operational dynamic of the energy megaprojects will not form part of this study due to the envisaged difficulties in accessing this information.

1.12 ASSUMPTIONS

For the purpose of this research, the following assumptions apply:

- All energy megaprojects are characterized by costs and schedule overrun.
- The energy megaproject using other sources of energy (except coal and water) will have the same characteristics as the megaproject of a coal or" hydro" power stations.

CHAPTER 2: LITERATURE REVIEW

The purpose of this chapter in the main is to holistically review literature on the phenomenon of megaprojects internationally and on the factors that impacts the legitimacy of these projects. The Chapter also highlights the knowledge deficiency that exists in literature to which this study attempts to address.

2.1 INTRODUCTION TO LITERATURE REVIEW

A review of literature on the research topic has been largely influenced by international developments in this ever developing field of mega project in general and energy megaprojects in particular. The literature divulged significant knowledge uncovered and formulated by researchers, scholars and experts in the developing field of megaproject in general. This knowledge contributed immensely to forming a basis of this study and moulding its outlook. Key to this is the identification and revelation of the knowledge deficiency in the field of energy megaproject to which this study attempts to address.

As stated in chapter one, the study aims to establish whether the energy megaprojects are legitimate intervention to alleviate the current energy problems in South Africa. The aim of the study and indeed the need to conduct the study are primarily influenced by the knowledge deficiency identified through the critical review of literature.

Literature review in the main covers the following sections.

- The characteristics of megaprojects
- The causes of ever increasing demand for megaprojects internationally
- Megaprojects in developed countries
- Megaprojects in developing countries with a deliberate focus of Africa
- Megaprojects in South Africa
- Decision making process in megaprojects
- Decision making process on energy megaproject in SA.
- Performance of the current energy megaproject commissioned in SA
- The Impact of energy megaprojects to end users in SA
- The capital cost of energy megaprojects
- The consumption and cost of electricity in SA
- Localization within the energy megaproject in SA

The literature review section concludes by highlighting the knowledge gap to which this study is centred.

2.2 THE CHARACTERISCTICS OF THE MEGAPROJECT

Megaprojects are completely different breed of projects in terms of their level of aspiration, lead times, complexity, and stakeholder involvement (Flyvbjerg, 2014). Lundrigan et al. (2014) state that megaprojects involve vast networks of public and private actors formed to develop capital intensive infrastructure. Flyvbjerg (2014) further state that megaprojects have recently transformed into multi – trillion dollar business that affects all aspects of our lives, from electricity bill to how we shop, what we do on the internet to how we commute.

Hirschman (1967, cited in Eisenstadt, 1995 and Sonderland, 2017) state that megaprojects functions as mechanisms to infuse trail making and establishing a new path of development and order transformation. Warrak (1993) states the following as the key characteristic of the megaprojects:

- They are often commissioned through the joint sponsorship
- The projects are effected through Public policy
- The projects are unique and causes disruption
- The projects have social and environmental impact
- The projects often must have an impact in the market
- The projects are risky
- The project must have difficulties associated with funding

Flyvbjerg (2014) on the other hand outlines the following as the key characteristics of megaprojects:

- That they are inherently risky projects;
- That the project management and megaproject leadership often lacks sufficient experience;
- That project management team constantly change due to the longer duration of megaprojects;
- That decision making processes involve multiple stakeholders often with conflicting interest;
- That technology and design are often custom made and non-standard
- There is often over commitment to certain projects concepts, which leads to a lock-out of alternatives

- The project scope or ambition level changes significantly overtime.

Flyvbjerg (2014) state that misinformation about costs, schedules, benefits, and risks is the norm throughout project development and the decision making process. Flyvbjerg (2014) further state that results of misinformation is cost overruns, delays, and benefit shortfalls that undermine project viability during project implementation and operations.

The predominant element of megaprojects highlighted by both Warrack (1993) and Flyvbjerg (2014) is that they:

- are inherently risky projects

- Cause social and environmental impact

- Often experience funding challenges

These characteristics are not limited to specific geographic areas but rather manifests in megaprojects both in the developing and developed countries.

2.3 THE CAUSES OF INCREASING DEMAND FOR MEGAPROJECTS INTERNATIONALLY

McKinsey (2015; cited in Sonderland et al., 2017) estimates that the world needs to spend about US$57 trillion on infrastructure by 2030 to keep up with the expected GDP growth. According to the futurist Thomas Frey from the Da Vinci Institute, megaprojects are expected to increase rapidly to 24% of the global GDP in the coming ten years (Sonderland et al, 2017). Already, spending on megaprojects is estimated to some US$6.9 trillion a year, roughly 8% of the global GDP (Alexander, 2018).

The futurist, Jacquith (2018) highlight the following as some of the prominent megaprojects being executed internationally:

- The International Space station at an estimated value of US$ 150 billion;
- The Almaktoum International Airport at an estimated value of US$82 billion;
- The South to North Water Transfer Project at an estimated value of US$ 78 billion;
- The California High Speed Rail at an estimated value of US$ 70 billion; and
- The London Cross Rail Project at an Estimated Value of US$ 23 billion.

Megaprojects are not only large and growing larger, they are also being built in greater numbers, at ever greater value (Flyvbjerg, 2014). Flyvbjerg (2014) observation is supported by Sonderland (2017) in acknowledging what seems to be a general consensus among many leading analysts that megaproject are not only on the rise but rather are also increasing in size and variety. Megaprojects, in the private and public sectors alike, are more ubiquitous and bigger than ever before (Ansar et al., 2017). At the same time as many more and much larger infrastructure projects are being proposed and built around the world, it is becoming clear that many such projects have strikingly poor performance records in terms of economy, environment and public support (Flyvbjerg, Bruzelius and Rothengatter, 2003).

Innovation by man, the need to improve the way of living, the increase in global population, globalization, international trade ,technological advancement as introduced by Frick (2008), international security needs and human curiosity has led to development and commissioning of large to very large built environments. Sachs (2006) argues that big challenges – such as poverty alleviation, energy and water scarcity, or urbanization can only be solved with "big push" solutions such as investment in megaprojects. Sonderland (2017; cited Frey 2015) state that projects initiated to control extreme weather, handle large amounts of data, and solve human problems, such as diseases, will also be organized as megaprojects in the future.

Ansar et al. (2017) argues that one of the key driving forces behind the exponential rise in demand for big solutions in the form of megaprojects is the manner in which business cases are drafted and presented. Ansar et al. (2017) state that business cases are drafted and presented with pre-selection of megaprojects as solutions for the needed infrastructure.

Flyvbjerg (2003) on the other hand attributes the surge in demand for megaprojects largely to the risk – negligence and lack of accountability in the decision-making process. Flyvbjerg (2003) asserts that ignorance and understatement of risk associated with megaprojects during the decision making processes contributes to rationalization of the decisions to invest more and more in megaprojects.

Other factors that appear as key contributors to the international surge in demand for megaprojects are the need to bolster countries' economic conditions and improvement the lives of the people. Megaprojects can be important engines for economic growth, transformation, and poverty alleviation (Balchin and Coughlin, 2018). Greiman (2013, cited in Khatleli, 2016) state that in some countries, megaprojects are the only way to deliver sustainable development. Greiman (2013, cited in Khatleli, 2016) further state that

understanding how megaprojects can be used to greater effect is key to solving major global problems including poverty alleviation, food security, bolstering of universal health and the improvement of the general welfare of the local citizens.

Flyvbjerg (2014) suggest that megaprojects boom may be caused by technological advancement, political effects, the need to stimulate economic development and aesthetic reasons. These factors have since been referred to as sublimes of megaprojects Flyvbjerg (2014). The four megaprojects sublimes which according to Flyvbjerg (2014) are the driving forces behind an increase in the demand for megaprojects are discussed below (in the order of increasing prevalence):

2.3.1 Political Sublime

Flyvbjerg (2014) defines the political sublime as a political rapture which politicians get from building monuments to themselves and for their causes. Indeed launching a megaproject is a way of getting attention, a way of getting things done – of creating dreams and high aspiration (Soderland, 2017). Flyvbjerg (2014) states that monumental projects boost the aspirations of politician and their statuses in the communities including publicity as a result they become first choice projects by politicians.

The notable such monument is according to Flyvbjerg (2004), the Sydney Opera House. Flyvbjerg (2004) argues that the original budget of the Austria's Sydney Opera House was more of a political budget and not a real project budget. Flyvbjerg (2004) argues that there was political interest in the approval process of the project and as a result, the consequences of costs, schedule and technical complexities were overlooked. The Labour government of New South Wales, in the main proponent of the Opera House, wanted the project approved and construction started before elections in March 1959 (Flyvbjerg, 2004).

2.3.2 Technological Sublime

Frick (2008; cited in Flyvbjerg, 2014) introduced the term "technological sublime" to the study of megaprojects and described it as the rapture engineers and technologists get from building large and innovative projects, with their rich opportunities for pushing the boundaries for what technology can do, such as building the tallest building, the longest bridge, the fastest aircraft, the largest wind turbine, or the first of

anything. Megaprojects are often technological *tours de force* with an innovative and, not infrequently, an exceptional character (Priemus et al., 2008). Altshuler and Luberoff (2003) state that megaprojects contribute to pushing technological barriers and that they attempt to solve mega problems with mega solutions.

The fact that technological advancement may induce the development of megaproject, presents challenges in relation to management of risk in such projects. The risk will vary from budget and time overruns risk to the risk of total collapse to the project. This sublime thrives mainly on the pleasure derived by innovators and engineers on successfully completing the project. Funders and investors are more likely to inject funds into such projects if the prospect of success exceeds that of failure since the benefits are given.

It is tacitly appreciated that technological advancement and innovation induces both the risk and opportunities. An idea to introduce a new technology which may lead to new industries is likely to appeal to investors than an idea to expand and or replicate the existing technology.

The classic example of this is the SpaceX ambition of commercializing the space through the galactic tours. SpaceX launch of a rocket early in the year 2018 bares testimony to the technological sublime. This rocket launch carried a Starman riding in an electric car, Telsa Roadster into space.

Figure 2: SpaceX Rocket Launch [An Example of Technological Sublime]



Source: SpaceX http://www.spacex.com/galleries

Life cannot be about solving one sad problem after another. There need to be things that inspire you, that make you glad to wake up in the morning and be part of humanity. This is why we did it (Elon Musk, 2018)

2.3.3 Economic Sublime

Economic Sublime is the delight business people and trade unions get from making lots of money and jobs from megaprojects. Given the enormous budgets for megaprojects, there are ample funds to go around for all, including contractors, engineers, architects, consultants, construction and transportation workers, bankers, investors, landowners, Lawyers and developers (Flyvberg, 2014)

The economic development is one of the prominent reasons given by commissioners for opting for megaprojects in most instances. This is precisely because projects numerous stakeholders stand to benefit from the implementation of the project.

2.3.4 Aesthetic Sublime

Flyvbjerg (2014) states that aesthetic sublime is the is the pleasure designers and people who appreciate good design get from building, using, and looking at something very large that is also ironically beautiful. Flyvberg (2014) mentions, San Francisco's Golden Gate Bridge or Sydney's Opera House as examples of megaprojects commissioned for aesthetic reasons.

Sydney Opera House is one of the most beautiful pieces of architectural work in the world and one of the main tourist attraction landmarks in Australia. The analysis of project performance in relation to cost and time reflects badly on the showpiece. The project was completed 1400% over its originally published budget (Flyvbjerg, 2004).

Flyvbjerg (2004) argues that such projects would not see the light had an in depth feasibility study been conducted and used as a basis for decision making prior to the approval. Flyvbjerg (2004) further asserts the Sydney Opera House would not be approved in the absence of aesthetic and political influences.

2.4 THE PERFORMANCE OF MEGAPROJECT IN DEVELOPED COUNTRIES

The United Nations report titled *The World Economic Situation and Prospects – Country Classification* (2014) defines the developed countries as countries that have high level of industrialization and GNI per capita of at least US$ 12,615 per the World Bank classification. The classification is economically inclined and is based on the WEPS report (2014). The United Nations recently developed a new country classification index based on the measure of human development (United Nations Index, 2016). This index is known as the Human Development Index (HDI) (United Nations, 2016). The United Nations (2016) HDI classifies countries based on the score derived from the analysis key factors which include: Long and healthy life; knowledge; and decent living standard.

The United Nations (2016) classifies countries into four categories. These four groups per UN classification are outlined below.

- Countries with the HDI below 0.500. These are countries Low Human Development
- Countries with the HDI between 0.500 – 0.799. These are countries with Medium Human Development
- Countries with the HDI of between 0.800 – 0.899. These are countries with High Human Development
- Countries with the HDI of 0.90 and above. These are countries very High Human Development

The development of literature on the phenomenon of megaprojects is spearheaded primarily by scholars from the developed countries. These may to a reasonable extent be credited to the historic megaprojects executed in these countries and the advancement in the search for knowledge and quality of education. The journal on the *top ten classics in megaprojects* by Li et al. (2017) is dominated by authors from the developed countries. The analysis of the literature crafted by the scholars responsible for publishing what has overwhelmingly been accepted as classical work depicts a consistent ubiquity of poor performance of megaprojects in relation to schedule and budget.

As a cases in point, Flyvbjerg et al. (2004) points the Channel Tunnel project between France and the United Kingdom as a classic example of poor cost performance. Flyvbjerg (2004) state that this project suffered a budget overrun of over 200%. The other well-known project is the Sydney Opera House which according to Flyvbjerg (2004) experienced overruns of over 1400%. Lehrer and Laidley (2009) state that megaprojects

such as the Big Dig in Boston, Los Angeles Subway line, and the Denver International airport, are legendary for their cost overrun. Ansar et al. (2017) found the following in relation to cost performance of megaproject in developed countries:

- That three out of every 4 large dams suffered a cost overrun in constant local currency terms; and
- That the actual costs were on average 96% higher than estimated costs.

These projects form the basis upon which some of the key theories of the megaprojects phenomenon. Upon observing and analysing numerous megaprojects over an extensive period of time Flyvbjerg (2014) concluded that *megaprojects are over budget, over time, over and over again*. Flyvbjerg (2014) named this theory as the "Iron –law of megaprojects". The key finding of the study revealed that nine out of ten megaprojects are unsuccessful when cost, time and benefits are used as a measure of success. Flyvbjerg (2014) discovered that 90% of the assessed megaprojects where over budget and time by over 50% of the project value in real terms.

The other expressive theory of megaprojects is the *break-fix model* of megaproject management. Flyvbjerg (2014) asserts that megaprojects planners and managers and their organizations do not know how to deliver successful megaprojects, or do not have the incentives to do so and therefore such projects tend to "break". Projects are then often paused and reorganized, sometime also refinanced in an attempt to "fix" the project and deliver the version of the initially planned project with a semblance of success (Flyvberg, 2014). It is tacitly understood that delivering projects in such a manner is risky and is likely to lead to additional costs and extended project duration, which consequently renders the project unsuccessful.

Given the prevalence of unsuccessful megaprojects internationally, it is logical to deduce that some of these projects may have been implemented through the break-fix model of project management. Could it be that some of the megaprojects fail as a result of the project decisions made on the basis of limited information or misinformation? Could it be that the decision makers relies on the Hirschman's hiding hand theory to development? The clearly articulated fact per theories introduced by Flyvbjerg (2014) is that the cost and schedule overruns in megaprojects are ubiquitous.

The tale of megaprojects in developed countries is however not all characterised by gloom and doom. There is evidence that seeks to highlight the successful delivery of some

megaprojects. The Guggenheim in Bilbao, the Eifel Tower and Pompidou in Paris, and Empire State Building in New York City all Stayed within budget (Flyvbjerg, 2005). The project management community is still struggling to find consistent ways to improve the performance of megaprojects in the engineering, construction, and defence sectors (Sonderland, 2017).

In light of the facts encapsulated in this section of the study, the existence of tacit consensus is clearly spelt-out regarding the trend of dismal performance of majority of megaprojects in developed countries. One known certainty as argued by Flyvbjerg (2014), Ansar et al. (2017) and Warrak (1993) is that megaprojects are susceptible to cost and schedule overrun. In particular Flyvberg (2014) stated that only one in a thousand megaprojects becomes successful when cost, schedule and benefit are used as a measure of success.

2.5 THE FUTURE PROSPECTS AND HISTORIC PERFORMANCE OF MEGAPROJECT IN DEVELOPING COUNTRIES (AFRIKA)

The United Nations report titled *The World Economic Situation and Prospects – Country Classification* (2014) defines developing countries (DVCs) as countries that have low level of industrialization and a GNI per capita of between US$ 1,036 and $ 12,615 per the World Bank classification. The classification is economically inclined and is based on the WEPS report (2014). The United Nations (2014) classifies countries such as Brazil, India, and South Africa as developing countries. Othman (2013) reported that countries with the HDI of between 0.500 and 0.799 are classified as developing countries.

Othman (2013) state that mega-construction projects represent a strategic option towards achieving sustainable development objectives in the developing countries. Othman (2013) state that governments in DVCs invest in the development of the megaprojects to achieve their social and economic sustainable development. PwC (2014) state that Africa's infrastructure lag behind that of the rest of world with some 30% in dilapidated conditions and with massive backlogs in almost all countries across all infrastructure types. The total demand for infrastructure investment and maintenance from developing countries are estimated at more than US$900 billion a year, with the greatest needs in Africa and Asia (Khatleli, 2016). PwC (2014) estimate that the infrastructure spends for sub-Saharan African countries is expected to reach US$180 billion per annum by 2025. PwC (2014)

state that as of 2013, group of 20 African national governments reported spending US$42.2 billion on infrastructure alone.

PwC (2014) state that some of the megaprojects in Africa experienced delays of between 40% and 150% of the baseline schedule and that the budget overruns of between 10% and 50% are common. Take for instance, the case of the rehabilitation of Inga 1 and 2 dam projects in Congo DRC which recorded a huge cost overruns amounting to US$ 1.1 billion far and above the initial estimate of US$ 250 million due to mismanagement and delays in project execution (Gbahabo and Ajuwon, 2017). Omoregie and Radford (2006, cited in Gbahabo and Ajuwon, 2017) state that transport infrastructure project reported overrun of averaging 14% cost escalation and time schedule delay of 188%. Ngacho and Das (2013, cited in Gbahabo and Ajuwon, 2017) state that a range of reports on Kenya megaprojects indicated a 48% cost and 87% time overrun.

International Rivers (2017) reports that the planned Great Inga Dam, estimated at US$ 80 billion is likely to suffer financial loses of over US$ 70 billion over the project lifespan. International Rivers (2017) further state that the first phase of the Great Inga 3 project is expected to generate over 4800 MW of electricity at an estimated cost of US$14 billion. The Great Inga 3 project would lead to large increase in external government debt, risking a downgrade in the risk assessment of the DRC's debt distress and harming DRC's long – term economic health (Internal Rivers, 2017). International Rivers (2017) further argues that Inga 3 risks destroying more livelihoods than jobs that it would support.

The assessment of the performance of megaprojects in the DVC's appears to be a replica of the performance of similar projects in the developed countries. A critical review of the literature on the concept of project overrun reveals that it is a widespread global phenomenon spanning across continents and historical divide (Omoregie and Radford, 2006). This bear testimony to the assertion by Flyvbjerg (2004) and Ansar et al (2014) that megaprojects are very risky ventures. Ansar et al. (2014) advises strongly against investment in mega energy projects by developing countries. Policymakers, particularly in developing countries are advised to prefer agile energy alternatives that can be built over shorter time horizons to energy megaprojects (Ansar et al., 2014).

2.6 THE PERFORMANCE OF THE CONTEMPORARY MEGAPROJECTS IN SOUTH AFRICA

The World Bank (2017) classification of countries broadly put South Africa under the umbrella of developing countries by virtue of its GNI per capita of higher than US$ 1,036 and lower than US$ 12,615. South Africa is located in the Southern tip of the African continent. The United Nations HDI report (2017) ranks South Africa at number 119 out of 187 countries in terms of the HDI score. South Africa is a fairly new democratic country with a population of over 55.6 Million people (Stats SA, 2016).

South Africa is a country characterised by a well-documented history of racial and economic segregation (SA History, 2011). The apartheid state made excessive investments in infrastructure that served mainly the white minority and maintained the apartheid state (Department of Planning, Monitoring and Evaluation, 2016). The National Development Plan (2012) state that in 1994, the new democratic dawn was ushered in SA and opened up the fiscus and economic benefits to all. These changes fundamentally altered the economic and social outlook in the country. Department of Planning, Monitoring and Evaluation (2016) state that apartheid induced fiscal choices contributed to poverty and inequality subsequently faced by the democratic state. The other conspicuous dynamic that was brought about by the political changes post 1994 is the migration of people within South Africa from rural areas to urban areas. This statement is corroborated by statistics SA (2011). As people relocate from rural to urban communities and population clusters grow, so does the demand for major infrastructure improvements to help manage the traffic, water, sewage, power, and living strains of these growing economies (Frey, 2018). This mass migration of people contributed to multiplicity of complications in planning and provision of the infrastructure. The migration trend continues to this day, Stats. SA (2011) state that as high as 2 125 478 people migrated from rural to urban areas between the years 2001 – 2011. As a case in point, the Human Science Research Council (2018) state that at least 376 000 people migrate into Gauteng province on an annual basis.

The National Treasury (2015) report titled "*Trends in Public Infrastructure Spending*", state that SA invested R 2.2 trillion in infrastructure between the years 1998/99 and 2014/15. Despite this South Africa remains with the infrastructure backlog that runs into trillions of Rands. The areas that are affected include, the transport sector, energy, water and sanitation (National Treasury, 2015). South Africa provides very good prospects for megaprojects implementation because of the infrastructure backlog (Khatleli, 2016).

It is worth noting that South Africa has to a greater extent attempted to alleviate some of this challenges through a combination of small, large and mega infrastructure projects. Most of the

small projects appears to have been executed and completed unnoticed while the megaprojects where exposed to public scrutiny due to their nature as being the megaprojects.

The recently completed megaprojects include: The Gautrain Rapid Rail system project; Gauteng Freeway Improvement Project (GFIP). Despite these achievements, the country remains infested with multiplicity of infrastructure backlog.

In the context of South Africa as a developing country with over 55 million people as stated above, the GDP growth of less than 2% annually (Stats SA, 2017) and the unemployment rate of over 26% (Stats SA, 2017), it is vital to assess the performance of the state funded megaprojects commissioned in SA. In conformity to the objectives of the study, the criteria for assessment of the performance of this projects are time, cost and benefit.

2.6.1 Gauteng Freeway Improvement Project (GFIP)

The Gauteng Freeway Improvement Project (GFIP) is another important transport project that was initiated in the Gauteng province to increase the flow of traffic (Khatleli, 2016). The project was commissioned by the South African National Road Agency Limited (SANRAL) and funded through a support from the national fiscus (Department of Transport, 2012). The project was inherently exposed to public scrutiny due to its disruptive nature and impact to the road users during the construction phase.

The first phase of the GFIP entailed improvement and widening of a tarred road network covering a distance in excess of 185 Km within the Gauteng province, South Africa (SANRAL, 2010). The GFIP have proven to be successful when assessed without factoring in the costs, schedule and the looming negative financial impact to households. The notable benefits attained through the GFIP are as follow:

- Economic multipliers that were expected to be realized as a result the GFIP have largely been positive, although they have been tempered by the perceived price of paying for the tolls (Parrot, 2015).
- The GFIP has achieved its construction goals, both on quality and quantity of infrastructure Parrot (2015)
- At the very least, 15 957 jobs were created during the construction phase of the project (SANRAL , 2010 , report titled :*“ An Economic analysis of the Gauteng Freeway Improvement Scheme”)*

- The project contributes immensely to the economic development of the Gauteng province and other adjacent provinces
- Peak traffics is being managed effectively with reduced congestion (SANRAL, 2010)
- According to SANRAL (2010), the road system has a cost ratio of 8.4. This means that for every Rand spent on initial capital costs and ongoing maintenance and running costs society benefits R 8.4 (SANRAL , 2010 , report titled :*" An Economic analysis of the Gauteng Freeway Improvement Scheme")*

This outlook changes completely when the costing aspects and the financial impact to the households are factored in.

In a classic megaproject character, the GFIP has conformed to the *Iron Law of megaprojects theory* enunciated by Flyvberg (2014). The project has exceeded the initially approved project and overran the baseline schedule. Brits (2010) and Parrot (2015) state that the revalidated budget for the GFIP was R 11.4 billion as of end of 2008. The estimated final cost of the project has been said to be R 17.5 billion excluding the tolling infrastructure (Creamer Media, 2010). This depicts an escalation of over 45% in costs, thus rendering the megaproject as a failure when cost and time factored as part of the measures of success.

The performance of the GFIP is exacerbated by the fact that financing model through the urban e-tolling system is being rejected by majority of road users and civil society organisations. Parrot (2015) state that this is mainly because the implementation of the e-tolling system meant a reduction in the disposable income of most household's relying on the usage of the road to make ends meet.

The rejection of the capital expenditure recovery mechanism rendered the entire project unsuccessful. The objectives of the project in relation to the revenue recovery are proving to be unsustainable and difficult to enforce. To this end, SANRAL's efforts to enforce the collection of Toll fees from the consumers has been ignored by majority of road users and has been met with resistance from organisations such as Organisation Against Urban Tolling (OUTA) and some labour unions.

2.6.2 Gautrain Rapid Rail System

Gauteng Provincial Government (2016) state that Gautrain rapid rail link system was necessitated by a need to provide efficient transport system and to partially ease the traffic

congestion between the three major metropolitan cities in Gauteng province; these are: Tshwane, Ekurhuleni and Johannesburg. Gauteng Provincial Government (2016) further state that project was partially funded by the State and private companies through a special purpose vehicle in the form of Bombela Consortium.

Van der Merwe et al (2001) stated that the project is an important project for Gauteng and South Africa, and also unique in the sense that it is the first of such modern metropolitan or regional rail systems to be provided and operated in Southern Africa.

KPMG (2015) reports that Gautrain rapid rail project has brought about considerable number of benefits to the public, commuters and to some notable extent, road users within the Johannesburg, Ekurhuleni and Tshwane Metropolitan cities. Among others, the benefits of Gautrain rapid rail link system are as follow:

- Provision of safe and reliable passenger rail service to commuters (KPMG report,2015)
- Reduction of the peak congestion on the road (KPMG report, 2015)
- Improvement of property values along the Gautrain route (KPMG report, 2015)
- The increase property values added R 18 billion to the provincial GDP in 2013 (Engineering News, 2015)
- 121 800 jobs were created during the design and construction phases of the Gautrain project (Engineering News, 2015)
- KPMG report on the economic impact of that Gautrain state that Gautrain system contributes R 1.7 billion to the Gauteng economy on annual basis
- KPMG report state that Gautrain project contributed over R 20 billion to the provincial GDP during construction

Gautrain project was a megaproject by virtue of its magnitude, public involvement, partial funding from the state fiscus, its impact to the public and environment; and that the project value is in excess of US$ 1 billion. The in-depth assessment of its performance shows the proclivity and conformity to the *Iron law of megaprojects theory* introduced by Flyvbjerg (2014). The Gautrain project was completed over time and over budget. The CEO of Gautrain reported the project's final cost as R 25.2 billion, 26% higher than the approved budget of R 20 billion in 2005.

The performance reinforces the notion that megaprojects are synonymous with financial loses and schedule overruns.

2.7 THE ENERGY PROJECTS COMMISSIONED IN SA [2005 – 2017].

The analysis of the various economic reports by Statistics South Africa (Stats SA) shows that South Africa experienced a rapid economic growth between the years, 2003 to 2007 The average GDP growth between these periods stood at 4.1% (Stats SA, 2017). This unprecedented economic growth led to a rapid rise in the consumption of electricity to a point where the demand outstripped supply. In response to the shortage of supply, a number of measures were put in place by the state. These included the immediate efforts to promote efficiency in the use of electricity, and plans to expand generation capacity were fast-tracked (National Treasury, 2011).

The analysis of the integrated financial statement published by the State owned company, Eskom in 2007, as per Table 1, shows that the demand and supply of electricity increased dramatically between the years 2003 and 2007. Eskom's Integrated financial statement shows that Eskom reached a record sale of 256 453 GWh in the year 2005, up from 206 799 GWh in the preceding year.

Table 1: Electricity Demand Trend (2003 to 2007)

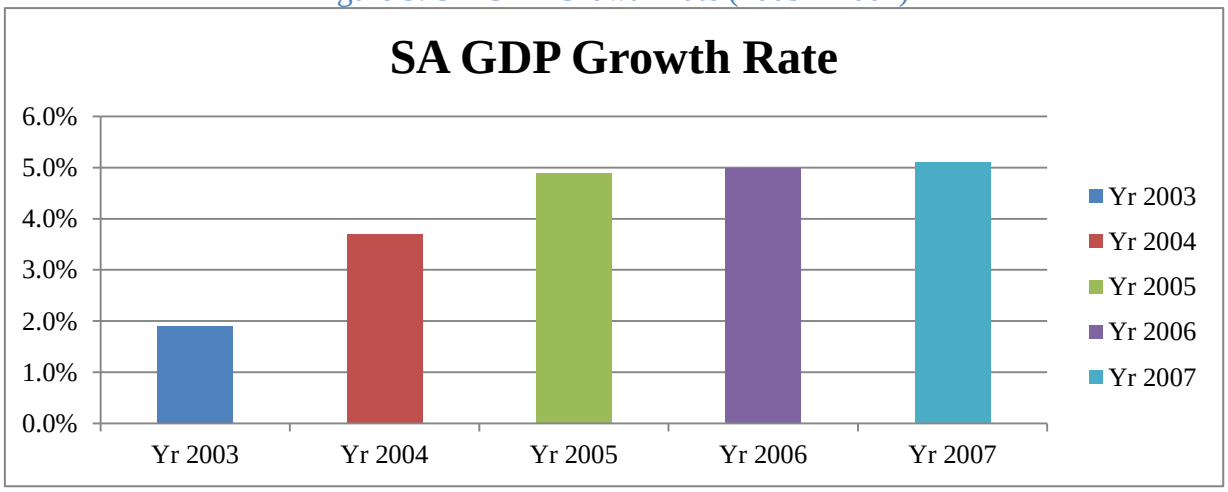
Year	**2003**	**2004**	**2005**	**2006**	**2007**
Total MW Produced by Power Stations [mw]	210 218	220 152	273 404	221 985	232 443
Electricity Sales [GWh]	196980	206 799	256 453	207 921	218 120
Peak Demand [mw]	31 928	34 195	34 195	33 461	34 807

Source: Eskom Integrated Financial Statement 2007
http://financialresults.co.za/2007/eskomar2007_fin/table_statistical.htm

The economic boom experienced through this period was accompanied by a reduction in the unemployment numbers, Statistics SA shows that unemployment dropped marginally to 23% as at the end of 2007, down from 27.9% in 2003.

Figure 3 below depict the improvements in South Africa's GDP growth rate between 2003 and 2007.

Figure 3: SA GDP Growth Rate (2003 – 2007)



Source: Statistics South Africa

The analysis of the economic growth data, electricity supply constraints and unemployment data depicted above confirms the inevitability of a need for action to address the situation that would threaten the country's growth aspiration. There was clearly a need to commission new generating capacity to expeditiously ensure continuous economic growth trajectory which would assist greatly in alleviating South Africa's socio economic challenges. PwC(2014) state that South Africa has made power generation a high priority in its National Development Plan, with spending projected to increase at an average annual rate of over 20% to US$120 billion by 2025. Khatleli (2016) state that the energy megaproject in the form of Medupi and Kusile Power Stations were implemented to meet the struggling energy infrastructure that could no longer cope with the growing needs of the economy. IRN (2006) acknowledged that large hydropower plants (megaprojects) increases electricity supply in big increments. IRN (2006) however, argues that the large hydropower plants (megaprojects) are inefficient way to address the gradual increases in market demands typical of developing economies (IRN, 2006).

According to Eskom (2017), the "build program" includes the commissioning of numerous energy plants which included the Medupi power station, Kusile Power Station, Ingula pumped storage plant, and Sere Farm, return to service of the Komati Power Station, among other initiatives.

The strategic focal point of this study is Medupi megaproject, Ingula megaproject and the Sere Wind farm generation plants. These projects were strategically identified as a result of their recency in development and varied characteristics in terms of scale and capital investment and delivery time. These projects and associated dynamics in the context of the study are discussed below:

2.7.1 Medupi megaproject

According to Eskom (2008), Medupi Power Station is one of the projects necessitated by a rapid increase in electricity demand driven dominantly by economic growth. The Medupi project was implemented hastily and not enough preparation was done to prepare for the organisational capacity and improve the technical know-how within the organisation (Khatleli, 2016)

Eskom (2011) asserts through its publication, *the Eskom Factor*, that Medupi Power Station would be the answer to the calamitous effects of electricity generation and supply challenges to South Africa's economy. Eskom (2011) further stated through a report titled *"The Eskom factor"* that as a long lead project, taking many years to plan, design and construct, there was no viable alternative for supply, other than building Medupi.

Medupi Power station is the fourth largest coal fired Power Station in the world. It is a undoubtedly the megaproject (Eskom, 2016).

Figure 4: Medupi Power Station Entrance



Photo Taken 15 August 2017

Medupi Coal fired Power Station is the first coal fired Power Station conceived in South Africa since the dawn of democracy. The last Power Station initiated in the early 1980's and commissioned in the late 1996 is Majuba Power Station (Eskom, 2017). Medupi Power Station is located approximately 10km West of Lephalale town in Limpopo province, South Africa. According to 2007 Census, as published by

Statistics South Africa, Lephalale had a population of 80 141 people as of the end of 2007.

Medupi Power Station is a dry cooled coal-fired generating plant - comprising of six units with 4 788 MW installed capacity (Eskom, 2007). Eskom (2007) state that Medupi Power Station is one of the Power Stations induced by an increase in electricity demand that led to load shedding in the years, 2008/9.

The Construction of the Medupi Power Station commenced in August 2008 and the expected completion date then, was December 2015. According Eskom (2007), the initial pronounced budget for the construction of Medupi Power Station is R 78.6 billion. The initial planned commissioning date for the first unit was end of December 2011 with subsequent commissioning of the remaining units at 9 months intervals. The planned completion for the whole project was end of the year 2015.

The expected key benefits of Medupi Power Station project are as stated below:

- According to the Eskom Factor publication (2011), Medupi energy megaproject was expected to contribute approximately 0.43% to the country's GDP year on year during construction.
- At least of 11 000 job opportunities would be created during the construction phase of Medupi project (Eskom, 2011).
- At least 64% of the material, services, plant and equipment's would be sourced locally
- At least 2 000 people would undergo formal training and skills development (Including on the Job – Training)

The performance of Medupi megaproject against these set objectives is discussed in the succeeding sections of this study.

2.7.2 Ingula pumped storage scheme megaproject

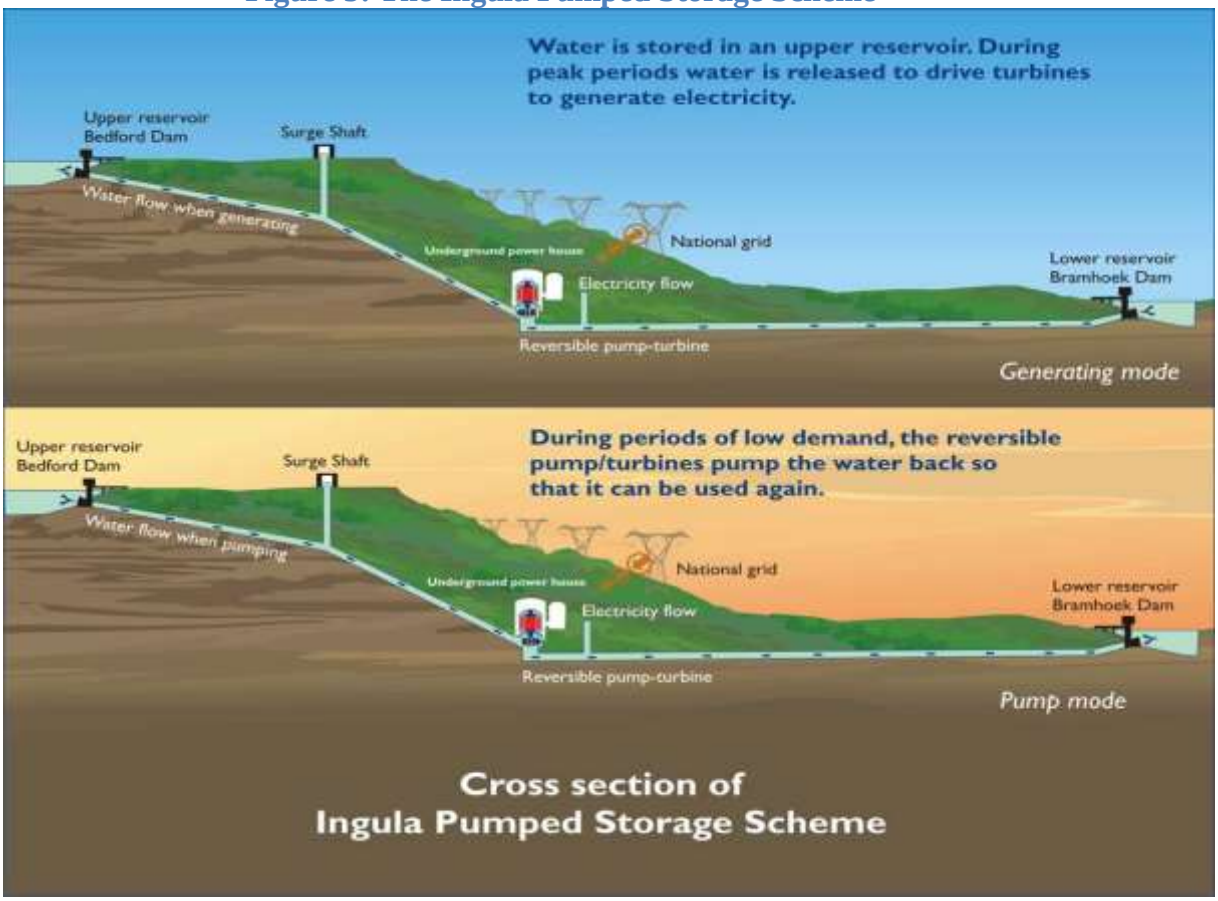
Ingula Pumped Storage Scheme project is the other megaproject necessitated by a rapid increase in electricity demand driven dominantly by high economic growth experienced in the years 2007/8. Similar to Medupi power project, the Ingula pumped storage scheme is expected to inject the much needed electricity generation capacity in South Africa, especially at the peak periods.

Ingula pumped storage scheme plant is located along the north-east of Van Reenen's Pass, near the little Drakensberg Mountain on the border of the Free State province and Kwa-Zulu Natal province. The pumped storage scheme consists of an upper and a lower dam, each capable of holding approximately 22 million cubic metres of water (Eskom Fact Sheet, 2013). Eskom (2013) further state that the dams, 4.6km apart, will be connected by underground waterways passing through an underground powerhouse with four 333 MW generators.

The construction of the Ingula Storage Scheme megaproject commenced in 2005 and the expected completion date then, was December 2012. The project last unit of the project was commissioned in 2016, thus marking the completion of the Ingula pumped storage scheme, thus injecting an additional capacity of 1332 MW (333x4) to the national grid.

According Creamer Media article titled "*Ingula Pumped – Storage Scheme project, South Africa*"(2016), the initial pronounced budget for the construction of Ingula Pumped Storage Scheme was R 8.9 billion. Eskom recently reported cumulative project costs of R26.8-billion against a revised budget of R25.9-billion and an initial budget of R8.9-billion (Mariaan Webb, Creamer Media, 2016).

Figure 5: The Ingula Pumped Storage Scheme



Source: Eskom (Corporate Affairs Division: Generation Communication HY 003 Revision 8)

The Ingula project is a megaproject by virtue of its inherent characteristics which are similar to those of megaprojects. This includes its performance in relation to time, cost and benefit. Ingula project was completed over budget and experienced schedule overrun.

The aspired benefits of undertaking Ingula megaproject are as stated below:

1. At least of 3 000 job opportunities would be created during the construction phase of Medupi project (Eskom, 2011).
2. At least 60% of the material, plant and equipment's would be sourced locally (Eskom Factor, 2011)

Ingula Pumped Storage scheme has now been fully commissioned and connected to the national grid and commercialised (Eskom, 2016). According to Eskom (2016), the power plant injects as high as 1332MW to the grid at peak times daily.

The pros and cons of the Ingula Power project and comparison of the critical elements such as cost and time to that of Medupi Power project and the Sere Wind farm are the focal point of this study and will be discussed comparatively in the succeeding sections of this study.

2.7.3 Sere wind farm energy project

Eskom (2016) state that Sere Wind energy generation project is the other projects necessitated by a rapid increase in electricity demand driven dominantly by high economic growth experienced in the years 2007/8. Unlike Medupi power project and the Ingula pumped storage scheme, the Sere project is inherently a renewable project and is solely dependent on the natural, non-organic resources to energy generation (Eskom, 2016).

Sere Wind farm energy plant, as it is commonly known, is located in the Western Cape Province of South Africa, some 300km north of Cape Town. According to Eskom, It is one of the largest energy wind-farms in Southern Africa with a generation capacity of 100 MW.

One of the key benefits of the Sere wind farm is the fact that it:

"... contributes to saving of over 6 million tons of greenhouse gas emissions over its 20 years expected operating life, with average annual energy production of about 298 000 MWh, enough to supply about 124 000 standard homes" (Eskom , 2015)

According to Eskom media report (2015); the Sere Wind farm project was commissioned at an estimated cost of R 2.689 billion and was completed in March 2015.

There is a limited literature on the socio-economic impact of the Sere Wind to the Western Cape people in general and Vredendal community in particular. This study partially attempts to uncover and bring to the fore, the socio-economic benefits attained through the commissioning of the Sere Wind farm project and compare these to the benefits realised through the commissioning of Medupi and Ingula projects.

Figure 6: Sere Wind Farm (Vredendal – Western Cape)



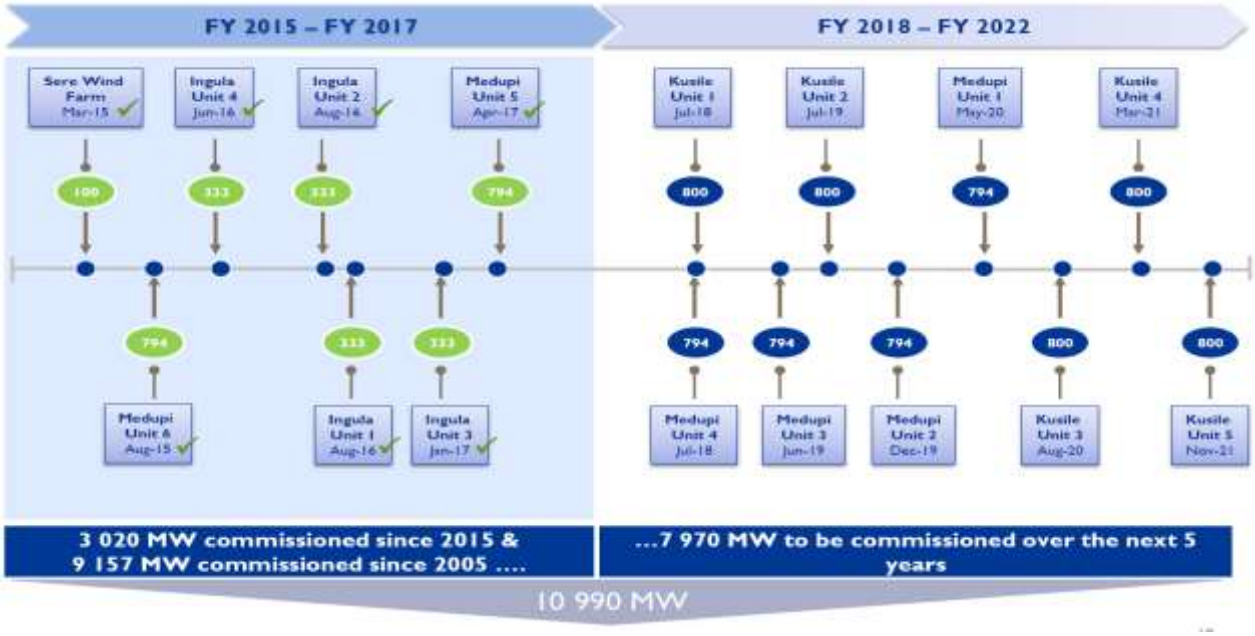
Source: Eskom http://www.eskom.co.za/news/Pages/SereApril.aspx

The performance of the Sere Wind farm in relation to the research objectives is discussed under the discussion section of this study. The performance and associated energy project characteristics are collated and compared with those of the Medupi and Ingula energy megaprojects.

2.6.4 Time performance of the energy projects

Figure 7 below, provides a glance view of the time performance of the energy projects commissioned since the inception of the build programme.

Figure 7: The Time Performance of the Eskom New Build Projects



Source: 2017 Audited Financial Statement -Eskom

- Medupi Power Station will now be completed in May 2020 against a baseline completion date of March 2015. The first of the 6 Medupi units was completed in August 2015, and the last units are expected to be completed by end of May 2020, Five years later than the initially planned completion date.
- Ingula Pumped Storage Scheme energy project was completed end of January 2017. Five years later than the baseline programme.
- The Sere Wind Farm on the other hand was completed on time. The project was scheduled for completion by no later than 31 March 2015 and the completion date was achieved.

The performance manifested through the implementation of these projects is to a greater extent in conformity to the Iron law of megaproject introduced by Flyvbjerg (2014). The Medupi and Kusile Power Projects are the most notable projects being implemented in South Africa that manifests the signs of failure when cost, time and to some extent "benefit" are used as a measure of success.

2.8 MEGAPROJECT – DECISION MAKING PROCESS

One of the distinct characteristics of megaprojects as stated by Warrak (1993) is that they're inherently public projects. The purveyors in the development of knowledge in the field of megaprojects unanimously agree that one way or the other, regardless of how projects are funded; megaprojects are bound to attract public interest. This is attributable to the impact that these projects have on the public, be it socially, economically or environmentally.

Lehrer and Laidley (2009) state that megaprojects are often based on the ideals of democratizing society and distributing a "fair share" of their benefits, such as, job security or housing. We learned through section 2.3 of this study that megaproject decisions may be influenced by technological advancement, political sublime, aesthetic reasons or economic sublimes as stated by Flyvbjerg (2014).

One of the notable facts about megaproject performance internationally as proven by Flyvberg (2014) and Ansar et al. (2017) is that they're susceptible to cost overrun, schedule overrun and benefits shortfall. Flyvberg (2003) proved that cost overruns are common in over fifty percent of the megaprojects and that most megaproject experiences schedule overruns. Despite these well publicized facts, the demand for megaprojects keeps surging internationally.

Flyvbjerg et al. (2003) state that megaprojects' promoters are often happy to go ahead with high risk project as long as they themselves do not carry the risks involved and will not be held accountable when projects fails. Flyvbjerg (2003) asserts that this is mainly due to the fact that the demand for the product (Infrastructure) and the benefits are often overestimated. Sonderland (2017) state that megaprojects justified on the bases of theories of big, are more ubiquitous and bigger than ever. Ansar et al (2017) state that he noticed the consistent trend of predetermined selection of big solutions upon reviewing business cases presented at the World Bank prior to approval. Ansar et al (2017) further state that the thought process on drawing up business cases for funding resembled the rationalization of pre-selected solution of megaprojects (large dams) than the rational assessment of alternative ways to solve a given problem (be it provision of water or electricity). This is observation corroborated by Flyvbjerg (1998) who stated that decision making process on megaprojects is often rationalization presented as rationality. The key to understanding the performance of megaprojects lies in the initial decision to proceed with it. It is therefore vital to understand how these decisions are taken.

Literature introduces key theories that are reasonably pivotal to decision making processes in megaprojects. Considerable number of these theories has been devised in a quest to encapsulate the manner in which decisions are taken in major infrastructure projects. The theories and methods discussed in this study include: the Hirschman's Hiding Hand Theory by Hirschman (1967); and The principle of Malevolent Hiding Hand Theory by Bent Flyvberg (2014).

2.8.1 Hirschman's Hiding Hand Theory

One of the fundamental theories which may assist in understanding the processes followed when decisions on megaprojects are taken is the concepts of Hirschman's hiding hand Theory.

Hirschman (2015 [1967]) states that:

"Creativity always comes as a surprise to us, therefore we can never count on it and we dare not believe in it until it has happened. In the other words, we would not consciously engage upon tasks whose success clearly requires that creativity be forthcoming. Hence the only way in which we can bring our creative resources fully into play is by misjudging the nature of the task, by presenting it to ourselves as more routine, simple, undemanding of genuine creativity than it will turn out to be"

This concept was introduced by Hirschman (2015 [1975]) in a quest to study and observe how developments unfold in the developing countries. Hirschman (2015 [1967]) asserts that if the planners and project managers of the projects in general where to know all challenges involved in the projects, nothing will be built. This assertion suggests that a megaproject must be approved regardless of the identifiable risks and conspicuously limited prospects of success in projects.

The assertion by Hirschman (2015 [1967]) that people becomes creative when facing challenges and that these creativity is the driving force behind the developments in the developing countries may be used to inform decisions on megaprojects in some regions around the globe.

In view of such a "theory", it is vital to question the basis upon which decisions on megaprojects are taken in South Africa taking into account the context of the socio-economic challenges and the South Africa's economy. Would it be prudent to proceed with a project without fully understanding the associated challenges?

2.8.2 The Principle of Malevolent Hiding Hand

The immediate question that may be asked in light of decisions taken on the basis of the Hirschman's hiding hand "theory" discussed above is at what price?

Hirschman (2015 [1967]) seemed to suggest that projects be approved and implemented at all cost. It is partly for this reason that this "theory" was later challenged and criticized by Flyvbjerg (2014) through the principle of Malevolent Hiding Hand. Flyvbjerg et al. (2014) exhibited his dissatisfaction to the Hirschman's hiding hand theory by conducting a study on performance of megaprojects conducted on the basis of misinformation and limited upfront planning. Flyvberg et al. (2014) is of the view that knowing the facts, challenges and risks associated with megaprojects are important ingredients of megaproject decision making processes. Flyvbjerg et al (2014) conducted an extensive study over multiple geographical regions with an intention of testing the Benevolent Hirschman's hiding Hand Theory introduced by Hirschman (2015 [1967]) .

Flyvbjerg et al. (2014) findings led to the origin of the principle of Malevolent hiding hand theory. Flyvbjerg et al. (2014) discovered that Hirschman's hiding hand which was said to be benevolent (giving) was in fact malevolent (malicious).

This means that when decisions on megaprojects are taken on the basis of limited information and without conducting the requisite due diligence, the results are likely to be dire. Conversely when decisions on megaprojects are taken with reasonable level of appreciation for complexities; risks; and challenges, proactive mitigating measures may be formulated to counter the negative impact on the project.

In view of the two theories contrasting theories discussed above (The Benevolent Hiding Hand Theory and the Malevolent Hiding Hand Theory), the question must be asked - how are decisions on megaprojects made?

Flyvbjerg et al. (2003) propose that risk and accountability be centrally placed in megaproject decision making than is currently the case. Flyvbjerg et al. (2003) asserts that this will avert and minimize the deliberate under estimation of risk and overestimation of benefits during the decision making process of the megaproject.

Warrak (1993) on the other hand assert that decision making process on megaprojects by governments is fragile and vulnerable in the best of time: and that at worst, a non-decision may be tempting. Warrak (2003) attributes this is to the bureaucratic nature of governments and the complexities of multi-stakeholders participation in megaprojects and a lack of clear-cut process on megaprojects decision-making which could somehow lessen the impact of megaproject failures in the society and the cost associated with the project.

Warrak (1993) identifies the three key components of megaproject decision – making process. These are *the Sponsor*, the *government* and the *interface between them* (Warrak, 1993). The interface between government and project funders is very important in the context of developing countries where projects are sponsored and funded by international agencies such as the World Bank and IMF.

Collaboration and Interface between various stakeholders in megaproject decision-making process is vital for ensuring that a right decision is taken and may go a long way in ensuring that the challenges which may be encountered later on during the implementation phase of the megaproject are averted.

Warrak (1993) states the decision on whether to proceed, or to delay a project for consideration, or to postpone, or to stop the megaproject can only be made upon:

- conducting a genuine and robust viability study

- Availing sufficient resources for objective investigation
- Availing experienced and capable analyst team for analytic views
- considering the first choice of key participants
- ensuring that the project objectives are achievable despite opposition
- ensuring a conducive economic and political climate

There are various approaches that may be adopted to arriving to the favourable decision which takes into account the public interest, stakeholder's interest and government interest. These approaches include Conventional decision making process, Concession approach to decision making, and the State Owned Enterprise Approach as introduced by Flyvbjerg et al. (2003).

2.8.3 Conventional Decision Making

According to Flyvbjerg et al. (2003), a considerable number of megaproject decision making processes follows what is considered a "Conventional approach" to decision making. This applies to instances where the megaproject is financed by the public funds or to instances where they are backed by sovereign guarantees. Table 2 below depicts the process followed through the *Conventional approach* to megaproject decision making process.

Table 2: Decision Making Steps in Conventional Approach to Project development

Steps	**Action**	**Responsibility**
1.	Identify alternatives	Government
2.	Draft terms of reference; recruit consultants for feasibility study	Government
3.	Undertake feasibility study • preliminary design and cost estimates • market analysis • economic analysis • financial analysis	Consultants
4.	Draft terms of reference; recruit consultants for evaluation of safety aspects of different alternatives	Government

5.	Carry Out Safety Study	Consultants
6.	Draft terms of reference; recruit consultants for environmental impact study	Government
7.	Undertake project appraisal: make recommendation to government	Consultants
8.	Make decision (Supplementary studies possible before final decision)	Government / Parliament
9.	Establish State – Owned enterprise (SOE) to implement project	Government
10.	Application for required permits (1st phase : approval of preliminary design); preparation of documentation	SOE
11.	Mobilise Finance	Government / SOE
12.	Recruit consultants to prepare detailed design and for supervision	SOE
13.	Preparation of detailed design	Consultants
14.	Application for required permits (2nd phase : approval of detailed design)	SOE
15.	Recruit contractors	SOE
16.	Supervise	Consultants
17.	Commission and initiate operations	SOE

Source: Flyvbjerg and Rothengatter – Megaproject and Risk (2003)

Flyvbjerg et al. (2003) acknowledges deficiencies of key aspects of decision making which are left out through the adoption of the conventional approach and these are discussed below.

(i) Lack of stakeholder involvement

Flyvbjerg et al. (2003) state that stakeholder identification and involvement in the megaproject project decision making should be prioritized at an infancy phase of the project. Public dissatisfaction with projects may increase owing to the simple fact that stakeholders groups and public are under – informed and feel left out (Flyvbjerg et al., 2003).

This is vital due to the fact that most megaprojects are commissioned for the benefits of the public and public funds are used to finance such developments. Total ignorance of the

stakeholders as stated by Flyvbjerg et al. (2003) may induce public rejection of the megaprojects. When developing and appraising megaprojects, concerned groups should be allowed to play an active role in defining the major objectives and requirements to be taken into account in the technical, environmental and economic design of possible projects (Flyvbjerg et al., 2003)

(ii) Public Interest is disregarded

Public funds are often used to undertake megaprojects; therefore the public interest must be taken into account when decisions are taken. The Conventional approach disregards the importance of public interest and prioritizes technical solutions as asserted by Flyvbjerg (2003).

Flyvbjerg et al. (2003) calls for a planning process that is less concern with technical solutions and more concerned with the public requirements with respect to the economic performance, environmental sustainability and safety performance for the project. A scenario where public interest takes precedence to technical solutions would prove more beneficial than that the later.

(iii) The dominating role of the Government

As stated previously, megaprojects are inherently public projects, regardless of the funder. Flyvbjerg et al. (2003) state that the government often plays the role of the promoter and the guardian of public interest issues such as the protection of the environment, safety and of tax payer against unnecessary financial risks. Flyvbjerg et al (2003) argues that the government cannot effectively perform these two roles due to the inherent nature of the conflict of interest that exist.

2.8.4 Concession approach

One of the fundamental characteristics of the megaprojects is that they're inherently public project by virtue of the impact they have on the society. The basic assumption of the concession approach is that, if it should be decided to establish a specific piece of infrastructure, private companies would be required to bid for a concession to build, operate it for a given time, and a contract would be negotiated with a selected consortium covering financing, detailed design, construction and operations (Flyvbjerg et al, 2003).

The typical concession decision making process is depicted in Table 3.

Table 3: The Concession Approach to Project Development

Steps	Action	Responsibility
1.	Undertake policy study; publish policy document	Government
2.	Prepare terms of reference; and recruit consultants to draft performance specification	Government
3.	Prepare draft performance specifications based on government policy objectives, laws and regulations	Consultants
4.	Prepare terms of reference; recruit consultants to prepare feasibility study	Government
5.	Prepare terms of reference; recruit consultants to prepare plan for public involvement (public hearing, stakeholder group involvement, peer review, etc.)	Consultants
6.	Prepare pre-feasibility study; if study indicates an unfeasible project, process may stop here	Government
7.	Prepare Consultation Document 1, to be used for wide consultation with public and stakeholders	Consultants
8.	Consultation with public, stakeholders and regulatory bodies	Government
9.	Prepare terms of reference; recruit consultants to : propose regulatory regime; do further analysis of additional, associated costs; prepare risk management plan; and make proposals for operation, etc.	Government
10.	Prepare Consultation Documents 2 for wide consultation with public and stakeholders	Government
11.	Prepare Final Performance Specification Document	Government
12.	Prepare Decision Document to Identify: • Performance specification • Financing conditions for operation • Risk management • Mode of operation • Tender procedures, if relevant • Regulatory regime • Cost estimate and financing conditions for	Government

	additional associated costs	
13.	Develop necessary legislation and make decision in Parliament to Stop or go ahead with project	Government and Parliament
14.	If project is ratified, undertake pre-qualification of bidders	Government and Consultants
15.	Prepare Shortlist and ask for bids	Government and Consultants
16.	Evaluate bids, including acceptance from performance point of view; if no bids received, or bids fail to meet performance specifications and bidders not willing to modify their bids accordingly, the process stops here	Government and Regulatory Bodies
17.	Select Concessionaire, negotiate and sign preliminary agreement	Government and Consultants
18.	Prepare and Circulate Information Document; publication subject to review by Auditor-General ; at this point selected concessionaire can initiate final designs to obtain: i) Final permits from regulatory authorities ii) Bids from contractor	Government and Concessionaire
19.	Submit negotiated agreement for approval and signature by relevant authorities and concessionaire	Concessionaire and Government
20.	Prepare detailed design and obtain final clearance from environmental and safety authorities; if clearance not obtained the project may be terminated at this point	Concessionaire and Government
21.	Implement agreement	Concessionaire and Government
22.	Monitor and audit agreement	Concessionaire and Government

Source: Flyvberg and Rothengatter – Megaproject and Risk (2003)

2.8.5 The State Owned Enterprise approach (SOE)

According to Flyvbjerg et al. (2003), the State Owned Enterprise approach is by far the most comprehensive and less risky approach to implementation of megaprojects. This approach embraces the involvement and participation of the public, stakeholders in general and regulatory bodies from the early stages of the project.

Flyvbjerg et al (2003) warns however, that the SOE model can only succeed if the SOE is sufficiently capacitated with knowledgeable and accountable management. The SOE approach is outlined in Table 4 below.

Table 4: The State Owned Enterprise Approach to Project Development

Steps	Action	Responsibility
1.	Undertake policy study; publish policy document	Government
2.	Prepare terms of reference; and recruit consultants to draft performance specification	Government
3.	Prepare draft performance specifications based on government policy objectives, laws and regulations	Consultants
4.	Prepare terms of reference; recruit consultants to prepare feasibility study	Government
5.	Prepare terms of reference; recruit consultants to prepare plan for public involvement (public hearing, stakeholder group involvement, peer review, etc.)	Government
6.	Prepare pre-feasibility study; if study indicates an unfeasible project, process may stop here	Government
7.	Prepare Consultation Document 1, to be used for wide consultation with public and stakeholders	Government
8.	Consultation with public, stakeholders and regulatory bodies	Government
9.	Prepare terms of reference; recruit consultants to : propose regulatory regime; do further analysis of additional, associated costs; prepare risk management plan; and make proposals for operation, etc.	Government
10.	Prepare Consultation Documents 2 for wide consultation with public and stakeholders	Government
11.	Prepare Final Performance Specification Document	Government
12.	Prepare Decision Document to Identify: • Performance specification • Financing conditions for operation • Risk management • Mode of operation	Government

	• Tender procedures, if relevant • Regulatory regime • Cost estimate and financing conditions for additional associated costs	
13.	Develop necessary legislation and make decision in Parliament to Stop or go ahead with project	Government and Parliament
14.	If project is ratified, establish state-owned (SOE)	Government
15.	Identify financial performance requirements to be met by SOE, negotiate preliminary agreement for these requirements	Government
16.	Require SOE to negotiate preliminary agreement with potential financier; if agreement not reached, project may be terminated at this point	Government
17.	Prepare and Circulate Information Document; publication subject to review by Auditor -General	Government
18.	Submit agreement between government and SOE for ratification and signature by relevant authorities and SOE	Government
19.	Implement agreement	SOE
20.	Monitor and Audit agreement	Government

Source: Flyvbjerg and Rothengatter – Megaproject and Risk (2003)

Discussion of the various decisions making approaches

Flyvbjerg et al. (2003) propose two alternative models for ensuring accountability in megaproject decision making,

- One based on state-owned enterprise (SOE) approach to project development,
- The other on build-operates and transfers (BOT).

Flyvberg et al. (2003) further state that each of the alternatives should be considered carefully prior to being adopted. Flyvbjerg et al. (2003) further state that the both modes of megaproject delivery are detailed to the level of amongst other issues, stakeholder participation, environmental impact assessment and reporting procedure.

Flyvbjerg et al. (2003) argues that conventional approach gives rise to the following undesired consequences:

a. Capturing of the decision making process by lobby groups due to the following:

   - Limited public participation
   - Lack of transparency
   - Limited involvement of stakeholders
   - The decision on whether to proceed or not is often based on the private risk capital than the holistic approach

b. Ignorance of risks associated with the project due to the following:

   Decision makers tend to go with the notion that when the government is involved there is no need to be alarmed by risks because ultimately the taxpayers will cover the project costs (Flyvbjerg and Rothengatter, 2003).

c. Lack of clear performance criteria

   The decision making criterial should be clear and firm to avoid manipulation and confusion when final decisions are made (Flyvbjerg, 2003).

The alternative approaches on the other hand are more inclusive and pro-public interest. They are open to participation by various stakeholders, regulatory bodies and lobby groups. The projects decisions made on the basis of inclusivity and participatory approach are likely to win public support during implementation, public sympathy during the challenging projects times and to yield public satisfaction when completed successfully.

It is a tacitly understood fact that those who have vested individual or organizational interest in the development of the particular project are more likely to act irrationally and in a biased manner during the decision making process. This includes underestimating the risk and cost during the cost-benefit analyses as mentioned by Flyvbjerg et al. (2003).

Flyvbjerg et al. (2003) proposed that risk and accountability be much more centrally placed in megaproject decision making. We see good decision making as a question not only of better and more rational information, but also institutional arrangements that provide the checks and balances necessary to ensure accountability, especially accountability toward the substantial risks that we have shown exist in megaproject development (Flyvbjerg, 2003)

The interface between the project sponsor, the government and other stakeholders is vital for ensuring successful project implementation. Warrak (1993) suggest that megaprojects sponsors should seek to facilitate reliable, robust government decision-making processes. The acid-test is whether the will, policies, and implementation capabilities exist for positive decisions on potentially viable megaprojects (Warrak, 1993).

2.9 THE ENERGY PROJECTS - DECISION MAKING PROCESS IN THE SOUTH AFRICA

The Department of Energy is the custodian of Energy Security in South Africa. The modus operandi for the Department of Energy is informed primarily by the White Paper on Energy, 1998. The White paper on energy outlined the energy policy objectives which included:

- Increasing access to affordable energy services
- Improving energy governance
- Stimulating economic development
- Managing energy-related environmental health impacts
- Securing supply through diversity
- Energy policy priorities

The Department was established in terms of the National Energy Act, 2008 (Act No.34 of 2008) to ensure:

That diverse energy resource is available, in sustainable quantities and at affordable prices, to the South African economy in support of economic growth and poverty alleviation, taking into account environmental management requirements and interactions amongst economic sectors ; to provide for energy planning; increased generation consumption of renewable energies, contingent energy supply, holding of strategic energy feedstock and carriers, adequate investment in, appropriate upkeep and access to energy infrastructure; to provide measures for furnishing of certain data and information regarding energy demand; supply and generation, to establish an institution responsible for promotion of efficient generation and consumption of energy and energy research ; and to provide all matters connected therewith.

The National Energy Act, 2008 (Act No. 34, 2008) is primarily tasked with the formulation and implementation of effective energy policy. The realisation of the objectives set-out in the

said National Energy Act is under the stewardship of the Department of Energy (DOE). The objectives of the National Energy Act, 2008, are as follow:

- To ensure uninterrupted supply of energy to the republic;
- To promote diversity of supply of energy and its resources;
- To facilitate effective management of energy demand and its conservation;
- To promote energy research;
- To promote appropriate standards and specifications for equipment's, systems and processes used for producing , supplying and consuming energy;
- Ensure collection of data and information relating to energy supply, transportation and demand;
- To provide for optimal supply, transformation, transportation, storage and demand for energy that are planned, organized and implemented;
- To provide for Safety, Health and Environmental matters pertaining to energy;
- To facilitate energy access for improvement of the quality of life of the people of the Republic;
- To Commercialize energy-related technologies;
- To Ensure effective planning for energy supply, transportation and consumption; and
- To contribute to sustainable development of the South African economy

The Department of Energy is led through the ministry of energy and accounts to the Parliament of the Republic of South Africa. The Minister of Energy is appointed by the Head of State and forms part of the cabinet by virtue of ministerial appointment. The National Energy Act, 2008, dictates that the ministry of Energy formulates and promulgate the Integrated Energy Plan (IEP). NEA calls for formulation of a plan that deals with issues relating to the supply, transformation, transport, storage and demand for energy.

The IEP (2012) is used as a compass to ensure that the mandate of the Department of Energy to ensuring the security of energy supply is realized. The purpose of the IEP (2012) is to provide a roadmap of the future energy landscape for South Africa which guides future energy infrastructure investments and policy development (IEP, 2010). The National Energy Act requires the IEP (2012) to have a planning horizon of no less than 20 years.

The IEP is a continuously evolving plan as it takes into account the changing economic landscape of South Africa and the changes in energy consumption. The IEP (2012) uses the prevailing energy consumption in various sectors including the Industry, residential, agriculture, commence and transport as a basis forecast the future demand.

One of the objectives of the IEP is to attain the optimal mixed energy sources and technologies to meet those energy needs in the most cost-effective manner for each of the scenarios outlined in the IEP. The associated environmental impacts, socio-economic benefits and macroeconomic impacts are also analysed.

The National Energy Act identified the following eight objectives as the key objectives of the IEP (2012):

- Ensure Security Supply;
- Minimize the cost of energy;
- Promote the creation of jobs and localization;
- Minimize negative environmental impacts from the energy sector;
- Promote the conservation of water;
- Diversify supply sources and primary sources of energy;
- Promote energy efficiency in the economy; and
- Increase access to modern energy.

According to the IEP (2010), these objectives are a culmination of integrated government policies. The energy projects that are pursued are expected to be aligned to these objectives. The IEP guides the development of energy policies and where relevant set the framework for regulation in the energy sector (Ramuedzisi [Director in the DoE], 2016). Ramuedzisi (2016) further state that the IEP guides the selection of appropriate technology to meet the energy demand. It dictates what type and size of new Power Plant should be built (Ramuedzisi [Director in the DoE], 2016). The IEP serves as a guiding tool when decisions on energy investment projects and policy decisions are taken.

The DoE uses the Integrated Resource Plan (IRP) as a tool to commit on future electricity investments. The IRP is essentially the National Electricity Plan (DoE, 2017). The DoE (2017) state IRP is the sub-set of the IEP and that it guides the country's investment in electricity infrastructure. The DoE state that the primary objective of the IRP is to determine the long –term electricity demand and detail *how* this demand should be met in terms of the generating capacity, type, timing and cost.

The decision making process in relation to the energy security in South Africa is as outlined in Table 5 below.

Table 5: The SOE approach in relation SA

Steps	Action	Responsibility
1.	Undertake policy study; publish policy document	Government – IEP, IRP
2.	Prepare terms of reference; and recruit consultants to draft performance specification	Government
3.	Prepare draft performance specifications based on government policy objectives, laws and regulations	Government
4.	Prepare terms of reference; recruit consultants to prepare feasibility study	Government
5.	Prepare terms of reference; recruit consultants to prepare plan for public involvement (public hearing, stakeholder group involvement, peer review, etc.)	Government
6.	Prepare pre-feasibility study; if study indicates an unfeasible project, process may stop here	Government
7.	Prepare Consultation Document 1, to be used for wide consultation with public and stakeholders	Government
8.	Consultation with public, stakeholders and regulatory bodies	Government
9.	Prepare terms of reference; recruit consultants to : propose regulatory regime; do further analysis of additional, associated costs; prepare risk management plan; and make proposals for operation, etc.	Government
10.	Prepare Consultation Documents 2 for wide consultation with public and stakeholders	Government
11.	Prepare Final Performance Specification Document	Government
12.	Prepare Decision Document to Identify: • Performance specification • Financing conditions for operation • Risk management • Mode of operation	Government/SOE

	• Tender procedures • Regulatory regime • Cost estimate and financing conditions for additional associated costs	
13.	Develop necessary legislation and make decision in Parliament to Stop or go ahead with project	Government and Parliament/Cabinet
14.	If project is ratified, establish state-owned (SOE)	Government
15.	Identify financial performance requirements to be met by SOE, negotiate preliminary agreement for these requirements	Government
16.	Require SOE to negotiate preliminary agreement with potential financier; if agreement not reached, project may be terminated at this point	Government
17.	Prepare and Circulate Information Document; publication subject to review by Auditor -General	Government
18.	Submit agreement between government and SOE for ratification and signature by relevant authorities and SOE	Government
19.	Implement agreement	SOE
20.	Monitor and Audit agreement	Government

The process as outlined above depicts the process purportedly followed in the decision making processes on energy generation projects in South Africa, especially the energy projects. Flyvbjerg et al (2003) state that the involvement and participation of the communities in decision making processes of public projects discourages public revolt when projects are implemented and improves public sympathy when projects encounters difficulties.

In a nutshell, the decision making process on energy megaproject in South Africa is as follow (DoE, 2016):

- DoE conducts a detailed study of the prevailing state of energy security and makes informed projections on the future energy security threats and opportunities
- DoE drafts the IEP based on the available data and reasonable projections
- DoE presents the IEP to the Cabinet prior to publication

- Once approved by the Cabinet, the DoE publishes the draft IEP to enable public consultation
- Public Consultation process with the broader members of the public, experts, organized labour, civic society organization and organized business commences
- Once the public Consultation process has been concluded, the final IEP is drafted and published

This approach corroborates the approach recommended by Flyvbjerg et al (2013). It values public participation and transparency in decision making process on energy projects in South Africa. Contrary to the legislative process outlined above, Khatleli (2016) found that decision making in South Africa's infrastructure projects follows a "top down" approach and that it is often met with negative public kickback. Babatunde et al. (2014; cited in Khatleli; 2016) state that the decisionistic top down approach in decision making negates the established and functioning institutions of accountability.

In relation to recent energy projects, it must be noted that the policy direction purportedly relied on was the Integrated Energy Plan (IEP) promulgated in the year 2003. Also, one of the notable eventualities is that the spike in the demand for electricity witnessed and experienced in years 2005/ 2007 triggered an emergency type response from the government. This lead to the approval of projects such as Medupi, Kusile, Ingula, Sere Energy Wind farm, and others with limited or no public participation. Khatleli (2016) found rushed decision making, coupled with the neglect of the public participation always result unfavourable project outcome. The fact that the decision was rushed and that the process of public consultation was limited appears point partly to an event of risk negligence. Flyvbjerg et al. (2003) state that problem with megaprojects is one of risk-negligence and lack of accountability induced by project promoters whose main ambition is to build the project for private gain, economic or political, and not to operate project for public benefit.

2.10 KEY FACTORS INFLUENCING LEGITIMACY OF ENERGY MEGAPROJECTS

As established in the introductory section of this study, the custodians of legitimacy are most often the stakeholders of the concerned organization. Suchman (1995) explained that legitimacy flourishes on the basis of relationship between an entity and the affected stakeholders. Patel et al. (2005) emphasized that organizational legitimacy is controlled by those outside the organization and thus relies on the organization maintaining a union of loyal stakeholders who have legitimacy determining power.

It is tacitly understood that in the context of energy megaprojects, the state and end users and consumers of electricity would be the key stakeholders with fiduciary duties to maintain legitimacy. Destabilization of the relationship between these two key stakeholders may jeopardise the legitimacy of the organization. This section of the report discusses some factors that are pivotal to the legitimacy of energy megaprojects, measured against their effect to the end users in the main. Key to this are the capital cost of energy; the energy demand and consumption trends associated with the energy megaprojects; the cost of electricity; factors around localization; and benefits of locals to energy projects.

2.12.1 The Capital Cost of Energy Projects

The capital cost of any project forms the basis upon which financial feasibility and viability studies are conducted. The capital cost is a product of intensive planning and cost estimation. This is often conducted on the basis of the concept design. Once approved by financiers, the project proceeds to the phase of detailed design. The detailed design provides the project cost estimators with necessary information to provide detailed cost estimate prior to the execution of the project.

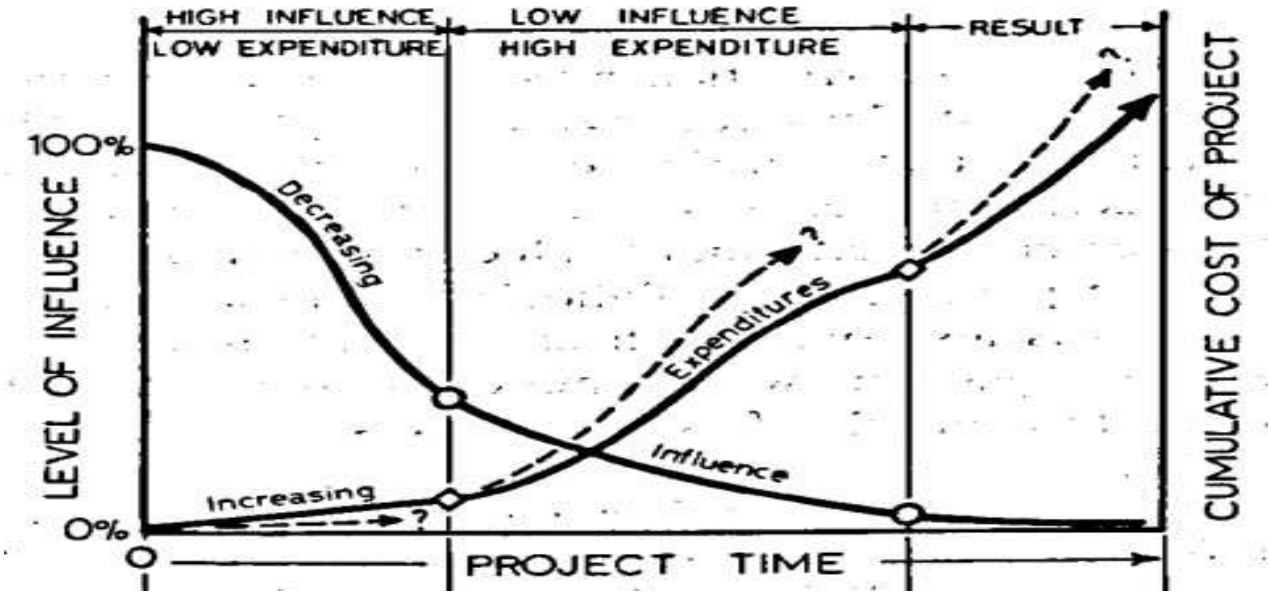
One of the conspicuously known facts introduced by Paulson (1976) is that project managers, planners, and designers' ability to influence the project outcomes without influencing the costs is greater at the infancy phase of the project. At the inception stage, the project technical requirements in terms of size, aesthetics and functionality can be altered with minimal impact to the costs.

Inaccurate cost estimates may prove disastrous to the delivery of the project, in the extreme cases it may lead to complete project failure. Siemiatycki (2016) state the following as the key technical factors that may lead to cost overrun:

- Prediction of future costs is plagued by uncertainty, poor forecasting methodologies, and inaccurate or incomplete data
- Commencement of the implementation phase of the project prior to the completion of the technical studies
- Scope creep
- Coordination challenges between designers and multiple contractors
- The use of "traditional" design-bid-build procurement model which according to Robinson (1987) and Naoum (1994) creates weak incentives for the firms to deliver projects within budget
- Weak risk identification and management
- Escalation in the cost of material, labour, equipment and plant
- Project delays as a result of strikes and contractor disputes
- Poor project reporting and performance monitoring

Failure to take into cognisant these and other projects risks at the early stages of the project may and often induces massive cost overrun. This eventuality is vividly depicted in the Paulson's curve (See Figure 8 below).

Figure 8: Paulson's Curve, 1997



Source: Designing to Reduce Construction Costs [Journal of the Construction Division – 1997

Based on the definition and the character of the megaprojects, it is understood that megaprojects are those projects worth a value in excess of US$1 Billion. The accuracy of the estimate is of paramount importance to raising the prospects of successful project

performance in terms of cost. The empirical determination of the capital cost of energy megaprojects is influenced by the technology adopted, the skills required to undertake the job, the location of the project, the strength of the currency of a particular country, the cost of skilled expatriates, the cost risk insurance, the cost of equipment and plant which are often custom made, the cost of material, fuel, labour related escalation. These are some of the factors that are considered when working out the capital cost of energy project.

The complexities of commissioning the energy plants differ from country to country and as a result, the cost estimate on one country cannot be used as a basis for an estimate in another country given these complexities. It is however vital to zoom into the international cost norms for energy plant per Megawatt.

The publication by the United States Department of energy shows that on average, the capital of energy plants excluding the financing costs are as depicted in Table 6.

Table 6: Comparison between Capital Costs of Energy Plants – US Department of Energy

Comparison of the Capital Costs of Energy Plants - US Department of Energy					
Technology	**Fuel**	**Capacity (MW)**	**Capital Cost R/MW '000**	**Capital Cost for 6 Units**	**Capital Cost/MW '000**
Ultra-Supercritical Coal	Coal	800	34 905 600.00	209 433 600.00	43 632
Onshore Wind (WN)	Wind	100	2 252 400.00	13 514 400.00	22 524
Pumped Storage*	Water	333	22 481 496.00	89 925 984.00	67 512

Source: The United States Department of Energy [Average exchange rate R 14/US$

One of the important considerations in relation to pumped storage scheme are the Civil costs in relation to the terrain, the costs of rechannelling water flow and the volume of water to be pumped. The key variables for considerations in relation to usage of these data for analysis is include the management cost, location and OEM country of origin.

2.12.2 The Consumption and cost of electricity in South Africa

Electricity has increasingly become one of the apex basic services provided by the local municipal authorities in South Africa (National Treasury, 2009). It is undoubtedly the lifeblood of the South Africa's Economy. Odhiamo (2009) asserts that an increase in the consumption of electricity propels economic growth and vice versa. This is corroborated by the analysis conducted by Deloitte (2017) wherein the GDP growth rate was compared to the

Eskom's sale of electricity. Deloitte (2017) shows that as the consumption of electricity increases, so is the country's GDP. Figure 15 adopted from Deloitte's report titled *"An Overview of electricity consumption and pricing in South Africa"*.

Figure 9: GDP vs. Electricity Sales (Adopted from Deloitte)



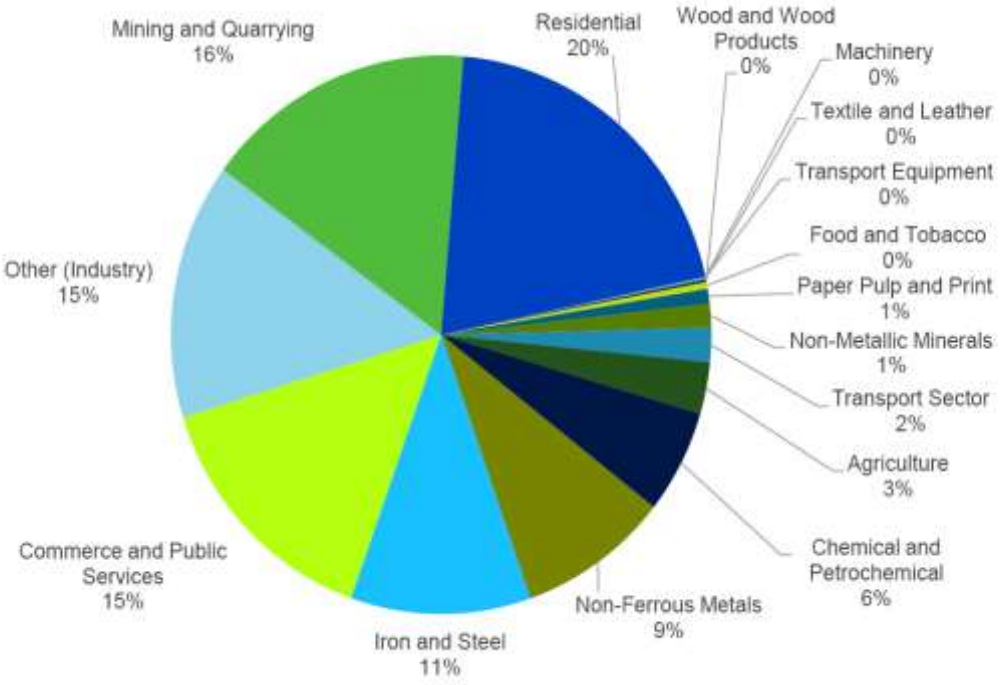
Source: Deloitte report "An overview of electricity consumption and pricing in South Africa"

Data compiled by the DoE on South Africa's national energy balances shows that mining and manufacturing are responsible for just under two-thirds of South Africa's total electricity consumption (62% in 2012) (Deloitte report titled " *An overview of electricity consumption in South Africa*, 2017). Deloitte (2017) further state that the remaining 28% of the electricity consumption is attributable to the households and services sectors.

The contrasting observation recorded in the Deloitte (2017) report is that while the mining and manufacturing sectors accounts to 62% of the total electricity consumption, the contribution to the country's GDP is approximately 30%. "..Mining sector's share of GDP declined from 20% in 1975 to just 8% in 2015, manufacturing sector fell from 16% to 14% of GDP over the same period (Deloitte, 2017).

The consumption of electricity by each economic sector is as depicted in figure 10.

Figure 10: Electricity consumption by sector



Sources: [Deloitte (2017) DoE, Aggregate Energy Balance, 2012]

Although the importance of electricity to South Africa's economic growth is conspicuously understood, the price has in recent years proven to be a thorn to electricity consumers in general. This is primarily as results of a consistent rise in the price per kilowatt hour contrast to the historically low electricity prices. National Treasury (2008) stated that the during the 1980's and 1990's, Eskom's tariff was steadily reduced in real terms, which means that electricity prices in South Africa has been historically lower in comparison to other countries and well below full economic cost. Deloitte (2017) state that between 1978 and 2004 the real average price of electricity fell by more than 40% from R 0.495c/KWh in 1978 to a low R 0.30c/KWh in 2004/5.

Deloitte (2017) asserts that the electricity price increases between the years 2008 to 2013 were induced by Eskom's need to raise capital so as to assist in financing the New Builds (Medupi, Kusile and Ingula projects). Electricity prices more than doubled in real terms (inflation – adjusted) rising by a cumulative 114% while nominal prices rose by 191% over the same period (Deloitte, 2017). One may on the basis of this revelation deduce that the average electricity increase per year for this period has been 38.2%.

These persistent, above inflation increases led to a series of protests and expression of dissatisfaction by the end users and consumers of electricity in recent years. Figure 11, shows one the protests against hikes in electricity tarrifs.

Figure 11: Protest Action against Electricity Tariff Hike – June 2017



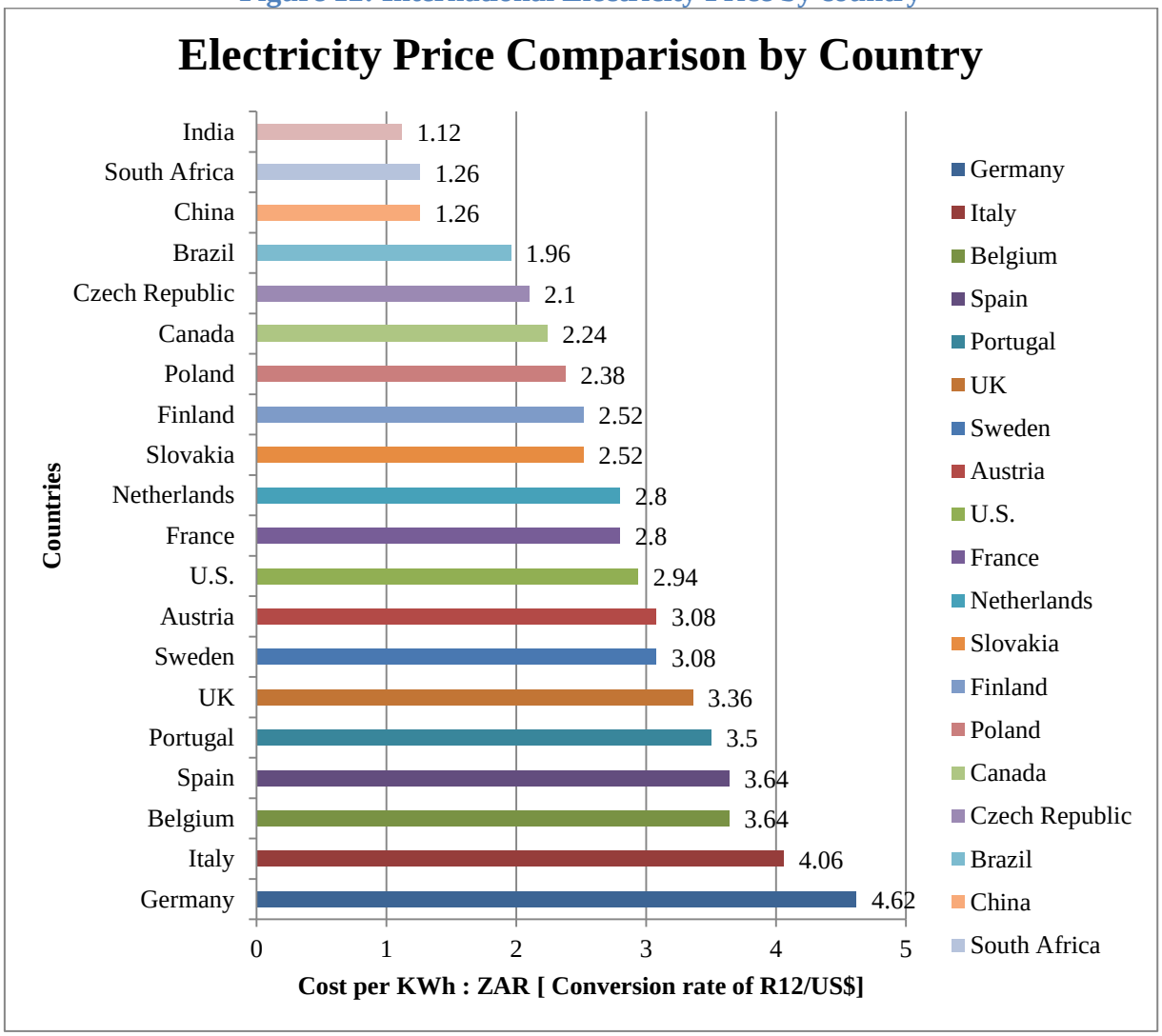
Source: Mark Wing adopted - https://publiceyemaritzburg.co.za/20172/electricity-price-increase-march

According to Deloitte (2017) report on *Electricity consumption and pricing in SA*, the aggressive increase in electricity prices was as a result of Eskom's Capital Investment programme, commonly known as New Build. The New Builds are predominantly energy megaprojects. Deloitte (2017) and the National Treasury (2008) reports on electricity suggest that the price of electricity increased so as to finance the energy megaprojects.

One of the objectives of the IEP is the minimization of the cost of energy. Assessment of the impact of the energy megaprojects thus far seems to be drifting away from the realization of this objective.

The analysis of international electricity price trends published by the World Energy Council (2018) shows that South Africa is amongst the countries with the cheaper electricity after India. Figure 12 below shows the prices of developing and developed countries.

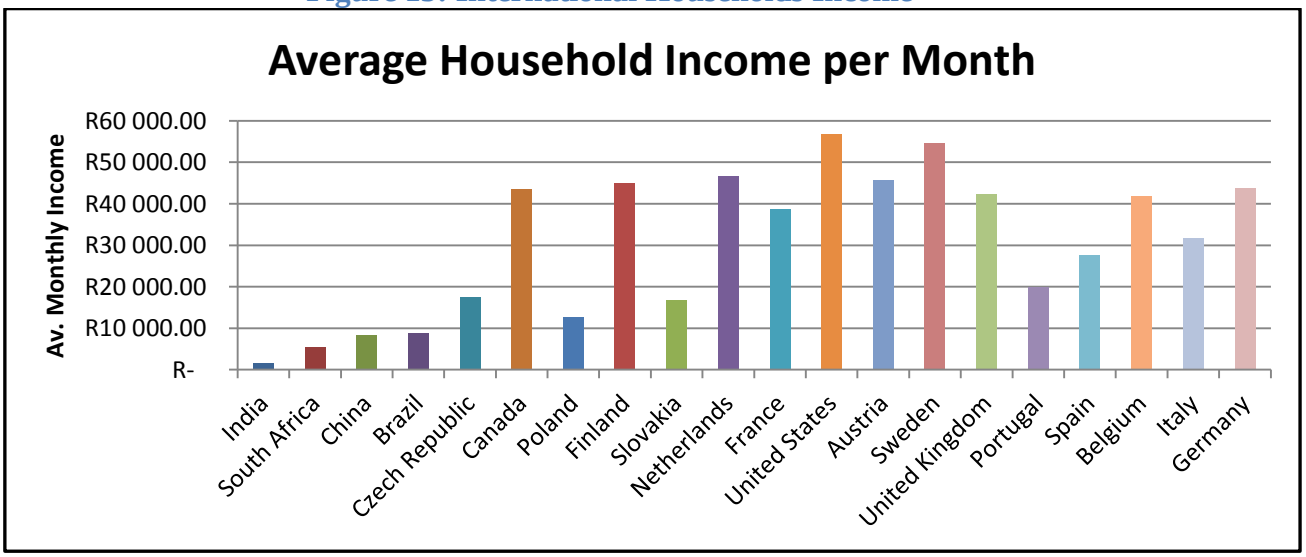
Figure 12: International Electricity Price by country



Source: World Energy Council 2018 https://www.statista.com/statistics/263492/electricity-prices-in-selected-countries/

It must be noted that although the price of electricity is lower in South Africa than it is in other developed countries, the socio-economic conditions differ greatly. The World Bank report on global house hold income depicts that the average household income in developed countries is relatively higher than that of developing countries. The average monthly household income in South Africa is R 5 496 and electricity price is R 1.26/KWh. In the United States of America, the average monthly household income is R 56 808 and the electricity price is R 2.94/KWh. Figure 13 below depicts a detailed breakdown of household income and selected countries internationally.

Figure 13: International Households Income

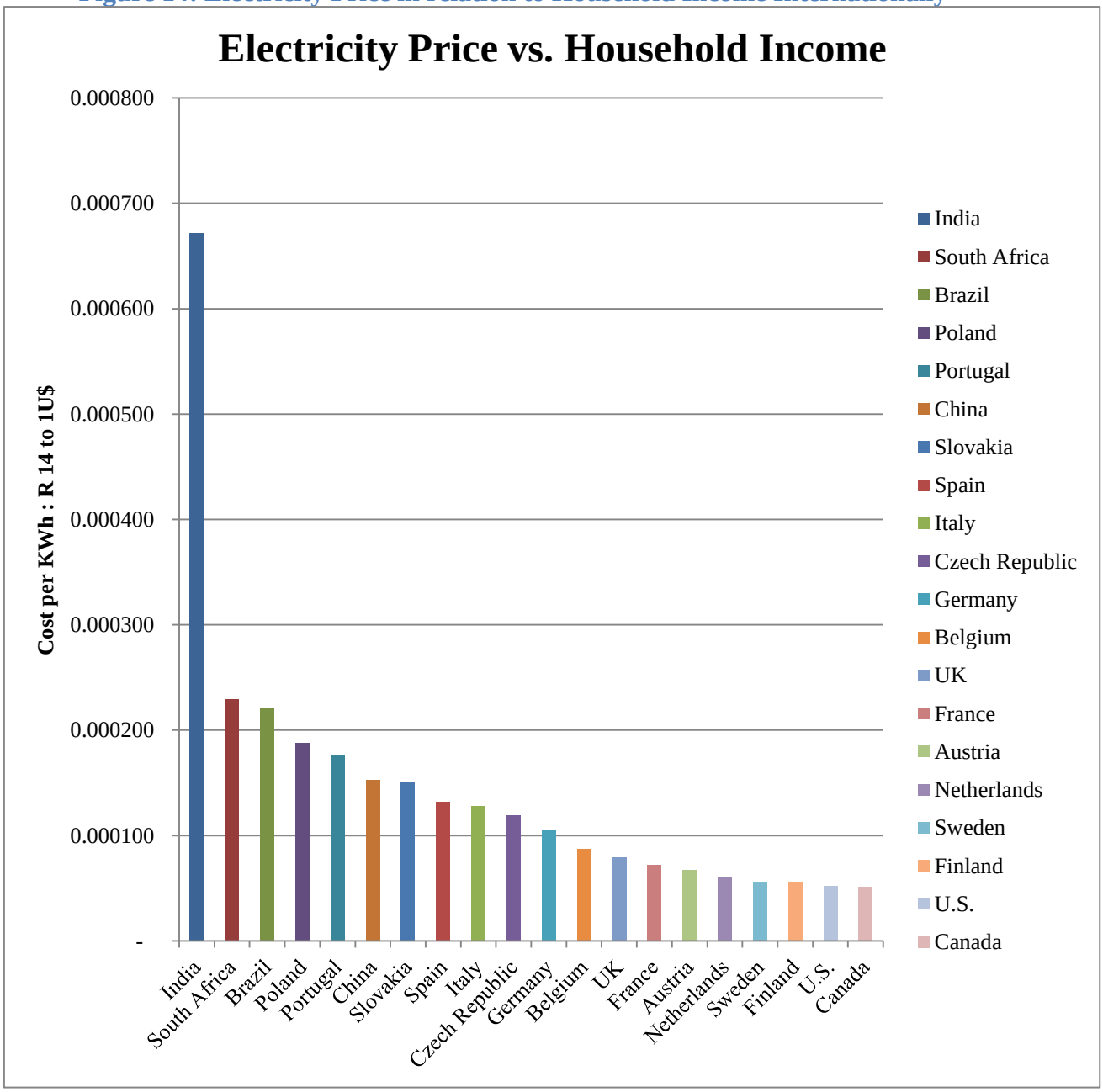


Source: World Bank 2017 [Re-arranged and graphically representation by the Researcher]

To enable valid and reliable comparison between the electricity costs in relation to the country's dynamics, the average cost of electricity is analysed in comparison to the average household income of a selected country. This measure will provide a fair basis upon which the cost of electricity and its economic impact to the country can be outlined and compared to other countries.

Figure 14 below, depicts this comparison vividly by representing the cost of electricity in relation to the household income. *If total household income was to be expended on electricity India would be the country with the most expensive electricity, followed by South Africa, Brazil, and Portugal.*

Figure 14: Electricity Price in relation to Household Income Internationally



Source: World Bank 2017 [The Graph populated by the researcher]

This detailed comparison shows that contrary to the perception by popular view that electricity in SA is inexpensive; the available data contradicts this assertion. On face value, the cost of electricity in SA looks economic in comparison to developed countries, however when social –economic factors such as the cost of living and household income etc. are factored in, this picture becomes changes.

2.12.3 Localization within the energy megaprojects in South Africa

Localisation involves the adaptation of any aspect of a product or service that is needed for a product to be sold or used in another market (Localisation Industry Standard Association, 2009). Deloitte (2015) state that localisation focuses on building capacity – in human capital growth, supply chain development and partnership with local businesses for talent and infrastructure development.

The Trade and Industry Minister of South Africa, Dr Rob Davies sees localisation as an important policy tool for industrial development in South Africa. Davies (2017) argues that if government decides to source products that are locally made, it will support the enterprises that are producing these products in our own economy, while creating and supporting jobs. This is supported by Deloitte (2015) in stating that localisation enables growth in communities in which companies operate while potentially increasing productivity and reducing long term costs.

Deloitte (2015) asserts that localisation does not necessarily refer to a portion of a local content on a product but rather the holistic participation of the local communities in the production, ownership and management of the product. It is more inclined to empowerment of the locals to limit dependency, increase production and ensure sustainability.

Deloitte (2015) argues that localisation is a strategy to:

- Improve the life hood of the local communities through involvement direct investment in wellbeing of communities
- Enhance participation of local firms to creation of products in a competitive manner.
- Up-skill the local workforce so as to improve the prospects of securing job opportunities in a sustainable manner.
- Empower the local communities to participate in the ownership and management of the businesses as opposed to relying on expatriates expertise
- Develop small enterprises so as to gain entry into the market

An Assessment of the current energy projects against the three relevant factors outlined by Deloitte pertaining to Localisation [i.e Socio – economic development, Local supplier development, and Skills development]:

- Socio – Economic development

  "*..As we embark on the Build Programme, we make sure that we contribute to the socio – economic upliftment of our communities* (Eskom Former Chairman – Zethembe Khoza, 2017).

  This statement was made after unveiling the two schools and a revamped clinic within the Marapong communities. Creamer (2017) state that the schools and a clinic created business for the local Small to Medium enterprises within the Lephalale area.
  According to the report titled, the Eskom Factor (2011), Eskom's investment to communities amounted R 62.3 Million. These revelations paint a picture of a caring organization with vested interest in the development and empowerment of the local communities.

- Local Supplier development

  In the instance cited above, the Schools and clinic were built by local Small to medium enterprises. It bears to testimony to the contribution of the organisation towards the development of the local suppliers.

- Skills development

  According to the Eskom Factor (2011), the two main contractors at Medupi have committed to train 1400 artisans and at least 60 engineers. This depicts the power utility as being committed to skills development and creation of employment.

Eskom (2011) states through the Eskom factor report that it is aggressively prioritizing localisation through its build programme to benefit the local communities and businesses. According to a report titled the Eskom Factor (2011), Medupi Power Station project has realised a localisation rate of 64% as of end of the year 2010.

According to Eskom (2008), the main contract packages amounting to R 33 billion were expected to spend a combined total of R 19.8 billion through localisation. Eskom endeavours to achieve an average of 60% localisation on its build programme.

There seems to be consensus by most stakeholders to the prioritization of localisation as the key to effectively reducing the unemployment rate and improving economic growth. One of

the key objectives of this study is to qualitatively establish the impact of localisation programmes adopted in the Eskom build programme to local businesses.

2.11 THE RESEARCH GAP

Lehrer and Laidley (2009) state that megaprojects are often based on the ideals of democratizing society and distributing a "fair share" of their benefits, such as, job security or housing. They represent the major achievements by collectives to influence the progress and direction of society and the mustering of collective strength to infuse major institutional change (Sőderlund, Sankaran and Biesenthal, 2017). Literature informs us that the envisaged prosperity through megaprojects is often accompanied by high risk of failing to meet the project objectives.

Literature further informs us that megaprojects are extremely risky and that at most, as established by Flyvbjerg et al (2014), only one out of one thousand megaprojects succeed in terms of meeting both the time and cost targets. Success in megaprojects management is typically defined as projects being delivered on budget, time and benefits (Flyvberg, 2014). Instances where megaprojects are portrayed as the causes of mega indebtedness; delays; budget overruns; and benefit shortfalls are ubiquitous in literature (Ibid.). IRN (2003; cited in Khatleli, 2016) suggest that some megaprojects are the cause of impoverishment for a number of people. Literature informs us that despite this, the demand for megaprojects keeps rising.

Flyvbjerg and Rothergatter (2003) state that megaprojects paradox consists of the irony that more and more megaprojects are built despite the poor performance record of many projects. The fact that megaprojects are consistently commissioned in light of the inherent risks and high probabilities of poor performance raises more questions than solutions, it ignites inquisitiveness. Flyvbjerg et al (2003) state that megaproject promoters are often happy to go ahead with high risk project as long as they themselves do not carry the risks involved and will not be held accountable when projects fails. Ansar et al (2017) state that upon analyzing the business cases submitted to the World Bank for funding, he noticed a trend that resembled the rationalization of pre-selected solution of megaproject than the rational assessment of alternative ways to solve a given problem (be it provision of water or electricity).

South Africa has commissioned at least five megaprojects over the past decade (Ibid.). These are Medupi; Ingula; & Kusile Power Stations in the energy sector and the Gauteng Freeway

Improvement Project (GFIP) & the Gautrain Rapid Rail Project in the transportation sector. The characteristics and performances of these projects have been extensively discussed in sections 2.6 and 2.7 of this report. The analysis of the performance of these projects, at least in terms of cost and schedule exhibits a gloomy trend of poor performance in conformity to the assertion by Flyvbjerg and Rothergatter (2003) that despite their poor performance, the demand for megaprojects keep rising. All these projects have exceeded their original budgets and literature suggests that those that are not yet completed are likely to exceed the baseline project durations.

The analysis of South Africa's fleet of energy plants promulgated by Eskom (2018) informs us that 92% of the total power generation in South Africa is generated through energy mega plants. Mega-plants are by definition the product of megaprojects. Eskom (2007) state that these fleets of power plants were commissioned before 1994, under the apartheid government. In 2007, Eskom (2008) announced that South Africa would commission three new additional mega -plants in the form of Medupi, Ingula and Kusile as the first power stations since the dawn of democracy. This revelation supports the notion that energy megaproject in South Africa are almost regarded as the default projects when decisions on energy projects are taken. Ansar et al. (2014) advises strongly against the investment in megaprojects by developing countries. Ansar et al (2014) state that developed countries, with a high per capita income are best suited to undertake megaproject than developing countries. Ansar et al (2014) state that energy megaprojects are susceptible to cost and schedule overruns. As stated previously, IR (2018) is of the view that megaprojects are capable of plunging countries into a spiral of international debt, which consequently lead to impoverishment and stagnation of basic infrastructure.

The assertion and advice by Ansar et al. (2014) is applicable to South Africa, as it is to other developing countries. Section 2.5 of this report, informs us that South Africa is a developing country and ranked number 119 out of 187 countries in terms of the United Nations human development index. There is strong evidence from literature to suggest that despite the conspicuously highlighted risk, cost overrun, schedule overrun, the resultant budget deficit, and possibility of impoverishment associated with megaprojects, South Africa's investment in these projects appears to be on an upward trajectory. There is also evidence that suggest that the impact of energy megaprojects has been relatively negative to consumers. Deloitte (2017) asserts that the electricity price increases between the years 2008 to 2013 were induced by Eskom's need to raise capital so as to assist in financing the New Builds (Medupi, Kusile and

Ingula projects). Electricity prices more than doubled in real terms (inflation – adjusted) rising by a cumulative 114% while nominal prices rose by 191% over the same period of 2008 - 2013 (Deloitte, 2017).

In light of the assertion by Flyvbjerg (2003) and Ansar (2017) that alternatives are ignored in favour megaprojects when decisions on megaprojects are taken. In light of the negative impact that these projects have on the consumers, exhibited by a sharp rise of 114% in the unit cost of electricity as reported by Deloitte (2017). In light of the inherent megaproject risks highlighted ubiquitously in literature, policymakers in South Africa, especially, in the energy sector appear to consistently opt for energy megaprojects when decisions on energy projects are taken. The legitimacy, viability and sustainability of this solution have not been properly interrogated. The study seeks to establish the legitimacy of opting for energy megaprojects as viable intervention to current energy challenges in South Africa.

2.12 SUMMARY

The literature introduced the characteristics of megaprojects in all sphere, covering risks and opportunities associated with megaprojects. It highlighted the performances of megaprojects in both developed and developing countries with a deliberate focus to the African continent. Literature review chapter further delved into the performance of megaprojects in South Africa including energy megaprojects. Furthermore, literature focused on factors that affects legitimacy of energy megaprojects in relation to the concept of legitimacy as introduced in section 1. 8.2. The aspects of literature considered pivotal to this study are discussed below.

Megaprojects in general

Flyvbjerg (2014) explained that megaproject have recently transformed into multi – trillion dollar business that affects all aspects of our lives, from electricity bill to how we shop, what we do on the internet to how we commute. Sachs (2006) explained that megaprojects are often chosen as solutions to societal problems, such as poverty alleviation, energy and water scarcity, or urbanisation. Flyvberg (2004) alluded to the fact that political; technological; economic; and aesthetic sublimes are prominent forces to the prevailing surge in demand for megaprojects internationally.

The rise to prominence of these projects is to a greater extent mysterious when their performances are analysed. Instances where megaprojects fail to meet the project objectives in

terms of time cost and benefits are ubiquitous in literature. The analysis of literature that contributed to the publication of the *"the top ten classics in megaprojects"* by Li et al. (2017) shows overwhelming evidence that megaprojects are susceptible to cost and schedule overrun. Flyvbjerg (2014) argued through the introduction of the theory of Iron law of megaproject that, only one in thousand megaproject become successful when cost, schedule and benefits are used as measure of success.

The performance trend of megaprojects, which is largely characterised by cost and schedule overrun, applies to both developed and developing countries. The Big Dig in Boston, Los Angeles Subway line, Denver International airport cited by Lehrer and Laidley (2009) are examples of the poor performance by megaprojects in developed countries. PwC (2014) explained that some of the megaprojects in Africa experienced delays of between 40% and 150% and budget overrun of over 10%. As a case in point, Ngacho and Das (2013, cited in Gbahabo and Ajuwon, 2017) explained that megaprojects in Kenya experienced cost overrun of 48% and 87% time overrun. The contemporary history of megaprojects in South Africa depicted a similar trend of cost and schedule overrun. The analysis of the GFIP and Gautrain Rapid Rail Link megaprojects shows that, the both projects failed to meet their cost and schedule targets.

In light of these poor performance trends, why do we notice the spike in demand for these projects? Flyvbjerg and Rothergatter (2003) noted and explained that megaprojects paradox consists of the irony that more and more megaprojects are built despite the poor performance record of many projects. Flyvbjerg et al. (2003) explained that megaproject promoters are often happy to go ahead with high risk project as long as they themselves do not carry the risks involved and will not be held accountable when projects fails. Ansar et al. (2017) argues that one of the key driving forces behind the exponential rise in demand for big solutions in the form of megaproject is the manner in which business cases are drafted and presented to multinational agencies providing funding for development. Ansar et al. (2017) state that business cases are drafted and presented with pre-selection of megaproject as solutions for the needed infrastructure. Flyvbjerg (1998) concurred with this observation and explained that decision making process on megaproject is often rationalization presented as rationality.

Ansar et al. (2014) advises strongly against the investment in megaprojects by developing countries. Ansar et al. (2014) explained that energy megaprojects are susceptible to cost and schedule overruns. Ansar et al. (2014) further asserted that developed countries, with a high per capita income are financially best suited to absorb the risks associated with megaprojects

than developing countries. IRN (2017) explained that megaprojects, if not executed correct, are capable of plunging countries into a spiral of international debt, which consequently lead to impoverishment and stagnation of basic infrastructure. South Africa is inherently a developing country according to the United Nations human development index (HDI, 2016), like all other developing countries, it is according to Ansar et al. (2014) not best suitable to undertake megaprojects due to its low per capita income.

Energy Megaprojects in SA

The choice of megaprojects as vehicle to deliver energy mega-plants appears to be standard in the South Africa's energy sector. This observation is informed by the fact revealed through the analysis of Eskom's fleet of Power plants, that 92% of the total power generation in South Africa is generated through energy mega plants. In addition, Eskom (2008) announced that that South Africa would commission three new additional mega-plants in the form of Medupi, Ingula and Kusile. The decision to commission new fleet of Power plants was to a large extent influenced by the surge in demand dating as far back as 2003. The analysis of the Eskom's audited financial statements between 2003 and 2007 depicts a consistent exponential rise in demand for electricity. Odhiamo (2009) explained that the rise in electricity consumption is directly proportional to the increase in economic growth. Khatleli (2016) state that energy megaprojects in the form of Medupi and Kusile were implemented to meet the struggling energy infrastructure that could not cope with the growing needs of the economy.
Decision making on energy projects in South Africa rests within the ambit of the Department of Energy (White Paper on Energy, 1998). The Department of Energy was established in terms of the National Energy Act (NEA), 2008 as amended (DoE, 2016). NEA dictates that DoE formulates and promulgate the Integrated Energy Plan (IEP) document to execute the mandate of the DoE (DoE, 2016). The purpose of the IEP is to provide a roadmap of the future energy landscape for SA which guides future infrastructure investment and policy development (IEP, 2010). The DoE uses the Integrated Resource Plan as a tool to commit on future electricity projects (DoE, 2016). The DoE (2017) explained that the IRP is the sub set of the IEP. The DoE further explained that the IRP is essentially the national energy plan.
The development of the IEP is according to NEA an inclusive process, which involves participation by variety of stakeholders with the general public as key stakeholders.

South Africa, through its energy policies, follows the State Owned Enterprise approach to decision making. Flyvberg et al. (2003) explained that, the SOE approach to decision making

is by far the most comprehensive and less risky approach to implementation of megaprojects. Flyvberg et al. (2003) stated that the SOE approach to decision making embraces the involvement and participation of the public, stakeholders in general and regulatory bodies from the early stages of the project. Although the NEA stresses the importance of public participation, it would appear that public participation in the implementation of Medupi, Kusile and Ingula projects was not prioritised. Eskom (2011), through the *Eskom Factor report*, state that there was no other alternative but to build Medupi in the megaproject fashion. Khatleli (2016) explained that the Medupi project was implemented hastily and not enough preparation was done to prepare for the organisational capacity and improve the technical know-how within the organisation.

The IEP is guided by eight key objectives which are pivotal to the investment in energy infrastructure. These objectives are explained in concept section of this study. They are of fundamental importance to legitimization of any investment in energy project in South Africa. Suchman (1995) explained that organisational legitimacy is a generalised perception or assumption that the actions of an entity are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions. Legitimacy is required to enhance stability (Suchman, 1995); ensure survival (D'Aunno and Zuckerman, 1987); and secure viability (Barnet, 1997) [Patel et al, 2005]. Patel et al (2005) further asserted that organizational legitimacy is controlled by those outside the organization and thus relies on the organization maintaining a union of loyal stakeholders who have legitimacy determining power. In the context of energy megaprojects being implemented in recent years in SA, legitimacy would be controlled by taxpayers, who are also financiers and consumers of electricity. Central to the relationship between the organization (*the State*) and the stakeholders (*the public*) are the IEP and IRP. One may deduce that realization of the objectives set out in the IEP ensures legitimacy of energy megaprojects and vice versa. As a case in point, Deloitte (2017) reports that electricity price increases between the years 2008 to 2013 were induced by Eskom's need to raise capital so as to assist in financing the New Builds (Medupi, Kusile and Ingula projects). These would impact on the question of legitimacy. As outlined in Chapter one, the objectives of this study centres on the question of legitimacy. This includes assessing the economic impact of energy megaprojects to consumers of electricity; job creation; skills development and localization.

Chapter three presents the research design for the study.

CHAPTER 3: RESEARCH, DESIGN & METHODOLOGY

The purpose of this chapter in the main is to outline the philosophical proclivity of this study, introduce the adopted research strategies, and introduce the research methods and data analysis techniques adopted.

3.1 Introduction to Research Methodology

Research is a systematic process of collecting, analyzing, and interpreting data in order to increase our understanding of a phenomenon about which we are interested or concerned (Leedy and Ormrod, 2010). Leedy (1989) defines it as a procedure by which we attempt to find systematically, and with the support of demonstrable fact, the answer to a question or the resolution of a problem. Hussey et al. (1997) concurs with these definitions to a greater extent by referring to research as an undertaking to enquire and investigate systematically and methodologically so as to increase knowledge.

The study is inherently exploratory by virtue of its endeavor to improve knowledge in the less chattered field of the megaprojects. Exploratory research tends to tackle new problems on which little or no previous research has been done (Brown, 2006). This study seeks to deepen and broaden the understanding in the phenomenon of megaprojects within the energy sector in South Africa. The study seeks to gain an understanding of the why these projects are preferred over other reasonably scaled and manageable alternatives. The study further seeks to achieve these through a systematic research strategy and methods discussed in this chapter.

This chapter comprises four sections. The first section introduces and locates the study into a philosophical stance. Secondly, the research methods are introduced. Thirdly, the research strategy and identified cases are introduced and described. The final section describes the data collection instruments and analysis framework. Furthermore, the validity, reliability and generalizability of the research results are described.

3.2 Research Philosophy

Saunders et al (2016) defines research philosophy as a system of belief and assumptions about the development of knowledge. This research questions what appears to be norm of

consistently opting for megaprojects in South Africa's energy sector; it states this practice as a problem due to its purportedly undesired outcome. It questions the legitimacy of the practice with a view of coming up with a solution to either ratify, improve or propose a change of course into the future. The study relied on variety of research methods to realize the set research objectives. This characteristic puts the study into a realm of pragmatism.

If a research problem does not suggest unambiguously that one particular type of knowledge or method should be adopted, this only confirms the pragmatist's view that is perfectly possible to work with different types of knowledge and methods (Saunders et al., 2016). Pragmatism strives to reconcile objectivism and subjectivism, facts and values, accurate and rigorous knowledge and different contextualized experience (Saunders et al., 2016). Creswell (1998) explains that in a quest to answer research questions, pragmatists employs multiple methods and focuses on practical implications of the research. Creswell (1998) further state that pragmatists emphasize the importance of conducting research that best addresses the research problem.

Saunders et al (2016) asserts that pragmatically driven research projects start with a problem, and aim to contribute practical solutions that informs future practice. Pragmatists assert that concepts are only relevant where they support action (Keleman and Rumens, 2008). Creswell et al. (2011) assert that choosing one position is often unrealistic in practice. This is supported by Saunders et al. (2016) and Creswell et al. (2011) who are of the view that pragmatists recognizes the existence of many different ways of interpreting the world and undertaking research, that no single point of view can ever give entire picture and that there may be multiple realities.

Although the study is exploratory per the title, it is to a greater extent pragmatically inclined. The study relies on both qualitative and quantitative methods to realize its objectives. The research methods are discussed in the succeeding section.

3.3 Research Method

The research methodology directs the whole endeavor: it controls the study, dictates how the data are required, arranges them into logical relationships, set up an approach for refining and synthesizing them, suggests a manner in which the meanings that lie below the surface of the data become manifest and finally yield one or more conclusions that lead to an expansion of

knowledge (Leedy and Ormrod, 2010). Leedy (1989) introduces the three broad research methodologies in the field of academic research as the: qualitative research; the quantitative research; and the Mixed - Method.

3.3.1 Qualitative Research

Qualitative research is an inquiry process of understanding based on distinct methodological tradition of inquiry that explores a social or human problem (Creswell, 1998). Denzil and Lincoln (1998) on the other hand define qualitative research as a research that stresses the socially constructed nature of reality; intimate relationship between the researcher and what is being studied, and the situational constraints that shape inquiry.

Leedy and Ormrod (2010) state that qualitative research focus on phenomenon that occurs in natural settings. It involves studying the phenomena in all their complexity (Leedy and Ormrod, 2010). The researcher builds a complex, holistic picture, analyzes words, reports detailed views of informants, and conducts the study in a natural setting (Creswell, 1998).

Leedy and Ormrod (2010) assert that qualitative researchers are mainly concerned with the complexity of the problem in its entirety. They recognize that the issue they are studying has many dimensions and layers, and so they try to portray the issue in its multi-faceted form (Leedy and Ormrod, 2010).

Leedy and Ormrod (2010) state the following as the advantages of the qualitative research:

- They can reveal the nature of certain situations, settings, processes, relationships, systems, or people
- They enable researchers to gain new insight about a particular phenomenon.
- They develop new concepts or theoretical perspectives about the phenomenon,
- They discover the problems that exist within the phenomenon
- They allow a researcher to test validity of certain assumptions, claims, theories, or generalizations within real-world contexts
- They provide a means through which a researcher can judge the effectiveness of particular policies, practices, innovation.

Leedy and Ormrod (2010) state that qualitative researchers often seek better understanding of complex situation and use their interpretative skills to create means from data; this meaning is then translated to form theory from the ground up.

3.3.2 Quantitative Research

Quantitative research is the research that involves identifying the characteristics of the observed phenomenon or exploring possible correlations among two or more phenomena (Leedy and Ormrod, 2010). Quantitative research is based on observations that are converted into discrete units that can be compared to other unit's statistical analysis (Maykut and Morehouse, 1994). This is supported by Saunders et al. (2016), who states that quantitative research, examines relationships between variables, which are measured numerically and analyzed using range of statistical and geographical technique.

A quantitative researcher attempts to fragment and delimit phenomena into measurable or common categories that can be applied to all of the subject or wider and similar situation (Winter, 2000). Leedy and Ormrod (2010) on the other hand state that quantitative researchers seek explanations and predictions that will generalize to other persons and places. The intent is to establish, confirm, or validate relationships and to develop generalizations that contribute to existing theories (Leedy and Ormrod, 2010).

Leedy and Ormrod (2010) state that quantitative researchers often choose method that allows for objective analysis of the data. Leedy and Ormrod (2010) further state that quantitative researchers are often detached from the research participants so that they can draw unbiased conclusions.

3.3.3 Mixed Methods research design

The mixed methods research is the branch of multiple methods research that combines the use of quantitative and qualitative data collection techniques and analytical procedure (Saunders et al., 2016). Tashakkori and Teddlie (1998) define mixed method studies as those that combine the qualitative and quantitative approaches into the research methodology of a single study or multiphased study. These definitions are supported by Morgan (2014) in defining the mixed method research as a research wherein both qualitative and quantitative methods are adopted. In relation to philosophical inclination, Saunders et al (2016) assert that both the qualitative and quantitative researches are valued and preferred by pragmatist researchers.

Literature informs us that the mixed method approach empowers the researcher to take multi-dimensional view in investigating the research problem. Saunders et al. (2016) argues that the usage of mixed methods designs in conducting research provides richer data than mono

method design and that they are shorter in timescale and practical to undertake. Mixed Methods research may use quantitative research and qualitative research equally or unequally (Creswell and Plano, 2011). Creswell (1995) introduced the following four mixed method designs, namely: Sequential studies; Parallel/Simultaneous studies; Equivalent status design; and dominant – less dominant studies.

The mixed method designs introduced by Creswell (1995) are differentiated below:

- *Equivalent Status designs*
  The researcher conducts the study using both the quantitative and the qualitative approaches about equally to understand the phenomenon under study (Creswell, 1995).
- *Sequential Studies*
  The researcher first conducts a qualitative phase of the study and then a quantitative phase, or vice versa (Creswell, 1995).
- *Parallel/ Simultaneous Studies*
  The researcher conducts the qualitative and quantitative phase at the same time (Creswell, 1995).
- *Dominant-less dominant studies*
  The researcher conducts the study within a single dominant paradigm with a small component of the overall study drawn from an alternative design (Creswell, 1995).

Creswell (1995) highlights the fact that the research methods that are mixed do not, on their own, suggest that they are being adopted and blended equally. The quest to realize the research objectives is pivotal to adapting a specific research design and methods.

The research design applicable to this study

Creswell (1998) is of the view that pragmatists emphasize the importance of conducting research that best addresses the research problem. In light of the qualitative, quantitative and mixed method strategies discussed above, the best fit method for meeting the research objectives of this study and addressing the research problem is the utilization of both qualitative and quantitative strategies.

Fellows and Liu (1997) is of the view that research methods are not mutually exclusive and that the application of both qualitative and quantitative methods for collection and analysis of data provides the researcher with multifaceted view of the phenomena and thus enhancing the researcher's ability to make reliable and relatively valid conclusions. This is further supported by Creswell (2008) in stating that the utilization of both qualitative and quantitative methods provides better understanding of the research problem and improves the prospects of reliability and validity of the research findings.

In light of the multidimensional data required, and a need for holistic view to problem solving, the mixed method – Dominant less dominant design is adopted as the best fit method. This enabled collection and analysis of data through both qualitative and quantitative means. Furthermore, both the subjective and objective factors to data collection and analysis were factored greatly in molding the findings of the study.

3.4 Research Strategy

Research strategy is a plan of how a researcher will go about answering the research question (Saunders et al., 2016). Denzil and Lincoln (2011) regard the research strategy as a link between the philosophy and subsequent choice of methods to collect and analyze data.

Saunders et al (2016) introduces eight research strategies which are commonly applicable to academic research projects. These are: Case study, Ethnography; Grounded Theory study; Content analysis; Survey Research; Narrative Inquiry; Experiment. Upon analysis of the characteristics of various research strategies, the cross sectional case study was identified and adopted as the best fit strategy for undertaking this study.

Case Study

Hussey et al. (1997) defines a case study as an extensive examination of a single instance of a phenomenon of interest. Yin (1994) defines a case study as an in-depth inquiry into a topic or phenomenon within its real – life setting. These definitions are supported by Leedy and Ormrod (2010) in stating that in a case study, program or event is studied in-depth for a defined period of time. Leedy and Ormrod (2010) further emphasize that a case study is suitable for learning more about a little known or poorly understood situation. A case study strategy has a capacity to generate insights from intensive and in-depth research into the study of phenomenon in its real-life context, leading to rich, empirical descriptions and the

development of theory (Dubois and Gaddle 2002; Eisenhardt and Graebner, 2007; Ridder et al, 2014; and Yin, 2014 cited in Saunders et al, 2016). '..Case study research draws on quantitative or qualitative research and frequently uses a mixed methods approach to understand fully the dynamics of the case (Saunders et al, 2016).

Leedy and Ormrod (2010) are of the view that case study may be conducted based on a single, multiple or collective cases. This is supported by Hussey et al. (1997) in stating that more than one case may be adopted so as to analyze the phenomenon in its entirety. Sometimes researchers focus on a single case, perhaps because its unique or exceptional qualities can promote understanding or inform practice for similar situation (Leedy and Ormrod, 2010). Leedy and Ormrod (2010) recognizes that in other instances, researchers study two or more cases – often cases that are different in certain key ways – to make comparisons, build theory, or propose generalizations. Leedy and Ormrod (2010) refers to these types of case studies as the *multiple* or *collective* case studies. This recognition is supported by Saunders et al. (2016) who affirms that case study can incorporate multiple cases. Leedy and Ormrod (2010) state that the major weaknesses of the case study research based on the single case is that the findings may not be generalizable to other situations..

Yin (1994) introduces three types of case studies, namely, the exploratory case study, descriptive case study and explanatory case studies. Yin (1984) argues that exploratory case studies are fundamentally adopted to explore any phenomenon in the data which serves as a point of interest to the researcher. Yin (1984) state that in most instances, exploratory case studies endeavors to address the questions of "what" or "who". Descriptive case studies are set to describe the natural phenomena which occur within data in question (Zainal, 2007).According to Yin (1984), the descriptive case study answers the questions of "how" or "why". The last type of case studies is the explanatory case study. Explanatory case studies examine the data closely both at a surface and deep in order to explain the phenomena in the data (Zainal, 2007).

Creswell (1995) argues that case study approach provides the researcher with multidimensional view of the phenomenon, thus ensuring the credibility and reliability of the research findings. Yin (1994) is of the view that multiple case design serve to confirm evidence which enhance the reliability and validity and generalization of the research findings. Yin (1994) argues that generalization on case study, be it single or multiple, stems from the theory rather than on populations. Camphell (1975 cited in Yin, 1994) state that

replication of the case through pattern-matching helps to formulate a theory which can be relied on to ensure validity of the multiple case studies.

Creswell (1995) acknowledges that the research work deploying the case study may have single or multiple cases. Creswell (1995) further state that a multiple case study strategy enables collection of both quantitative and qualitative in relation to the research phenomenon, thus ensuring the provision of rich and multidimensional views to resolving the research problem.

To answer the research questions, meet the objectives of the study and resolve the research problem, the multiple exploratory case study strategy has been adopted as the best fit strategy. This is primarily because of the exploratory nature of the study and limited literature in the phenomenon under the microscope, especially in the developing countries in general and South Africa in particular. Herriot & Firestone (1983 cited in Yin, 2009) argues that the evidence from multiple cases is often considered more compelling, and the overall study is therefore regarded as being more robust. Yin (1994) is of the opinion that researchers conducting case studies do not necessarily need to visit the site under study; but rather could collect their data by consulting secondary sources.

This strategy would ensure collection of rich data which would prove useful to use in conducting comparative analysis between various chosen cases. Data collection is conducted through questionnaires, survey and semi-structured interviews. The chosen cases are outlined in 3.1.5 below.

3.5 The Selection of sites

As the title explicitly state, the fundamental purpose of this study is to explore. The characteristics of the study identified thus far are that: it is guided by pragmatic philosophy; it relies on dominant – less dominant method to data collection and analysis; wherein the collection of data is largely inclined to qualitative method; it cross-sectional in nature as outlined in the succeeding section of this report. The study is strategically executed through a multiple - case study in the main. The cases where strategically chosen based on their potential to yield data that would enable comparative analysis in relation to the following key factors:

- Capital cost per megawatt;

- Training opportunities;
- Benefits of the local businesses vis-à-vis localization of equipment; and
- The economic impact of the project outcomes to end users of electricity.

The cases where further chosen as a result of their recency, accessibility, and availability of key information relating to the cases. The selected projects are those that commenced between 2005 and 2017 in conformity to the limitations of the study. These cases are as follow:

- The Medupi Power Station in Limpopo province, South Africa
- Ingula Pumped Storage Scheme in KwaZulu Natal, South Africa
- Sere Wind Fam Project in the Western Cape, South Africa

Data collected from these three energy projects have been analyzed empirically and qualitatively in a quest to resolve the research problem. The data has been analyzed using charts, graphs, theme analysis and other statistical methods to formulate valid and reliable answers to the research sub-questions.

The brief overview of the chosen cases is outlined below.

3.5.1 Medupi Power Station

Medupi Power Station (Medupi), as established in the preceding sections, is one of the projects commissioned through the government's energy generation "Build Programme" spearheaded by the state utility, Eskom. Medupi Power Station is a dry - cooled coal fired power station, located in the Waterberg region of Limpopo Province, South Africa (Eskom, 2008). When completed, the project will have six boiler units, each generating up to 800 Megawatts into the national grid. The estimated value of the Medupi Power Station is R 135 billion (Eskom, 2018). Medupi is by definition an energy megaproject.

The project plays a pivotal role as a source of primary data in this study. The data collection in relation to Medupi has been analyzed and interpreted so as to assist in achieving the research objectives and the resolution research sub-questions. The collection of data has largely been limited to the areas in close proximity to the project location, the Waterberg region in particular.

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3.5.2 Ingula Pumped Storage Scheme

Ingula Pumped Storage Scheme (Ingula) is a power station located on the boarder of KwaZulu-Natal and the Free State Provinces, South Africa. Ingula Power Station, as it is commonly known, consists of four units, each unit generates 333 Megawatts into the national grid (Eskom, 2011). The Estimated value of Ingula Power Station stood at R 36 billion as at November 2011 (Eskom, 2011). It is by definition a megaproject.

The project has been used as a basis upon which comparative data is collected. These data is analyzed quantitatively and qualitatively and the findings compared to other two projects, in the form of Medupi Power Station and the Sere Wind Farm project.

3.5.3 Sere Wind Farm Project

Sere Wind farm power project is a wind-farm located in the Western Cape Province, South Africa. According to Eskom (2013), the Sere Wind Farm generates 100 Megawatts to the national grid. For the purpose of this study, Sere Wind farm is regarded as the Small scale Power Station. The Estimated Value of the Sere Wind-farm is R 2.4 billion (Eskom, 2017). Contrary to Medupi and Ingula Power Stations, the Sere Wind-farm is not a megaproject.

Similar to Ingula Power Station, data collected through the in-depth analysis of the Sere Wind farm has been analyzed quantitatively and qualitatively and the findings compared to the megaprojects, in the form of Medupi Power Station and Ingula Project.

3.6 Data collection and Analysis methods

Data collection strategy included the semi- structured interviews targeting professionals and experts within the energy sector; questionnaire to the broader energy consumers in South Africa, and the questionnaire to the organised labour within the energy sector.

As stated previously, this study relied on the dominant-less dominant mixed method, which features in prominence, the qualitative aspects and part quantitative aspects to data collection and analysis. The meticulous collection of these data has been pivotal to ensuring the reliability of the findings. To achieve this, the following instruments have been adopted to ensure collection of credible data:

3.6.1 Interviews (Semi-structured)

Janesick (1998) describes an interview as a meeting of two persons to exchange information and ideas through questions and responses, resulting in communication and joint construction of meaning about a particular topic. Interviewing is the most rewarding component of any qualitative research (Janesick, 1998). Leedy and Ormrod (2010) affirms that interviews can yield great deal of useful information

Leedy and Ormrod (2010) state that interviews in qualitative studies are either open ended or semi-structured, in the latter case revolving around a few central questions. Saunders et al. (2016) defines semi-structured interviews as wide-ranging category of interview in which the interviewer commences with a set of interview themes but is prepared to vary the other in which questions are asked and to ask new questions in the context of the research situation. Leedy and Ormrod (2010) argue that unstructured interviews are flexible and likely to distort the ability of the researcher to make comparisons among the interviewees.

Due to the limitation of research in this field and its inherent outlook to explore, the semi-structured interviews were adopted. Participants were given space to engage and provide additional information on the subject of energy projects in general. These inputs ranged from comments on the decision making processes, the cost of energy, and the state of electricity generation and stability of supply in South Africa. This was carried out so as to maximize reliability of the collected data and to improve the quality and validity of the outcome.
The semi-structured interviews where pivotal to ensuring fulfilment of the following research objectives:

- The motivation behind undertaking the energy megaprojects in SA.
- The economic benefits derived by the local businesses through the implementation of the energy megaproject.
- The number economic benefits derived through job creation.

The participants to the conducted interviews are as follow:

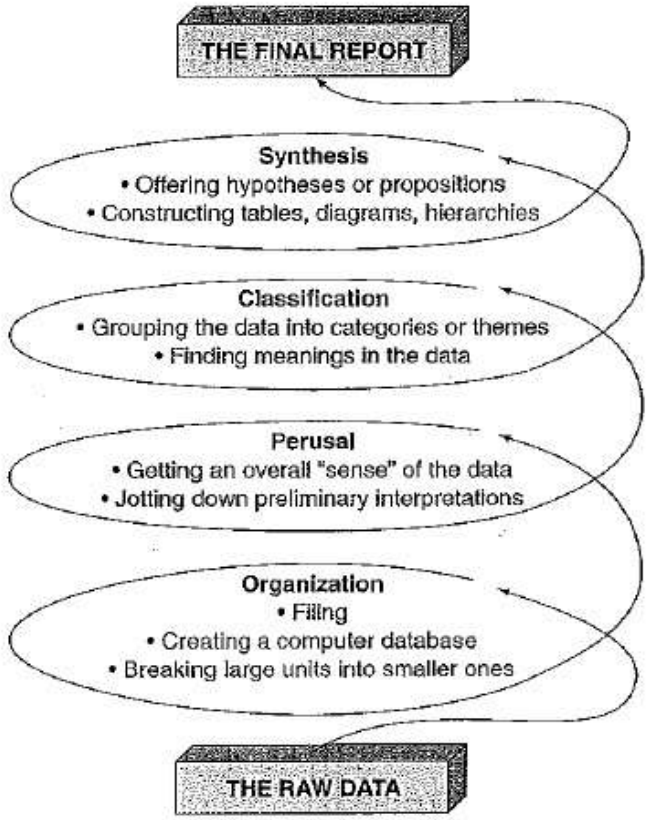
- Professionals at Medupi Project.
- Professionals who participated in the execution phase of Ingula Pumped Storage Projects.
- Professionals who participated in the execution phase of Sere Wind Farm Project.

These interviews were conducted to gain an in-depth understanding of the energy megaprojects phenomenon in South Africa and to examine the perceptions of professionals and experts towards these types of projects. The interviews specifically delved into the perceptions and opinions of energy experts and professionals in relation to the following:

- Capital costs invested in commissioning these project
- indicative monetary value expended in local goods through commissioning of these projects
- indicative number of local jobs created through commissioning of these projects
- The number of training opportunities created through commissioning of the energy projects
- Performance of the respective projects against the key objectives spelt-out in the IEP.

The analysis of data collected through these series of interviews was analysed qualitatively. To generate contributory meanings from the information obtained through the series of interviews, the content analysis technique was adopted. Saunders et al. (2016) defines it as an analytical technique that codes and categorises qualitative data in order to analyse them quantitatively. Creswell (1998) refers to this as a data analysis spiral technique. This technique is illustrated in figure 15.

Figure 15: Data Analysis Spiral (Creswell, 1998)



Source: Adapted from Leedy and Ormrod, 2010 "Practical Research: Planning and Design"

This technique has been adopted to ensure a reasonable derivation of meaning, through analysis of themes to aid in realising the research objectives.

3.6.2 Survey and Questionnaires

A survey involves acquiring information about one or more groups of people – perhaps about characteristics, opinions, attitudes, or previous experience – by asking them questions and tabulating their answers (Leedy and Ormord, 2010). Leedy and Ormord (2010) further state that the ultimate goal of a survey is to learn about a large population by studying a sample of that population.

Survey Sample

Welman and Kruger (1999) define a research sample as representative of the population, groups, and organizations. The population is the study object which may be individuals, groups, organizations, human products and events, or condition to which they are exposed (Welman and Kruger, 1999). Welman and Kruger (1999) state that the data collected from the sample of a population may be used to derive conclusions about the entire population or

group. McBurney and White (2004) introduce four types of survey samples as haphazard samples; purposive samples; convenience sample; and probability samples. These sampling types and application or lack thereof are differentiated below.

Haphazard Sampling

McBurney and White (2004) state that haphazard sample is a sample whereby the researcher has no control on who to use in collecting data. It involves haphazardly selected elements which may jeopardize the validity of the results and consequently, the quality of the study. The haphazard samples are almost worthless (McBurney and White, 2004). It is worth noting that, haphazard sampling has not been employed for collection of data in this study.

Purposive Sampling

The purposive sampling technique, also called judgement sampling, is deliberate choice of a participant due to the qualities the participants possesses (Etikan et al., 2016). McBurney and White (2004) regard it as a non-random sample selected for a particular reason. McBurney and White (2004) assert that purposive sampling can almost be considered to constitute a population. Etikan (2004) state that purposive sample involves selection of individuals that are well-informed with a phenomenon being investigated. Simply put, the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience (Bernard, 2002 cited in Etikan et al, 2016).

This purposive method has been particularly useful for collection of data from professionals within the energy sector. These are predominantly personnel that are registered as professionals with the councils under the ambit of the Built Environment Council. Furthermore, this sampling method was adopted in the collection of data from the representatives of the key union bargaining within the energy sector. It must be noted that not all, but main labour unions within the energy sector where selected for participation in this study. This method and the questionnaire thereof where adopted with an aim of probing the opinions and perceptions of the labour unions on matters concerning energy megaprojects. Key to these where:

- The impact of energy megaprojects on the promotion and advancement of job and training opportunities

- The effect of energy megaprojects to the promotion of localization of energy plant and equipment
- The economic impact of energy megaprojects to end users of electricity

Convenience Sampling

According to McBurney and White (2004) convenience sample is similar to purposive sampling in its selection of desirable group but differs in that it may not come close to sampling all of a population. It is effectively a non-random sample that is chosen for practical reasons (McBurney and White, 2004). The assumption associated with convenience with convenience sampling is that the members of the target population are homogeneous (Etikan et al, 2016). Etikan et al. (2016) further state that the main objective of the convenience sampling is to collect information from participants who are easily accessible to the researcher. This sampling type has been adopted together with purposive sampling to collect data from professionals within the energy sector.

Random Sampling

A selection is said to be random if every member of the population has the same probability of being selected and that selection of one individual is independent of the selection of any other (McBurney and White, 2004). McBurney and White (2004) introduces three main random samples in conducting surveys, namely: Simple random sample; stratified random sample and cluster sample. These techniques and their applicability in this study are discussed below.

Simple Random Sampling

Simple random sample is used when the researcher believe that the population is relatively homogenous with respect to the question of interest (McBurney and White, 2004). It is worth noting that Simple random sampling has not been used in this study.

Cluster Random Sampling

The last sampling method is the cluster sample. Cluster sample is a sample wherein a group is selected from a large population (McBurney and White, 2004). According to McBurney and

White (2004) this group should be a group out of many groups from a population. Barnett (2002 cited in Saunders et al. (2016) argues that Cluster sampling is similar to stratified sampling in that it the target population is divided into discrete groups prior to sampling. McBurney and White (2004) emphasize that this group has to be randomly selected for use in data collection. Although this sampling method resembles features that may be applicable to meet the requirements of this study, it was not adopted. Rather, the stratified sampling approach was found to be the best fit. This is discussed below.

Stratified Random Sampling

A stratified random sample is random sample in which two or more subsamples are represented according to some predetermined proportion, generally in the same proportion as they exist in the population (McBurney and White, 2004). McBurney and White (2004) further state that a population that has identified subgroups that are likely to differ markedly in their responses requires the use of stratified random sample to improve accuracy. Stratified random sample entirely fit the required sampling method for collection of data in this study.

This sampling method was adopted with an aim of sourcing rich, diverse, first hand data direct from the electricity consumers on matters relating to electricity security, cost and to probe their perceptions on the recent energy megaprojects being commissioned in South Africa. The survey is structured so as to assess the financial impact of these energy megaprojects have to consumers. The representative sample of the participants (Electricity consumers - in this instance) was drawn predominantly in Gauteng, Limpopo, Mpumalanga and the Western Cape provinces of South Africa. This is in conformity to the character of stratified random sampling.

A distinction has been made between the data collected from the Medupi, Ingula and Sere wind farm areas to limit the bias of opinions and distortion of the findings. This is informed by the tacit understating that the communities were the projects are executed have different views to those participants who do not reside in these areas. The minimum sample size was calculated based on Yamane's formula (Yamane, 1967).

$$n = \frac{N}{1 + Ne^2}$$

Wherein:

N – Is the population size

n – Sample Size

e – Margin of error

p – Standard Deviation

- The population size = 16 276 376 households consumers in SA (Stats. SA Census report, 2016)
- Margin of error = .10

The minimum sample size per the above formula is 100.

Notwithstanding this indicate quantity of elements, the study targeted at least 20 in each of the clusters, that is, in the province and online, adding up to a population of at least 120 participants. These samples were further categorized in terms of their location, proximity and association with various energy megaprojects. Medupi Power Station is located in the Limpopo province, Ingula Power Station is in the border of KwaZulu Natal, Sere Wind Farm is located in the Western Cape, Mpumalanga province is the home of Kusile power Station, and no megaproject is executed in Gauteng. The inclusion of participants from Gauteng province and those online is particularly significant to ensuring balanced outcome. The envisaged breakdown of the participants was as follow:

- Limpopo Province – 20
- Kwazulu Natal – 20
- Western Cape – 20
- Mpumalanga – 20
- Gauteng – 20
- On-Line – 20

The results of the surveys and questionnaires are presented in Chapter 4 of the study

3.6.3 Framework to Data Analysis

The collected data was qualitatively and quantitatively analyzed and the guideline outlined below used to form the basis of analysis. The opinions and perceptions of the participants were analyzed based on the set of questionnaire and the results were presented graphically to derive a generalized meaning.

Quantitative data analysis data has been collated and represented through the usage of *Microsoft excel* graphs and table to aid in interpreting the data.

The framework for analysis is as outlined below:

- Minimization of the cost of electricity will legitimize the investment in the energy megaprojects
- Creation of considerable number of jobs will point to legitimization of the investment into the energy megaprojects
- Promotion of localization will point to legitimization of the investment into the energy megaprojects
- The less expensive capital cost on energy mega-plants will point to the legitimacy of the investment into the energy megaproject.

The analysis of the data is presented in chapter four.

3.7 Time Horizon

There are broadly two time horizons in academic and business researches (Saunders et al, 2016). Saunders et al (2016) introduces these as cross –sectional and longitudinal time horizon.

Cross-sectional research is defined as the study of a particular phenomenon at a particular time (Saunders et al, 2016). These types of research projects are conducted within the constraints of time. This description is supported by Hussey (1997) in stating that cross-sectional studies are conducted when there are constraints of time or resources. According to Saunders et al (2016), the cross –sectional study may use qualitative, quantitative or mixed method approach to achieve the research objectives.

Longitudinal research is a study of a phenomenon over extended period of time (Saunders et al, 2016). The time is not necessarily a constraint in these types of studies. Saunders et al (2016) state that these study provides the researcher with a measure of control over some of the variables being studied.

As stated, the data may be analyzed both quantitatively and qualitatively.

The time horizon applicable to the study

One of the conspicuous constraints to this study is the availability of time. The study comprises comparison of three energy projects implemented in South Africa between the years 2005 and 2017. Two of these projects, are megaprojects. One of these is yet to be fully commissioned as of end of 2017.

This study is said to be inherently cross-sectional. It studied a phenomenon of energy megaprojects at a particular time, that is, between the years 2005 and 2017. The study is inherently exploratory; it seeks to gain an insight into the energy megaprojects phenomenon with a view of understanding its legitimacy at a particular time.

3.8 Validity, Reliability and Generalizability of the Findings

Quality concern play a central role throughout all steps of research process from the inception of the research question and data collection, to the analysis and presentation of research findings (Ali and Yosuf, 2011). Yin (2009) is of the view that quality of any research project relies on the validity, reliability and generalizability of the findings. McBurney and White (2004) assert that for a measurement to be of any use in science, it must pass both reliability and validity tests. Yin (2009) is of the view that the results of any research amount to nothing if not subjected to systematic logical test.

Yin (2009) introduces four commonly applicable tests in case studies, as validity, internal validity, external validity, and reliability. This study focuses on three of these tests, namely, construct validity, generalizability (external validity) and reliability. These test are discussed below

- *External Validity (Generalizability)*

  This test deals with the problem of knowing whether a study's findings are generalizable beyond the immediate case study (Yin, 2009). This test is applicable where the researcher attempts to apply the result of a particular study for formulation of the broader theory. In a quantitative study, generalizability generally depends on statistical procedures for drawing the sample of the survey respondents in a way that specifies the likelihood the sample represents the properties of the larger population (Morgan, 2014). Yin (2009) states that generalizability of the case study results stem

from the development of theory. The appropriately developed theory also is the level at which the generalization of the case study result will occur (Yin, 2009). Yin (2009) state an analytical generalization may be achieved in a qualitative research through analysis of multiple cases wherein the results of one case are compared to other cases. If two or more cases are shown to support the same theory, replication may be claimed (Yin, 2009). Yin (2009) asserts that this generalization of the results ensures generalizability of the findings.

- *Construct Validity*

Construct validity refers to the extent to which a set of questions actually measures the presence of the construct you intended them to measure (Saunders et al, 2016). McBurney and White (2004) is in concurrence with this in defining it as the property of test that the measurements actually measure the constructs they are designed to measure, but no others. Yin (2009) introduces the first test of construct validity as the use of multiple sources in a manner encouraging convergent lines of inquiry. Saunders et al (2016) state that convergence validity refer to a scenario where different scales are used to measure the same construct, the overlap or correlation between these scales. A second tactic is to establish a chain of evidence (Yin 2009).

In this study different questionnaires and interviews were conducted to resolve the research sub questions. The approach drafting these questionnaires was guided by the expectation to ensure validity.

- *Reliability*

Reliability refers to the property of consistency of a measurement that gives the same result on different occasion (McBurney and White, 2004). The objective is to be sure that, if a later investigator followed the same procedures as described by an earlier investigator and conducted the same case all over again, the later investigator should arrive at the same findings and conclusions (Yin, 2009). Saunders et al (2016) concurs that reliability refers to consistency of the results. This can, according to Yin (2009) be achieved with ease through case study protocol. Saunders et al (2016) state that one way of ensuring reliability within a questionnaire is through comparing responses to alternative forms of the same question or group of questions.

To ensure validity, reliability and generalizability this study has been conducted as described follow. Firstly as mentioned previously, the three cases are identified are Medupi Power Station, Ingula Power Station and Sere Wind Farm project. These projects have distinctly varied in terms of their scale, duration and project values. Medupi and Ingula Power Stations are by definition energy megaprojects whereas the Sere Energy Wind farm project is the ordinary small scale project. As stated previously, the study fundamentally comparing the outcomes of this projects in relation to:

- the economic impact of energy megaprojects to energy consumers in South Africa;
- the economic benefits derived from the implementation of the energy megaprojects vis-à-vis Localization of major equipment;
- the economic benefits derived from the implementation of the energy megaprojects vis-à-vis job creation; and
- the capital cost per megawatt

Survey questionnaire and interviews in the main has been extensively used to collect data with a fundamental aim of answering the research question. The participants to these studies are varied, this include professionals, end users of electricity and the tax payers in the productive sectors represented partly by labour unions.

The results of data obtained from these projects are analysed and compared so as to fulfil the aim of the study and resolve the research problem. These data herein is collected per the data collection methods described in the proceeding sections of this report. The analysis of the project characteristics and performance in relation to the above stated factors contributes to a formulation of common trends which in turn justifies generalizability of the findings of this study in relation to South Africa. Contrary to conversional case studies, one key character of this study is that the data collection and analysis in the three strategically selected cases takes place almost simultaneously and that the results are presented comparatively. In the absence comparative analysis of the data, the research problem would not be resolved.

3.9 Summary

Leedy and Ormrod (2010) defined research as a systematic process of collecting, analysing, and interpreting data in order to increase our understanding of a phenomenon about which we are interested or concerned. The research method adopted to undertake this study is the mixed method approach. This has largely been influenced by the quest to realize the research objectives. Tashakkori and Teddlie (1998) defined mixed method study as that which combines the qualitative and quantitative approaches into research methodology of single or mutiphased study. This study is more inclined to Dominant – less dominant mixed method design. Creswell (1995) defined the Dominant-less dominant mixed method as the study within a single dominant paradigm with a small component of the overall study drawn from an alternative design. The study has been largely qualitative, with quantitative elements.

The case study strategy has been adopted focusing of three cases in the form of Medupi, Ingula and the Sere energy Wind farm project. Medupi and Ingula Power Stations are inherently energy megaprojects by virtue of their project values and characteristics. The Sere Wind Farm project is an ordinary energy projects. Leedy and Ormrod (2010) explained that case study is suitable for learning more about a little known or poorly understood situation. The study is exploratory in its outlook; hence the case study was adopted. The adoption of three cases, ensures comparative analysis of the results, thus ensures generalizability, reliability and validity of the results.

The research methods adopted research methods are summarised as follow.

Table 7: Data Collection and Analysis Methods

Research Objectives	**Research Question**	**Method Adopted**	**Data Collection Instrument**	**Data Analyses Technique**
To investigate the motivation behind undertaking the energy megaprojects	What were the motivations behind undertaking energy megaproject in South Africa?	Qualitative Method	Interviews, primary data source documents	Content analysis. Analysis of Documents
To investigate the economic impact of energy Megaproject to energy consumers in South Africa.	What is the direct cost impact of energy megaproject to the South African energy consumers?	Quantitative Method	Survey to Electricity consumers and Energy professionals	Statistical Data Analysis based on a sample of the electricity users population and energy professionals
To investigate the economic benefits derived from the implementation of the energy megaproject vis-à-vis localization of major equipment	What economic benefit has local businesses derived out of the implementation of the energy megaproject in comparison to the foreign firms?	Qualitative Method/Quantitative	Survey, Interviews	Statistical and Content Analysis
To investigate the economic benefits derived from the implementation of the energy megaproject vis-à-vis Job creation	How many direct jobs have been created during the construction phase of the energy megaprojects?	Quantitative Method	Survey to Energy professionals	Statistical Data Analysis based on a sample

To conduct a comparative analysis of capital cost per megawatt between the power generation megaproject and the ordinary small – scale power generation projects	How does a capital cost per megawatt of megaproject power generation plant compare to that of the ordinary, small-scale power project?	Quantitative Method	Questionnaire to Energy professionals	Comparative Analysis based on a sample

The following chapter presents the data collected through the course of conducting the research and the interpretation thereof.

CHAPTER 4: RESEARCH DATA ANALYSIS AND FINDINGS

The purpose of this chapter is to analyze and present the results of the collected data. These include data collected through interviews and questionnaires. As stated previously, the participants include professionals within the energy sector, the end users and consumers of electricity and labour unions as representative of productive workforce in the society.

It is worth noting that the results have been integrated and presented in comparative fashion so as to assess and highlight the distinct characters between the three chosen cases which are: Medupi Power Station, Ingula Power Station and the Sere energy Wind Farm. Medupi and Ingula are inherently energy megaprojects by virtue of their project values and scale, the Sere energy Wind farm is an ordinary – small scale energy project.

4.1 The results of questionnaire directed at the professionals within the energy sector [Predominantly Medupi, Ingula and Sere Wind Farm Project]

4.1.1 The Approved Budget vs. Estimated Final Costs for Medupi, Ingula and Sere Wind [The Cost Performance Analysis]

To enable sensible project cost comparison, it is vital to rely on the conspicuously established project management technique, the earned value technique. Burke (2007) state that the earned value (EV) or the Budgeted cost of work performed (BCWP) is essentially a measure of the value of the work done. The Key Performance Index (KPI) commonly known as the Cost Performance Index (CPI) is more appropriate to assist in the analysis of the performance of the project costs. The CPI compares the work earned with the actual cost, if the CPI< 1 then the project is spending more than it is earning and will make a loss if corrective action is not taken (Burke, 2007). The CPI formula adopted from Burke (2007) is as follow:

Cost Performance Index (CPI) = Budgeted Cost of Work Performed (BCWP) / Actual Cost of Work Performed (ACWP)

This formula is adapted herein to assess the cost performances on the three projects at the centre of this study.

The CPI (Medupi) = BCWP/ACWP

= 78 600 000 000/ 135 000 000 000

= 0.58

**This is based on the assumption that R 135 billion will be the estimated Final Cost of Medupi.*

** The budgeted cost at completion (BAC) and Estimated Final cost (EFC) herein excludes the cost of capital, finance charges, interest and escalation during construction*

As stated, and in line with Burke (2007) interpretation, the CPI < 1 means the project is not successful against the budget. The CPI for Ingula and Sere Wind Farm projects are as depicted in Table 8 below.

Table 8: The Cost Performance Analysis

Costs Performance Analysis (CPA)				
Projects	**Budget**	**Estimated Final Value**	**End Variance**	**Cost Performance Index**
Medupi Energy Megaproject	R 78 600 000 000	R 135 000 000 000	R -56 400 000 000	0.58
Ingula Pumped Storage Plant	R 8 900 000 000	R 26 800 000 000	R -17 900 000 000	0.33
Sere Energy Wind Farm	R 2 400 000 000	R 2 689 000 000	R -289 000 000	0.89

Note: Original Budget values discussed in Chapter 3 have been used as baseline for analysis

It must be noted that CPI on the Sere Wind Farm project is 0.89. This according to Burke (2007), shows that the project slightly performed below the project budget. The project is 11% over budget. A better performance when compared to Medupi and Ingula megaproject.

Medupi show a cost overrun in excesses of 90% of the original project budget. Ingula pumped storage scheme equally depicts poor cost performance Index of 0.33. Like Medupi megaproject, Ingula megaproject exceeded the original project budget by an amount in excess of 300%.

The Sere Wind farm energy project display a better performance against the project budget compared to the two megaprojects in the form of Medupi and Ingula.

4.1.2 The overall number of jobs created through commissioning of Medupi, Ingula and Sere Wind Farm.

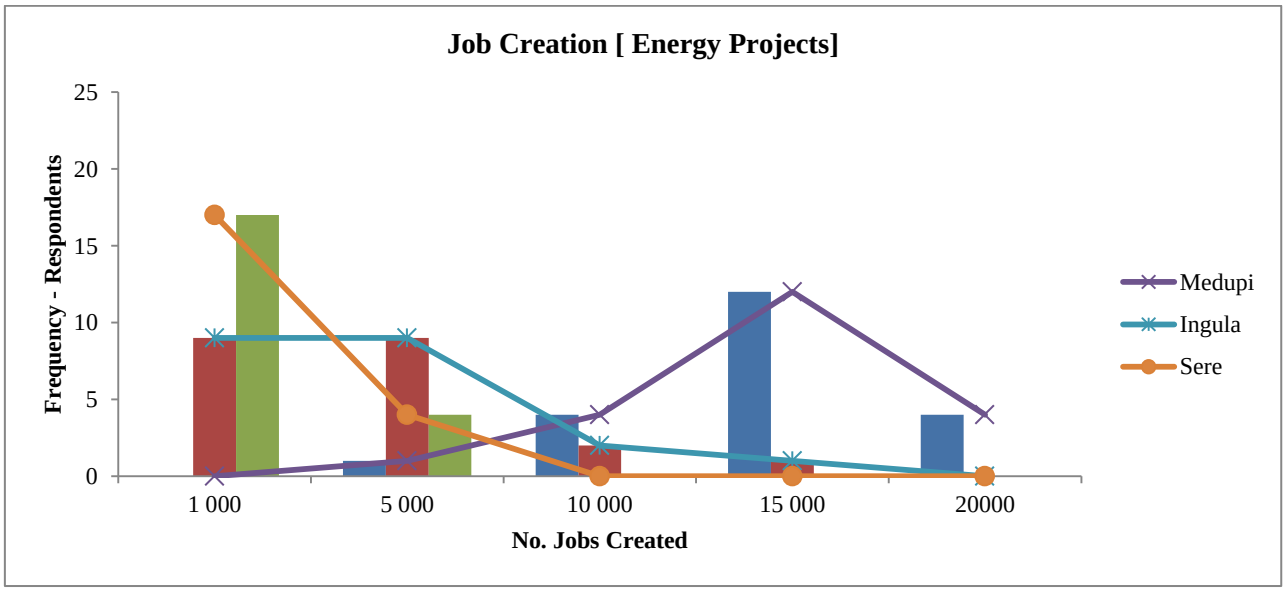
The respondents were asked to state the number of jobs created through the implementation of these projects. The given range was as follow:

- *500 – 1000; 1000 – 5000; 5 001 – 10 000 ;and 10 001 – 20 000*

For the purpose of data analysis, the highest number in the range was taken.

The notable outcome of this analysis is that the number of jobs created through the execution of the energy project is directly proportional to the project value. Medupi as a megaproject shows the highest number of jobs output, followed by Ingula pumped storage project as the project with the second highest value. Sere Wind Farm project created the least number of jobs in line with its value. These results are graphically represented in figures, 15.

Figure 16: Comparative Analysis of the number of Jobs Created per project



The analysis of the results shows that:

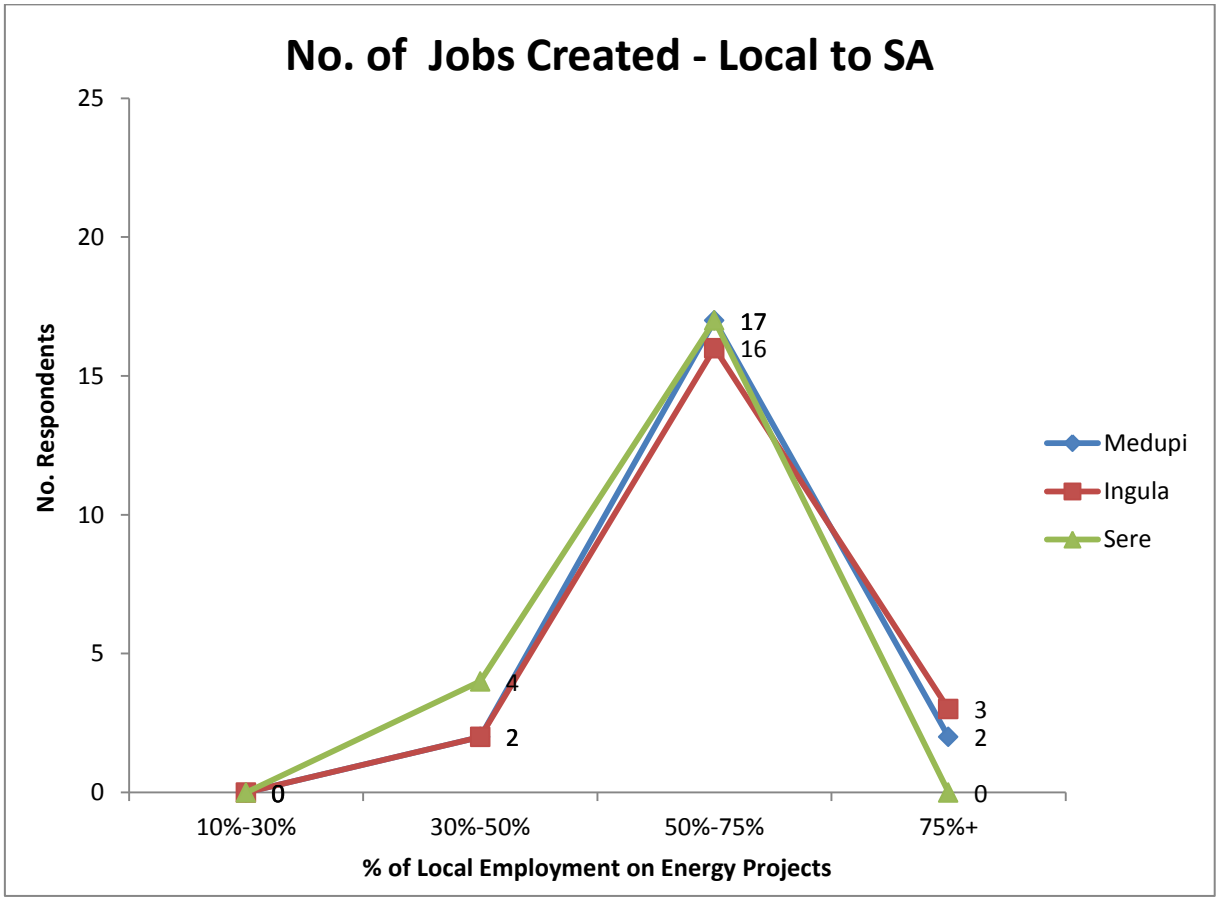
- At most, 15 000 jobs were created at the peak of Medupi Power Station
- An average of 5 000 jobs were created at Ingula Power Station
- Less than 5 00 jobs were created during the construction phase of the Sere Wind Farm

One of the notable facts from the analysis of the data in figure 15 above is that Medupi created the highest number of jobs when compared to Ingula and the Sere Wind Farm project.

An analysis of this performance in isolation, that is, all other things being equal, depicts an exceptional performance. However, as other factors such as Schedule performance and Cost performance are factored in, the picture may change.

4.1.3 The number of local people employed through these projects

Figure 17: Comparative analysis of the Jobs Created



As seen on figure 16 above, at least 75% of the respondents are of the view that at least 60% of the labour force on all energy projects is local to South Africa.

- 62% of the respondents are of the view at most 75% of the Sere work force is local to SA.
- 81% of the respondents are of the view at most 75% of the Medupi work force is local to SA.
- 81% of the respondents are of the view at most 75% of the Ingula work force is local to SA.

4.1.4 The value of the project values expended local to South Africa

Analysis of the results shows that reasonable effort has been made to maximise sourcing of material and services locally within South Africa. The results are depicted in table 8 below.

Table 9: Expenditure on Goods and Services Local to South Africa

Expenditure on Local Good & Services					
Projects	**Estimated Final Values '000**	**Local Expenditure [10% - 30%]**	**Local Expenditure [30%-50%]**	**Local Expenditure [50%-75%]**	**Local Expenditure [75%+]**
Medupi Energy Megaproject	**135 000 000**	**21%**	**29%**	**43%**	**7%**
Ingula Pumped Storage Plant	**26 800 000**	**14%**	**36%**	**29%**	**21%**
Sere Energy Wind Farm	**2 689 000**	**40%**	**40%**	**20%**	**0%**

The results as depicted in the table are narrated below:

Medupi Power Station megaproject

- 43% of the respondents are of the view that the expenditure on local goods and services at Medupi Power Station is over 50% of the contract value.
- 21% of the respondents are of the view that between 30% and 50% of the project values are expended local to South Africa
- Only 7% of the respondents are of the view that less than 30% of the project values are expended locally.

Ingula Power Station megaproject

- 45% of the respondents are of the view that the expenditure on local goods and services at Ingula Power Station is over 50% of the contract value.
- 29% of the respondents are of the view that between 30% and 50% of the project values are expended local to South Africa
- Only 7% of the respondents are of the view that less than 30% of the project values are expended locally

Sere Power Station project

- 20% of the respondents affirm the expenditure on local goods and services at Ingula Power Station to be over 50% of the contract value.
- 40% of the respondents are of the view that between 30% and 50% of the project values are expended local to South Africa
- The remaining 40% of the respondents are of the view that less than 30% of the project values are expended locally

4.1.5 The value of the contracts expended to local communities (Local to Site)

One of the benefits of construction projects in general is the creation of large number of temporary jobs and business opportunities for the locals. In this context, local refers to the communities within areas in close vicinity to the construction sites. The local communities referred to are those within the Waterberg district for Medupi project, Thabo Mofutsanyane and UThukela municipalities for Ingula project, and Matzikama district for the Sere Wind Farm. The benefits to locals are one of the key indicators of the effects of energy projects. This indicator will contribute to achieving the research objectives.

To this effect, the value of the project expended within the local communities is assessed and the results are tabulated below.

It is worth noting that in its 2012 report to the Portfolio Committee on Public Enterprises, as at July 2012, 47% of the "Build Programme" was committed to local content. It is worth noting that this data is reflected in this fashion due to accessibility to credible audited information, also because some of these projects are yet to be completed.

The data presented herein is the reflection of professionals who were involved in the implementation of these projects.

Table 10: Expenditure on Goods and Services Local to Site

Expenditure on Local Good & Services [Local to Site]					
Projects	**Estimated Final Values '000**	**Local Expenditure [0% - 5%]**	**Local Expenditure [5%-10%]**	**Local Expenditure [10%-20%]**	**Local Expenditure [20%+]**
Medupi Energy Megaproject	**135 000 000**	**50%**	**36%**	**14%**	**0%**
Ingula Pumped Storage Plant	**26 800 000**	**50%**	**29%**	**21%**	**0%**
Sere Energy Wind Farm	**2 689 000**	**60%**	**40%**	**0%**	**0%**

The Waterberg District [Medupi Power Station]

- 14% of the respondents are of the view that between 10% and 20% of the project values is expended within the Waterberg district, Limpopo Province.
- 36% of the respondents are of the view that between 5% and 10% of the project values is expended within the Waterberg district, Limpopo province
- As high as 50% of the respondents affirm the expenditure on local goods and services within the Waterberg region has been in the region of 5% of the project value.

Thabo Mofutsanyane / UThukela district Municipalities [Ingula Power Station]

- 21% of the respondents are of the view that the value in ranging from 10% to 20% is expended in the surrounding communities.
- 29% of the respondents are of the view that between 5% and 10% of the project value is expended through the procurement of goods and services within the communities surrounding the Ingula project,
- 50% of the respondents are of the view that as high as 5% of the project value is expended within the Thabo Mofutsanyana / Uthekela district Municipalities, in the KwaZulu Natal and the Free State province respectively.

Vredendal / Matzikama Municipality district [Sere Power Station]

- 40% of the respondents are of the view that between 5% and 10% of the project value is expended through the procurement of goods and services within the communities surrounding the Sere Farm project,
- As high as 60% of the respondents are of the view that at most, 5% of the project value is expended within the Vredendal / Matzikama Municipality district, in the Western Cape Province.

As seen above, the energy megaproject depicts a higher contribution to the local economies than the small scale project. A bigger piece of the expenditure pie is expended in areas other than those in the vicinity of the Sere Wind Farm project.

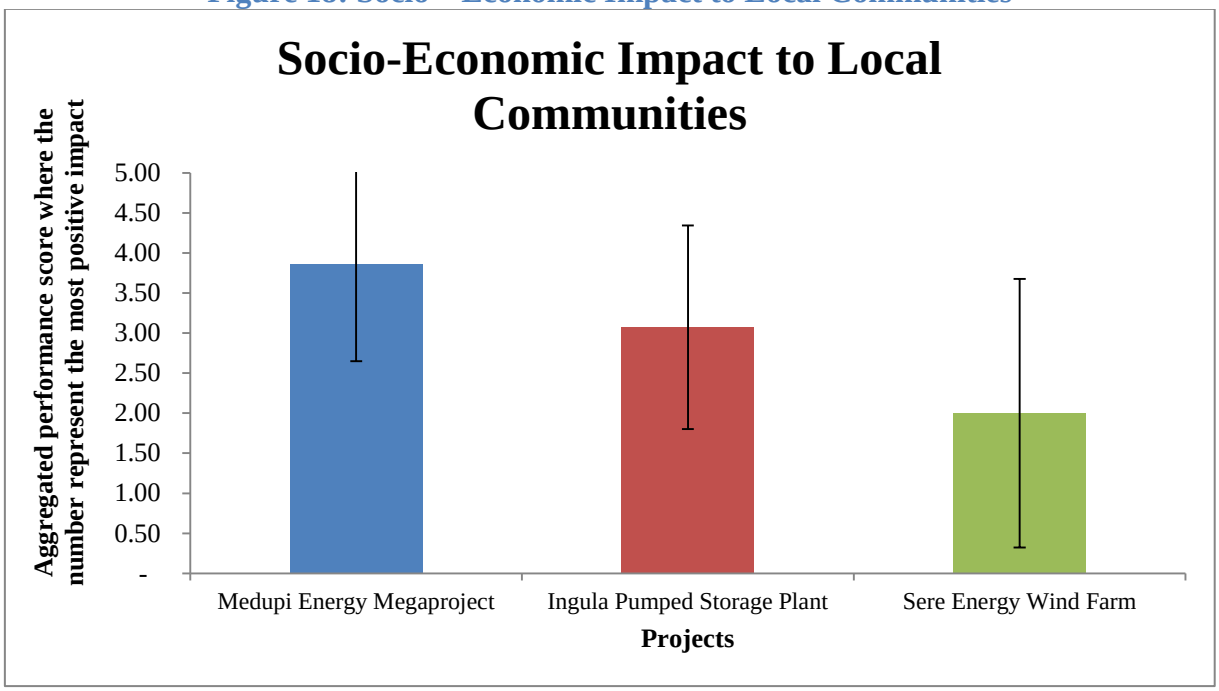
4.1.6 The Socio-economic impact of Medupi, Ingula and Sere energy projects

The participants were asked to rate the performances of these projects in relation to their impact to local communities. The adopted scale was as follow:

- *5 – Good , 3 – Neutral , and 1 – Poor*

Mean calculation of the various score is presented as follow.

Figure 18: Socio – Economic Impact to Local Communities



As depicted in the graph above, the Medupi project has had the greater positive impact to communities in close proximity to site than both Ingula and the Sere Wind Farm project. One may deduce based on the revelation of this result is that the higher the project in terms of value and complexity, the greater the positive impact to the immediate communities.

4.1.7 The number of people trained through the development of Medupi, Ingula and Sere Wind Farm

Table 11: Number of training opportunities Created

Trained Personnel				
Projects	**No. People Trained [3000 +]**	**No. People Trained [2000-3000]**	**No. People Trained [500 - 2000]**	**No. People Trained [0 - 500]**
Medupi energy megaproject	**21%**	**57%**	**14%**	**7%**
Ingula Pumped Storage Plant	**0%**	**21%**	**57%**	**21%**
Sere Energy Wind Farm	**0%**	**0%**	**30%**	**70%**

The energy megaprojects registered the highest number of training outputs in comparison to the ordinary small scale energy project in the form of the Sere energy Wind Farm.

The analysis of data shows that:

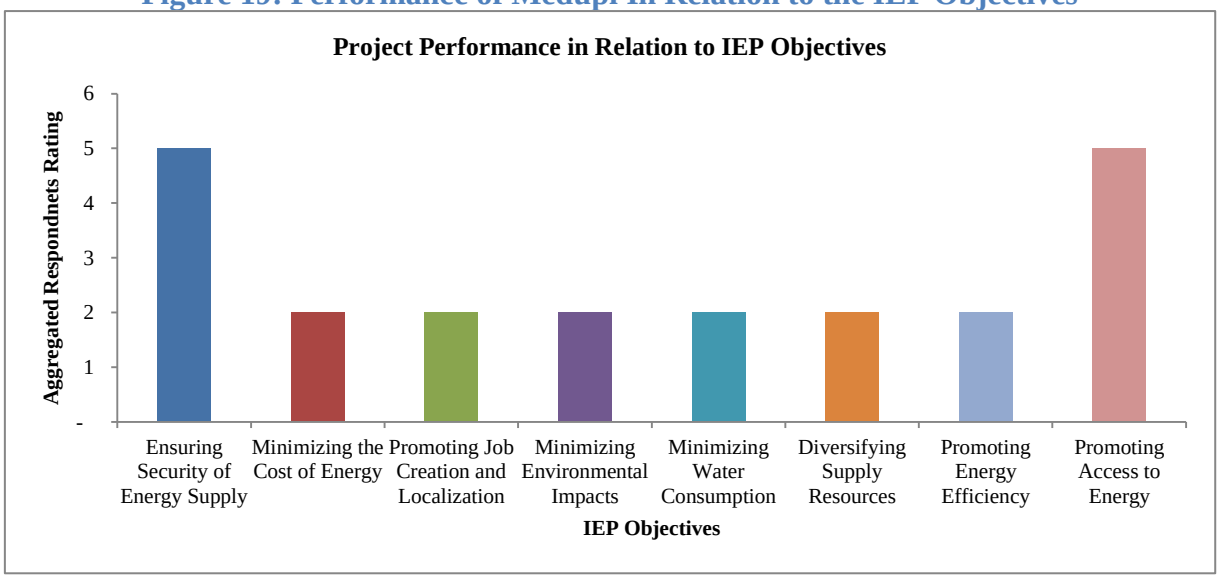
- At least 2000 people benefitted from the training opportunities presented through the Medupi energy megaproject
- Over 500 but less than 2000 people benefited from the training opportunities presented at Ingula energy project
- Less than 500 people benefitted from the training opportunities presented through the construction of the Sere energy Wind Farm

4.1.8 The performance of the energy projects in relation to meeting the objectives set-out in the IEP. The respondents were asked to rate the performances of the eight IEP objectives wherein 5 are the highest rating and 1 is the lowest.

The aggregated project specific performances are comparatively depicted in figures 19, 20 and 21 respectively. Figure 19 depicts the results for Medupi, figure 20 depicts results for Ingula and figure 21 depicts the Sere Wind Farm. The results are narrated as follow:

The Sere Wind Farm obtained the highest score in relation to meeting the objectives set out on the IEP.

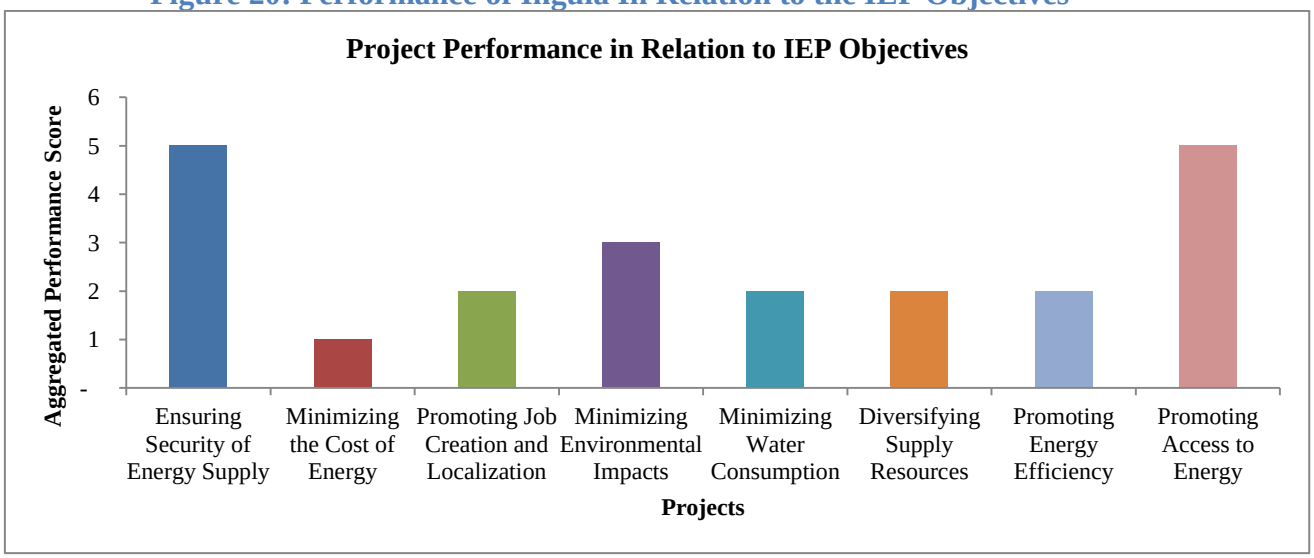
Figure 19: Performance of Medupi In Relation to the IEP Objectives



As seen on figure 19:

- Medupi contributed immensely to the promotion of energy supply
- Medupi projects performed relatively well in promoting of access to energy
- The rest of the objectives are set to poorly in relation to Ingula and the Sere Wind Farm

Figure 20: Performance of Ingula In Relation to the IEP Objectives

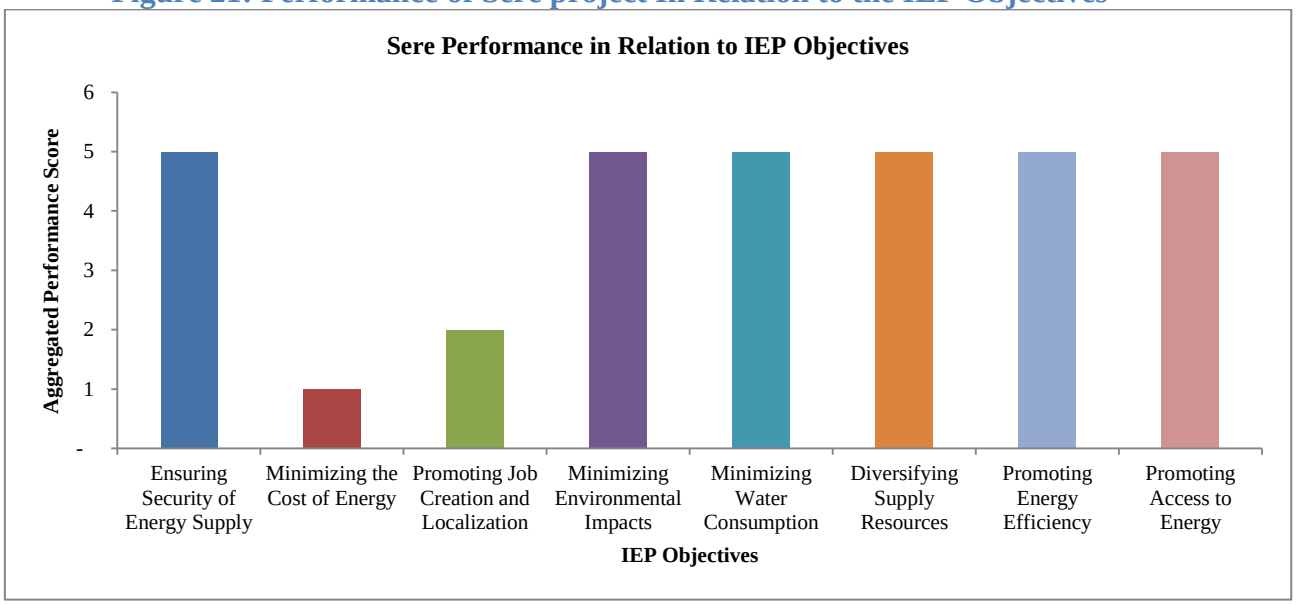


As seen on figure 20:

- Ingula contributed immensely to the promotion of energy supply. It fared an aggregated score of 5 out of 5

- Ingula projects performed relatively well in promoting of access to energy. It fared a score of 4.5 out of 5
- Ingula scored an aggregate of 1.2 out of 5 on minimizing the cost of energy
- Ingula scored an aggregate of 3 out of 5 on minimizing the environmental impacts
- Ingula scored an aggregate of 2 out of 5 on promoting job creation and localization, minimizing water consumption, diversifying the supply resources and promoting energy efficiency.

Figure 21: Performance of Sere project In Relation to the IEP Objectives



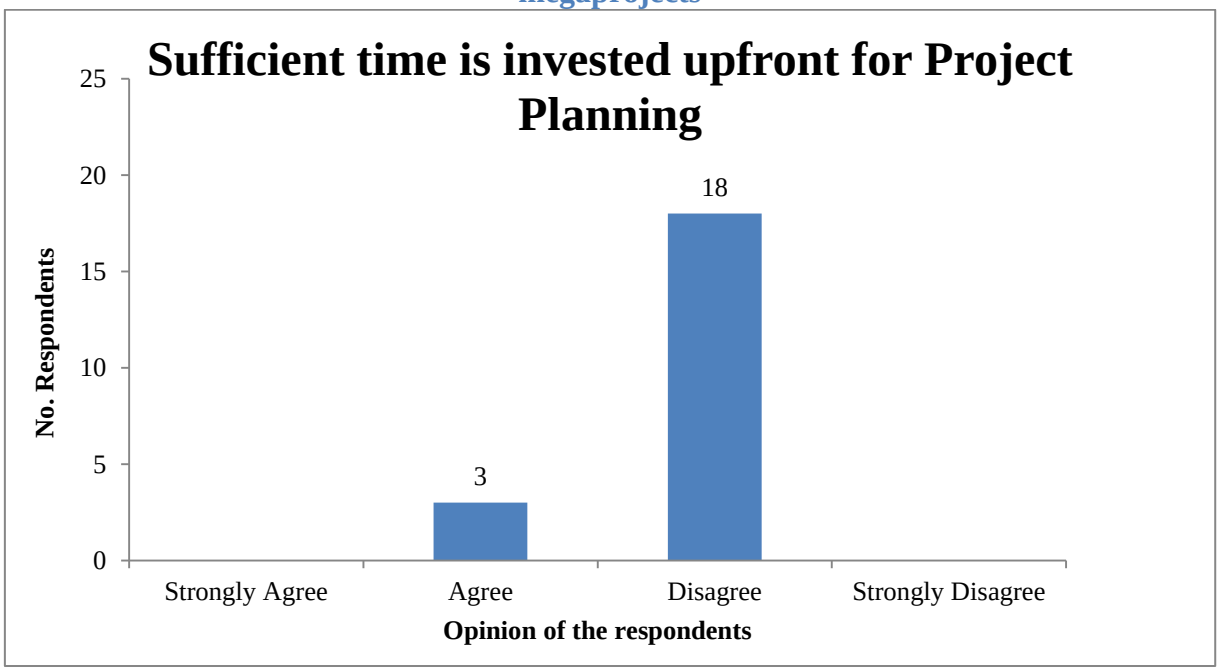
As seen on figure 21:

- Sere fared relatively well towards promoting access to energy with an aggregate score of 5 out of 5
- The project fared 5 in the promotion of energy efficiency, diversification of supply resources; and minimization of water consumption.
- Sere scored an aggregate of 1 out of 5 on minimizing the cost of energy

The analysis of the results in totality shows that an energy megaproject lacks the propensity to realize and promote the objectives of the Integrated Energy Plan.

4.1.9 Is sufficient time invested in planning and designing of the energy megaprojects prior to implementation?

Figure 62: The perceptions of professionals on upfront planning for energy megaprojects



An overwhelming 87% of the respondents are of the opinion that sufficient time is not invested in conception and planning phases of the energy megaprojects. Only 13% of the respondents are of the opinion that sufficient time is granted during the inception to pre-execution phase of the energy megaprojects.

4.1.10 Are Medupi, Ingula and Sere Wind Farm energy projects successful projects?

Table 12: Success Rating of the Energy Projects

Success Rating of the Projects [Opinion of the Professionals]		
Projects	**YES**	**NO**
Medupi Energy Megaproject	**33%**	**67%**
Ingula Pumped Storage Plant	**33%**	**67%**
Sere Energy Wind Farm	**100%**	**0%**

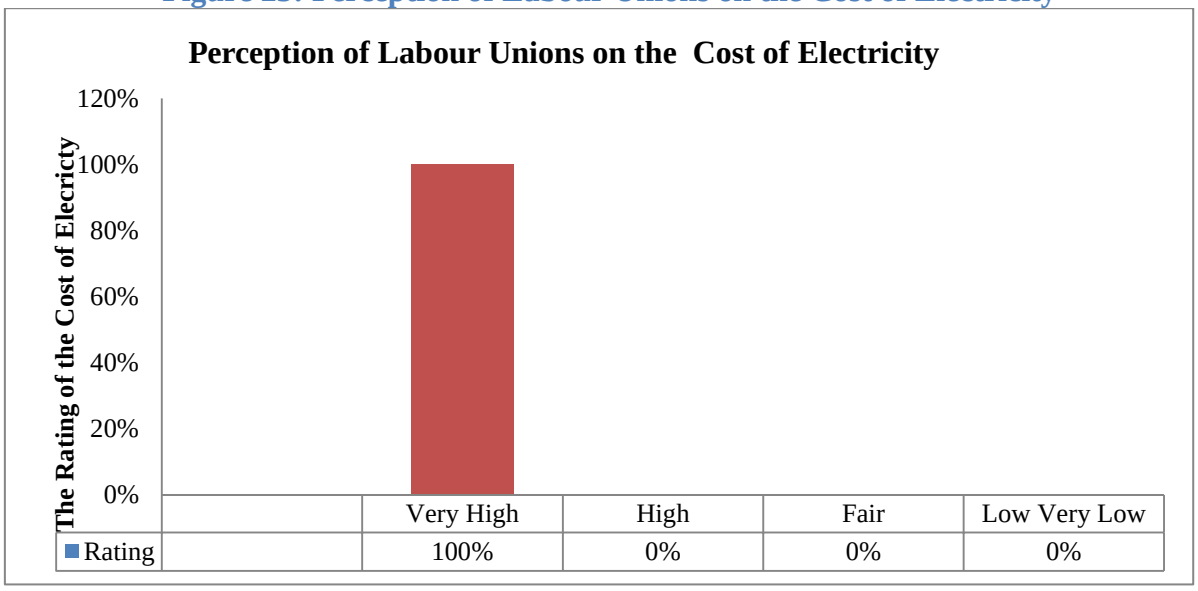
In the opinion of the respondents, Medupi and Ingula are not successful projects. The analysis of the detailed data shows that both projects failed to meet the cost performance and that the envisaged benefits to end users where delayed.

Sere Energy Wind Farm on the other hand is regarded as a successful project by the respondents. The project is said to have performed fairly on its budget. The project also met its schedule and the benefits to consumers, financiers and users where delivered timeously.

4.2 The results of questionnaire directed the labour unions

4.2.1 The rating of the cost of electricity in South Africa.

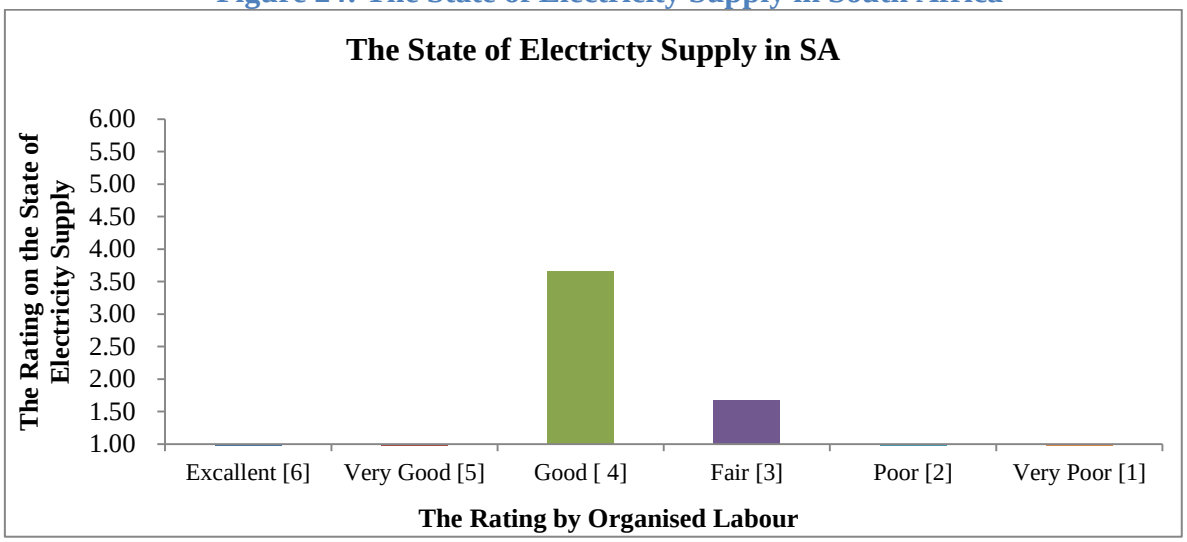
Figure 23: Perception of Labour Unions on the Cost of Electricity



The perception of the labour unions organizing within the energy sector is that the cost of electricity is very high. As high as 100% of the respondents are of the opinion that electricity cost is very high.

4.2.2 The state of electricity supply in South Africa.

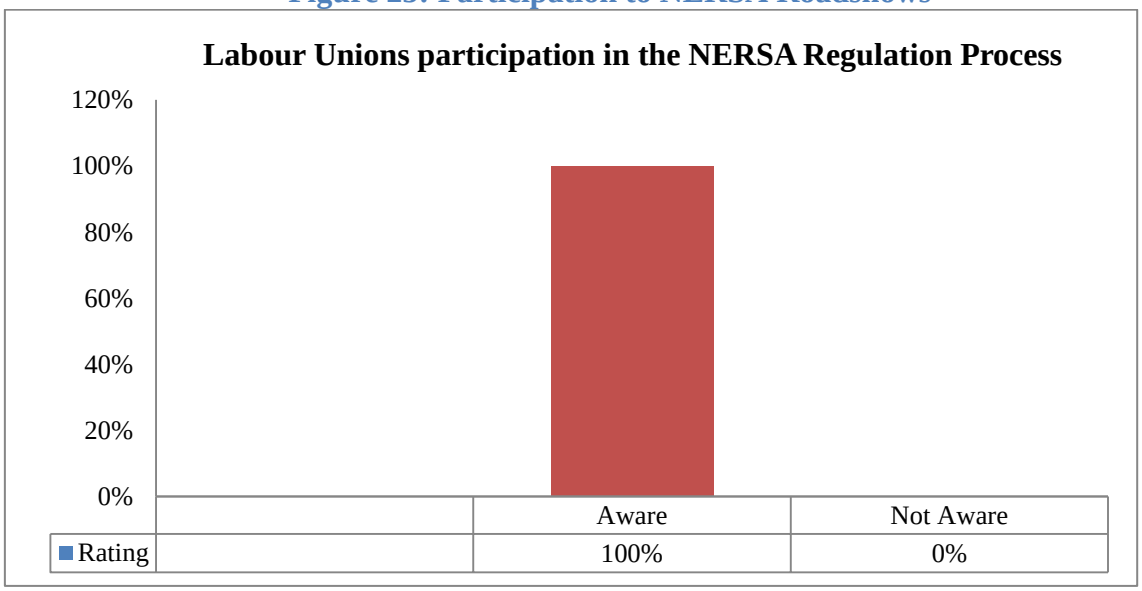
Figure 24: The State of Electricity Supply in South Africa



The perception of the labour unions organizing within the energy sector is that the state of electricity supply in South Africa is good. As high as 67% of the labour unions organizing within the energy sector is of the opinion that the supply of electricity is satisfactorily.

4.2.3 The level of awareness on the processes of NERSA in regulating the cost of electricity and the participation of the labour unions.

Figure 25: Participation to NERSA Roadshows



All trade unions that participated in the study are aware of the NERSA public engagement processes on the adjustment of electricity costs and all do participate through submission to NERSA in the interest of their members.

As discussed in the literature review section of this study, NERSA is the electricity prices regulator body. The state electricity utility company, Eskom submits application for price increases for consideration to NERSA on an annual basis. NERSA assesses the application and in the course of such review invites members of the public and civil organisations to make representations in support of or against Eskom's application.

The labour unions affirmation as participants to the processes of electricity price adjustment points to openness and transparency in the electricity pricing processes in South Africa.

4.2.4 Do you think the public benefits from the commissioning of energy megaprojects?

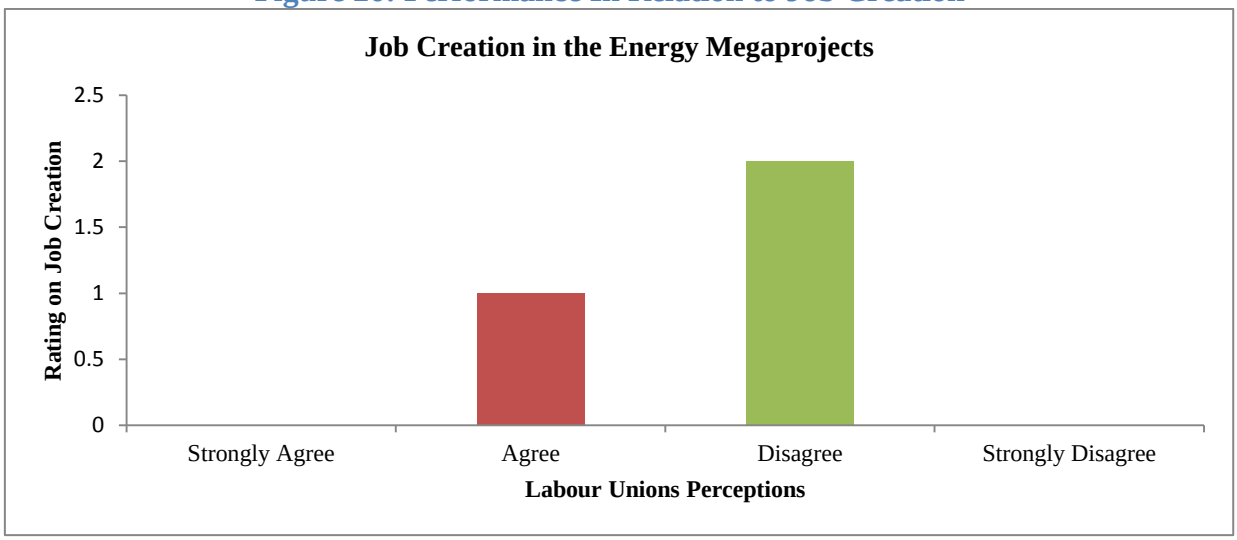
100% of the unions are of the opinion that the public benefits through the security of electricity supply.

Electricity is the catalyst for economic development; it is the pulse of industrial development and job creation. Any kilowatt of electricity injected in the national grid contributes to powering the economy and bettering the lives of consumers. Although trade unions affirm the benefit of energy megaprojects as being positive, they all cited the cost of electricity as a major concern. High cost of energy megaprojects (Medupi and Ingula projects) is also highlighted as being too high by respondents.

It must be noted that all others things being equal, the public reaps rewards from the development of energy megaprojects.

4.2.5 Optimum job opportunities are created through the States investment in the energy megaprojects?

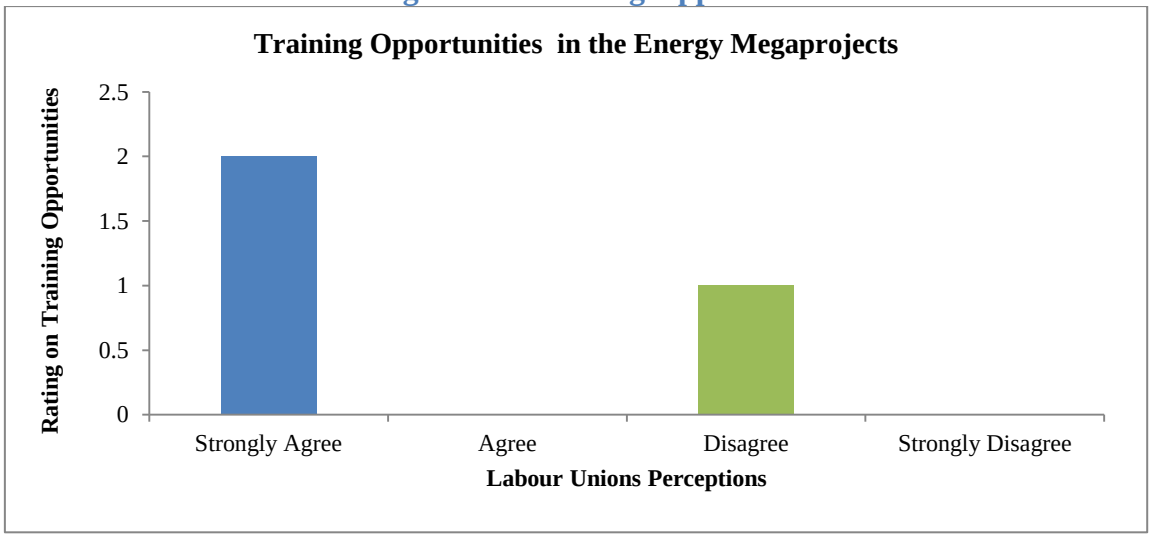
Figure 26: Performance In Relation to Job Creation



As high as two thirds of the respondents strongly disagree, 10% strongly disagree that sufficient job opportunities are created through the investment in energy megaprojects. 30% of the respondents agree and the remaining 10% strongly agree that optimum job opportunities are created through investment in the energy megaprojects.

4.2.6 Optimum training opportunities are created through the construction of projects such as Medupi and Ingula for the benefit of local unemployed and unskilled people.

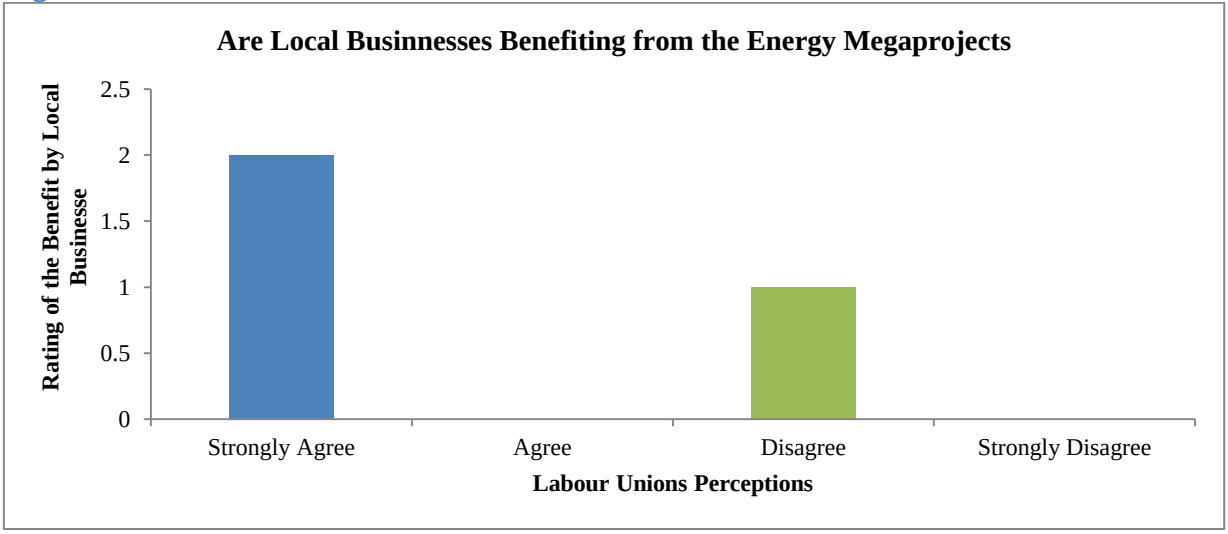
Figure 27: Training Opportunities



Majority of the respondents are of the opinion that sufficient training opportunities are created for the benefit of the local unemployed. 89% of the respondents affirm that training and skills development is given priority during the execution phases of the recent energy megaprojects. Only 11% disagree.

4.2.7 Businesses that are "Local to South Africa" benefits from the Government's investment in the energy Megaproject?

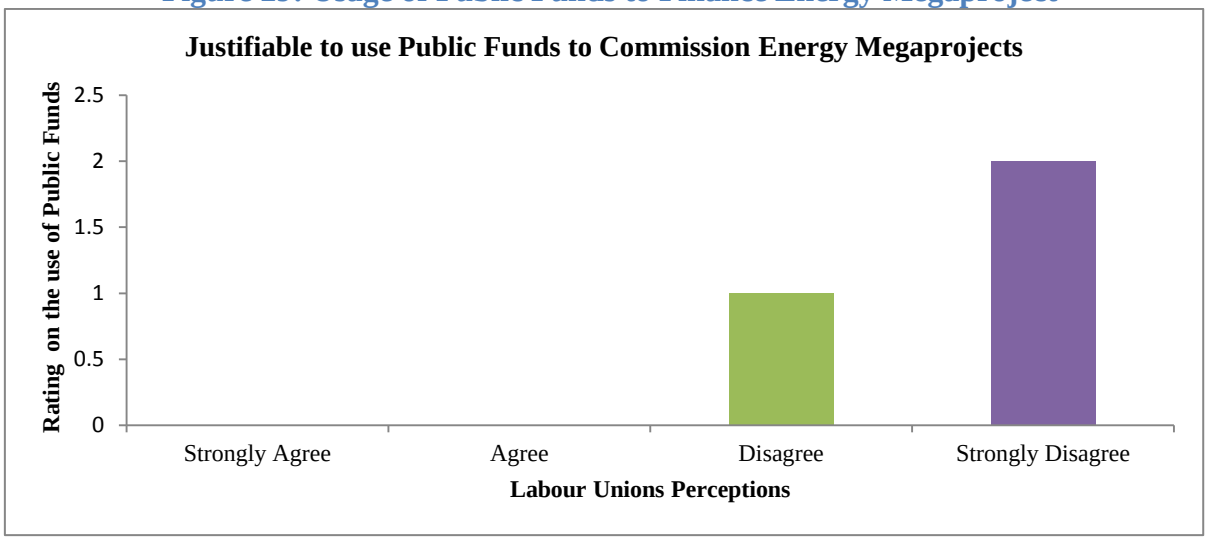
Figure 28: The Benefit of Local Businesses



Two thirds of the respondents are of the opinion that local businesses benefits from the government's investment in the energy megaprojects. The remaining one third of the respondents disagrees.

4.2.8 It is justifiable to use the public funds to develop energy Megaproject [Medupi and Ingula]

Figure 29: Usage of Public Funds to Finance Energy Megaproject

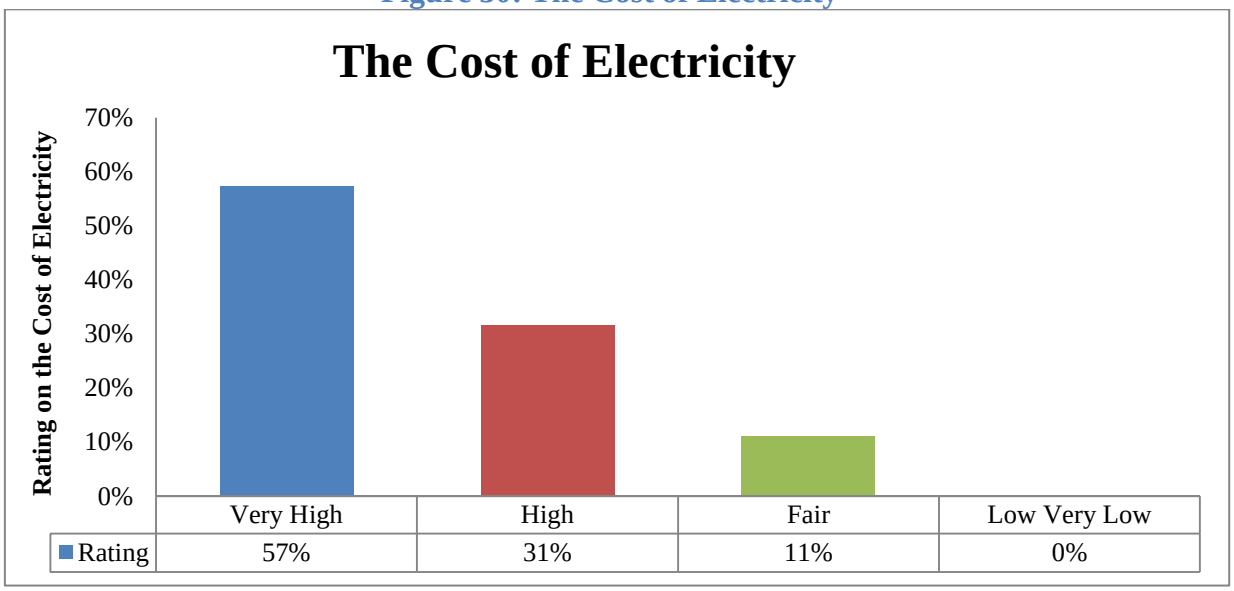


44% of the respondents strongly disagree to the usage of public funds to financing the energy Megaproject. 33% of the respondents disagree, 11% agree and the remaining 11% strongly agree to the financing of the energy Megaproject through the support from the national fiscus.

4.3 The results of electricity consumers' survey.

4.3.1 The cost of electricity in SA from a consumer vantage point.

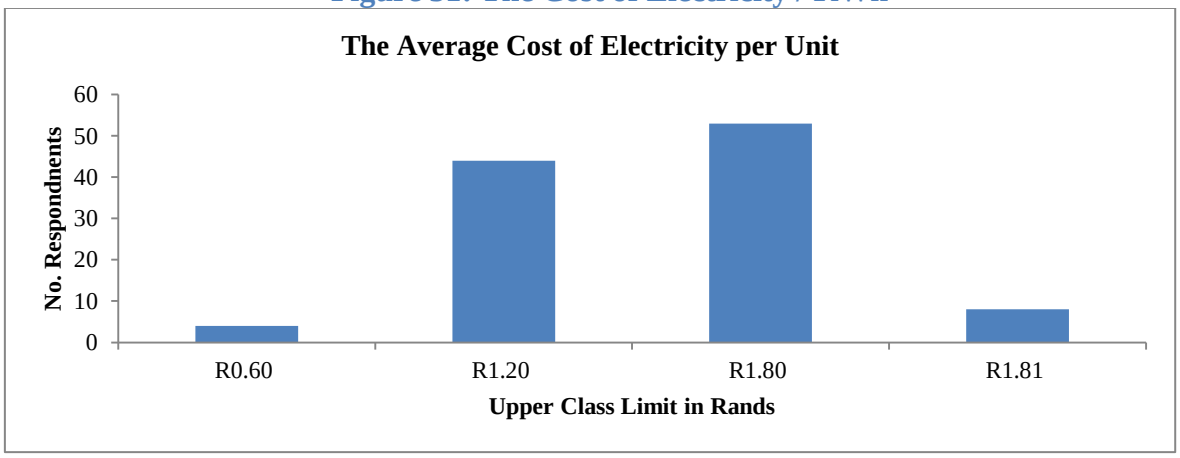
Figure 30: The Cost of Electricity



- 57% of the respondents states that the cost of electricity is very high
- 31% of the respondents regard the costs as high
- 11% are of the opinion that the cost is fair

4.3.2 The average cost of electricity kW/h.

Figure 31: The Cost of Electricity / KWh



- 46% of the respondents pays between R 1.20/kWh and R 1.80/kWh for electricity
- 43% of the respondents pays between R 0.60/kWh and R 1.20/kWh for electricity
- 7% of the respondents are of the view that the cost of electricity is higher than R 1.80/kWh

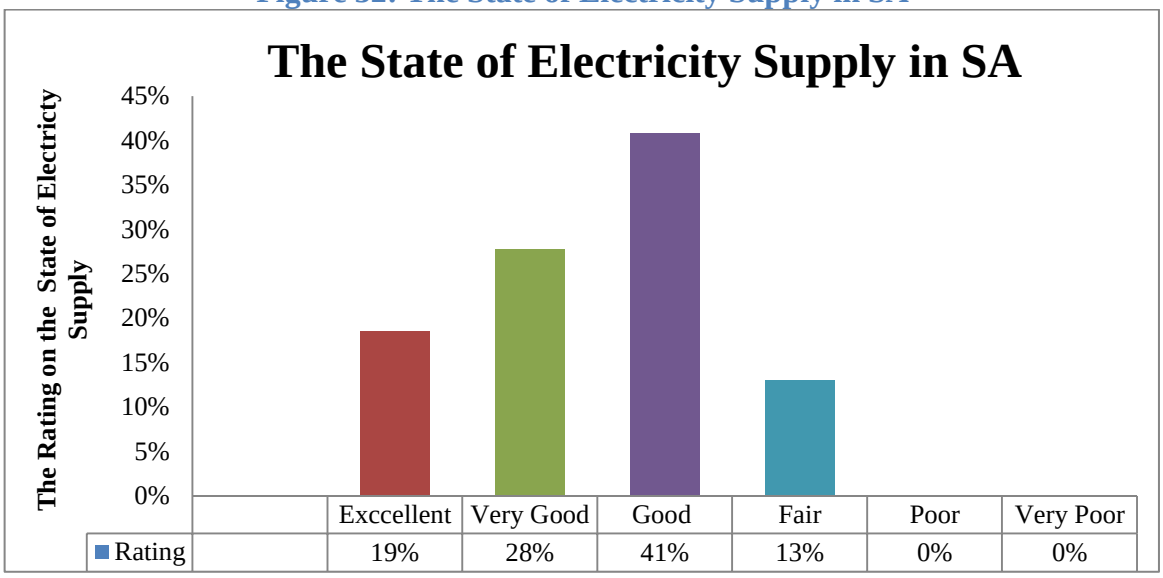
- Less than 4% of the respondents are of the view that the cost is less than R 0.60/kWh

The price of electricity paid by the end users varies from one location to the other. It is influenced by variety of factors. This survey incorporates all users, those in the urban and rural settlements in equal proportions.

The common trend as depicted in the chart above is that majority of consumers pay between R 1.20 and R 1.80/KWh. An average electricity price is therefore R 1.50/KW/h up from an average of R 0.60/KWh in 2007

4.3.3 The state of Electricity Supply in South Africa.

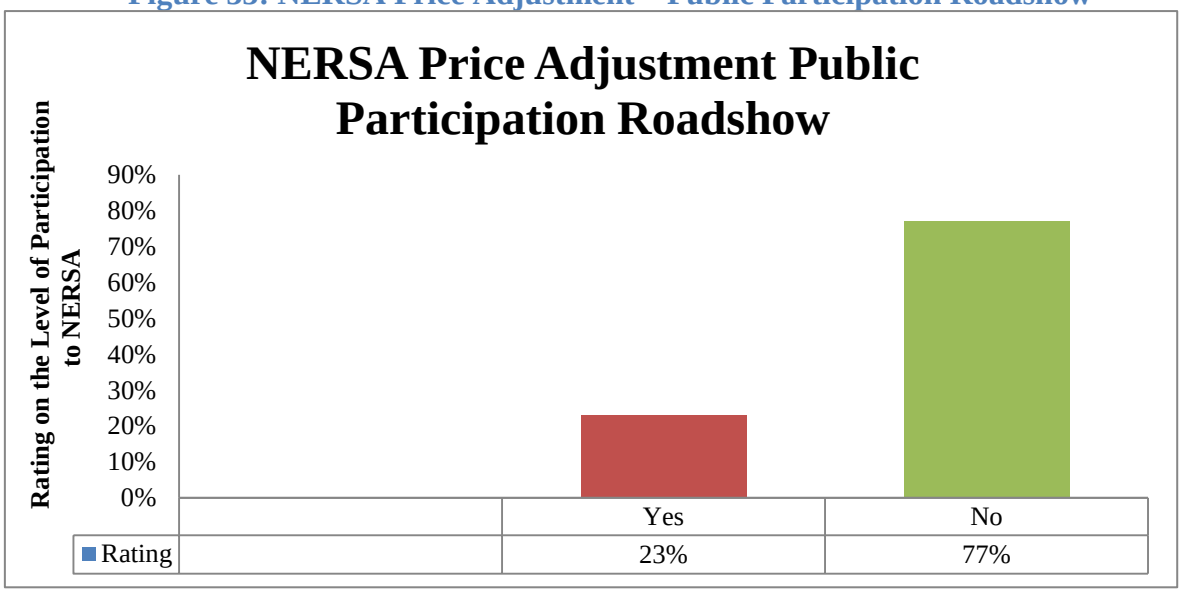
Figure 32: The State of Electricity Supply in SA



- 41% of the respondents states that the electricity supply in SA is good
- 19 % of the respondents are of the opinion that it is excellent
- 28% of the respondents state that it is very good
- 13% state that the state of electricity is fair

4.3.4 The level of awareness and participation to NERSA public engagement processes in electricity tariff adjustments

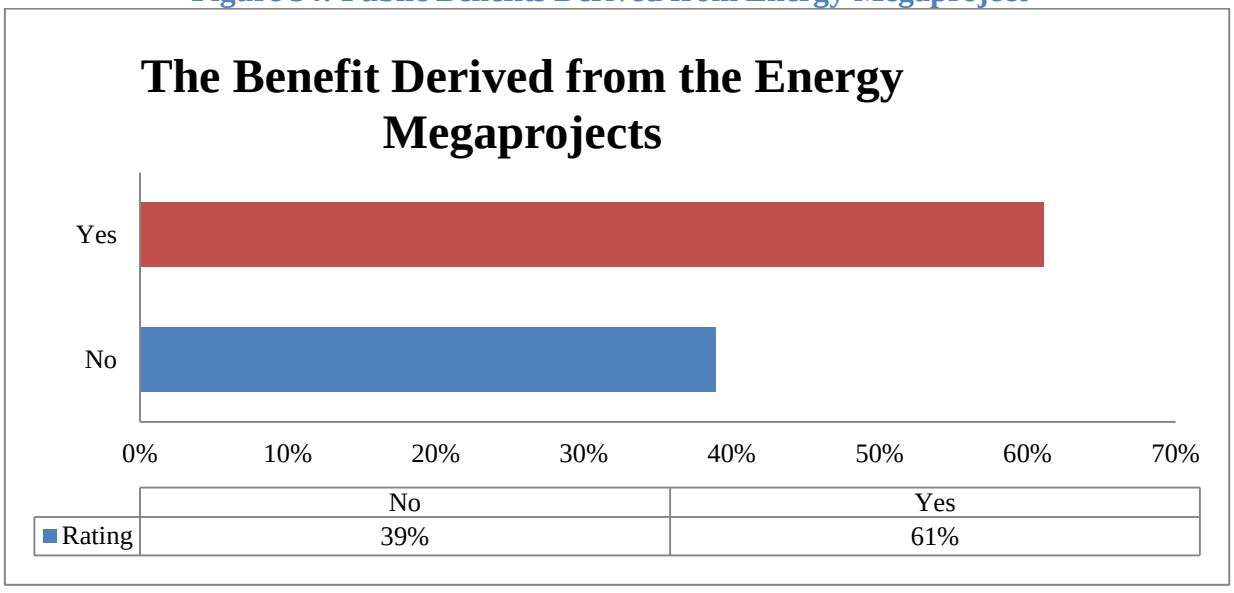
Figure 33: NERSA Price Adjustment – Public Participation Roadshow



As high as 77% of the respondents are neither aware nor participate in the NERSA roadshows on electricity tariff adjustment. The remaining 23% are aware of the processes.

4.3.5 The public reaps benefits other than electricity from energy Megaproject.

Figure 34: Public Benefits Derived from Energy Megaproject



As high as 61% of the respondents are of the opinion that the public reaps benefits other than electricity as a result of the energy Megaproject.

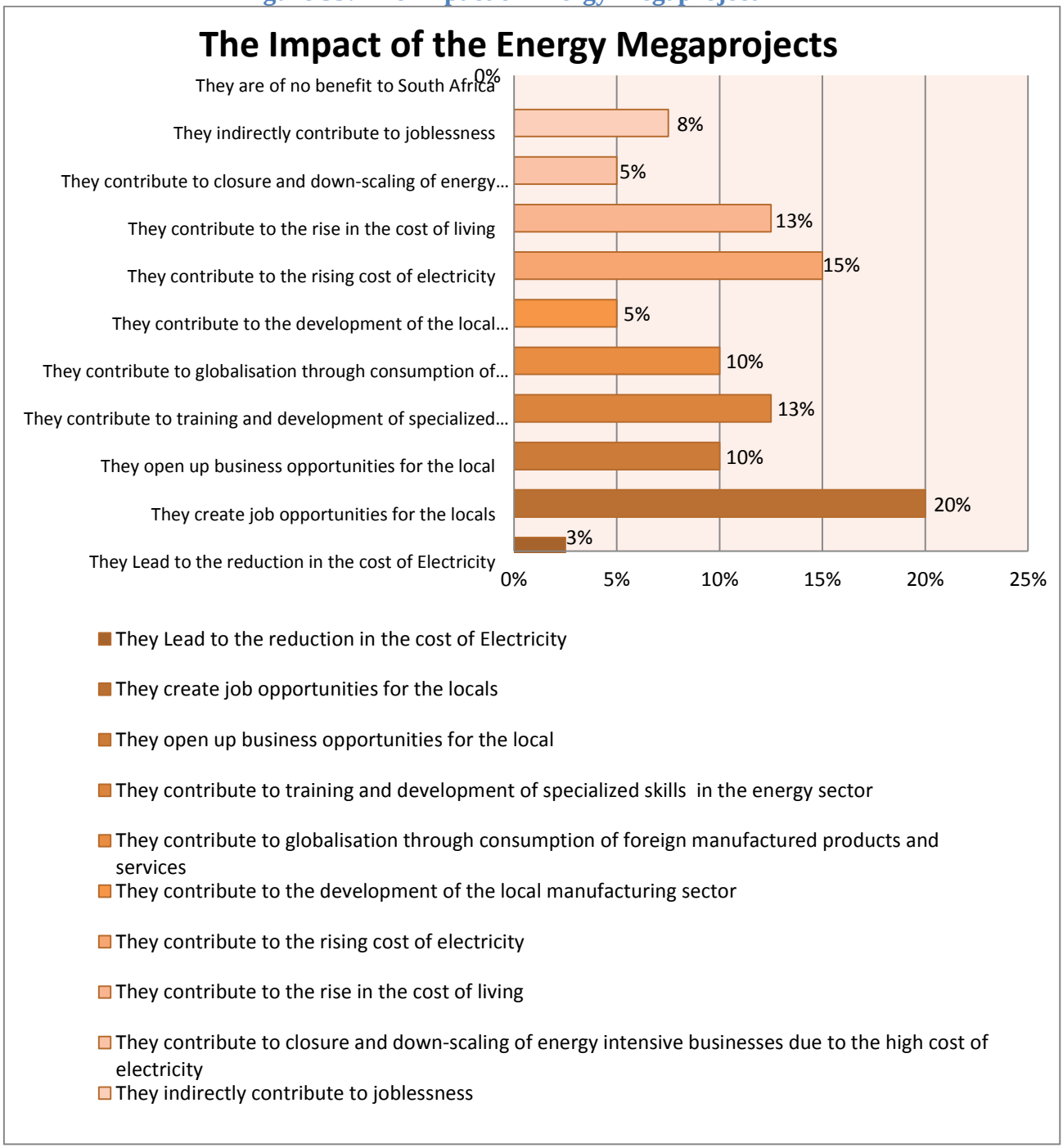
39% of the respondents are of the view that the benefits other than electricity are limited.

The end product of energy project is the output of energy. Therefore, the greatest benefit of all derived from the energy project is the Kilowatts discharged to power the economy and improve the lives of over millions of people. Any other benefit is regarded as secondary benefit. These may include job creation, business and training opportunities through the lifecycle of the electricity plants.

Participants are of the view that they enjoy benefits over and above the electricity itself.

4.3.6 The impact of energy Megaproject in South Africa.

Figure 35: The Impact of Energy Megaproject

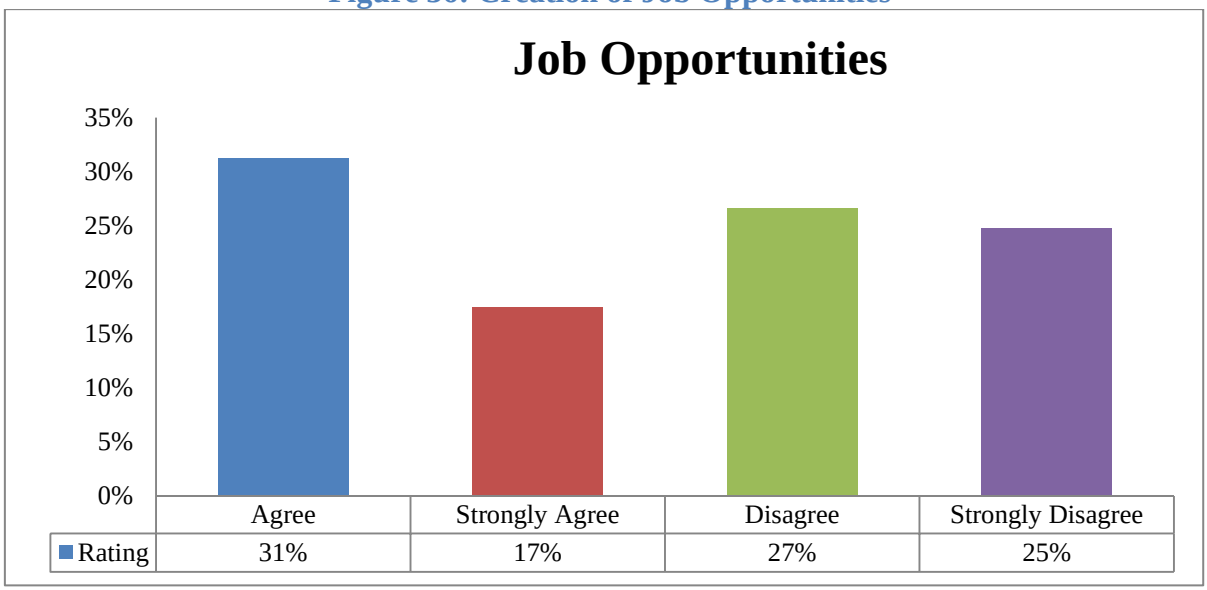


The top five impacts of the energy projects are as follow:

- They create job opportunities to locals
- They contribute to the rising cost of electricity
- They contribute to the rise in the cost of living
- They contribute to training and development of specialized skills in the energy sector
- They contribute to globalization through the consumption of foreign manufactured goods and services

4.3.7 Optimum job opportunities are created through the development of energy Megaproject in South Africa.

Figure 36: Creation of Job Opportunities

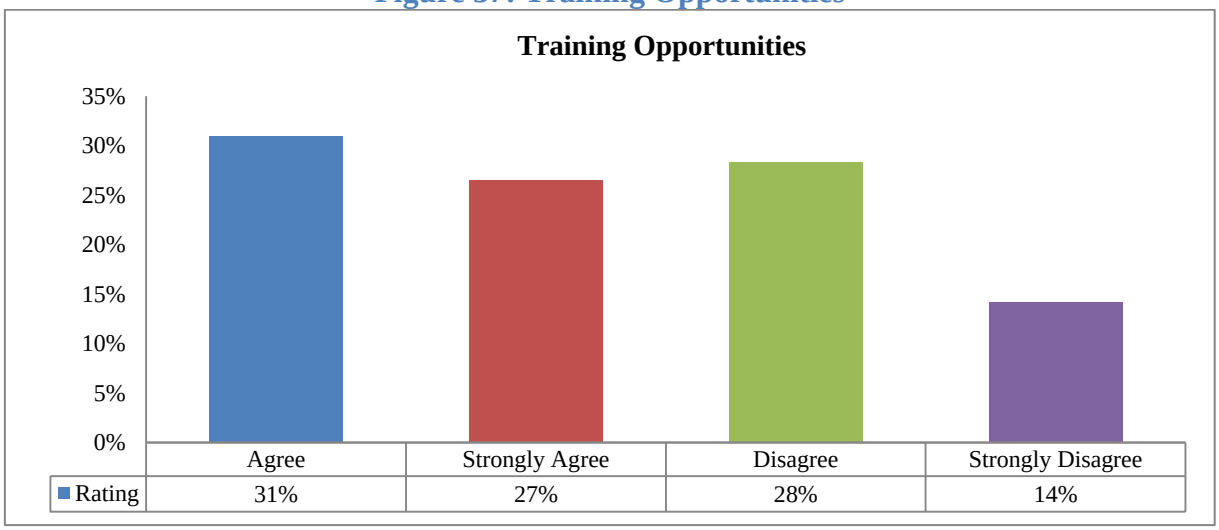


As seen on the chart above, as high as 31% of the respondents agree with the notion that optimum job opportunities are created in the energy megaprojects.

- 18% of the respondents strongly agree that optimal job opportunities are availed through the energy megaprojects.
- 27% of the respondents are of the view that optimal job opportunities are not availed through the energy megaprojects.
- 25% of the respondents strongly disagree with the notion that optimum job opportunities are created through development of the energy megaprojects.

4.3.8 Optimum training opportunities are created through the development of energy Megaproject in South Africa.

Figure 37: Training Opportunities

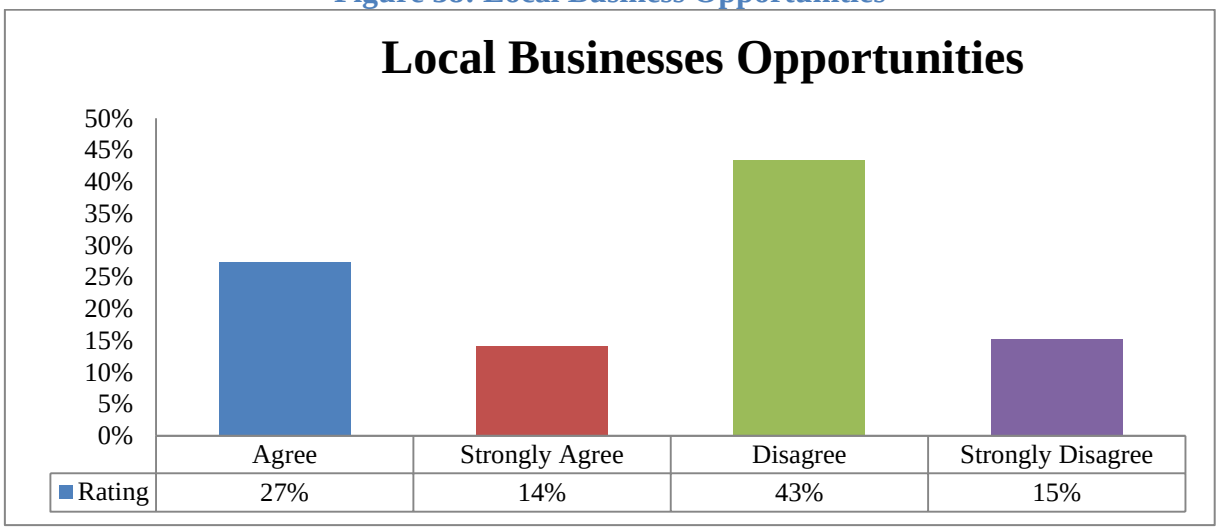


As seen on the chart above, as high as 27% of the respondents strongly agree with the notion that optimum training opportunities are created in the energy Megaproject.

- 31% of the respondents are in concurrence with the view that that optimal training opportunities are presented through the energy megaprojects.
- 28% of the respondents disagree with the view that optimal training opportunities are not availed through the energy megaprojects
- 14% of the respondents strongly disagree with the notion that optimum training opportunities are created through development of the energy megaprojects.

4.3.9 Local businesses reap the benefits from the execution of energy Megaproject.

Figure 38: Local Business Opportunities



As seen on the chart above, as high as 14% of the respondents strongly agree with the notion that local businesses reap benefits from the energy megaprojects.

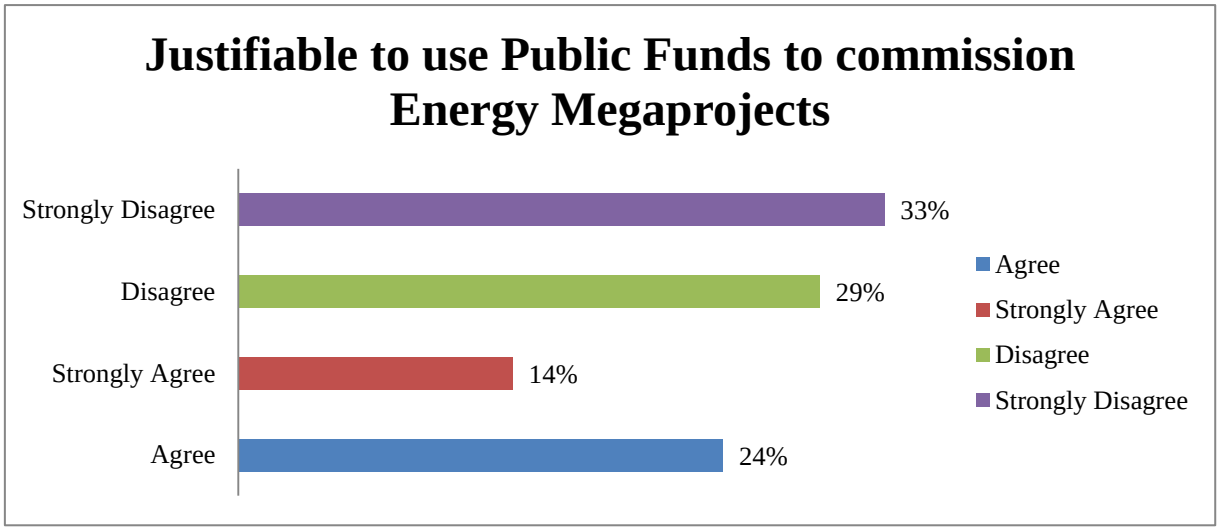
- 27% of the respondents are in concurrence with the view that that local firms benefits from energy megaprojects.
- 43% of the respondents on the other hand disagree with the view that local businesses benefits from the energy megaprojects.
- 15% of the respondents strongly disagree with the notion that that local firms benefits from the energy megaprojects.

4.3.10 It is justifiable to use public funds to invest in commissioning energy megaprojects.

An aggregated 62% of the respondents are of the view that the fiscus should not be used to finance energy Megaproject

An aggregated 38% of the respondents are of the view that it is justifiable to use the public funds for the purpose of financing the energy megaprojects.

Figure 79: Public Funds for Megaproject Funding

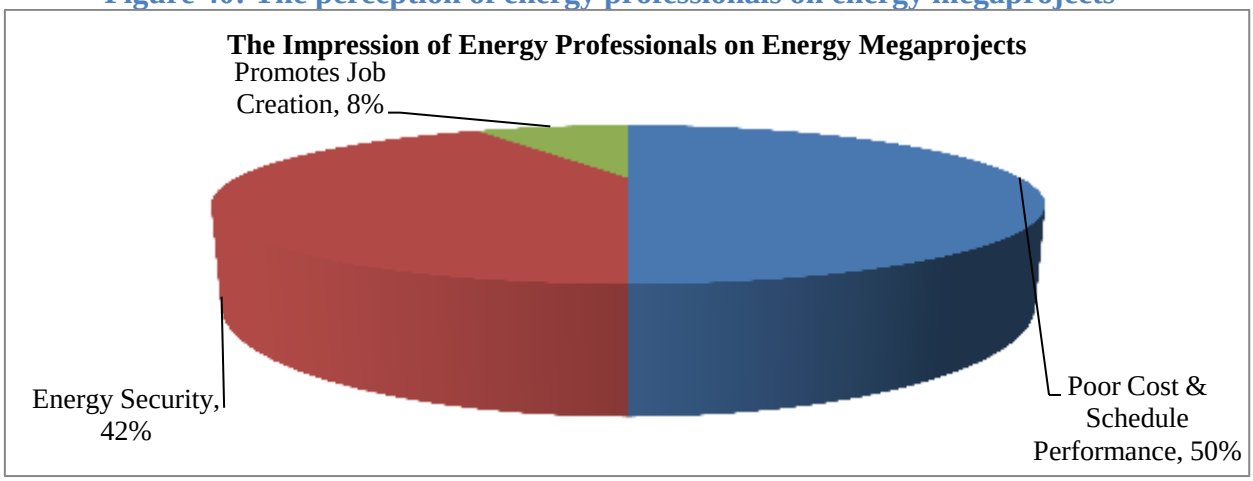


4.4 The results of Semi-structured Interviews [Professionals in the energy sector]

The detailed analysis of the interview is contained in the appendix section of this report. The analysis follows a "data analysis spiral method" introduced in chapter three of this report. The detailed analysis is in Appendix D2.

4.4.1 The impression of professionals within the energy sector on energy megaprojects in South Africa.

Figure 40: The perception of energy professionals on energy megaprojects



As depicted on figure, at least 50% of the professionals who participated on the study are of the view that energy megaprojects being implemented in SA recently performed poorly on both cost and schedule.

- 42% of the respondents are of the view that these projects contributes immensely to ensuring security of energy supply
- 8% of the professionals interviewed are of the view that energy megaprojects contribute positively to job creation.

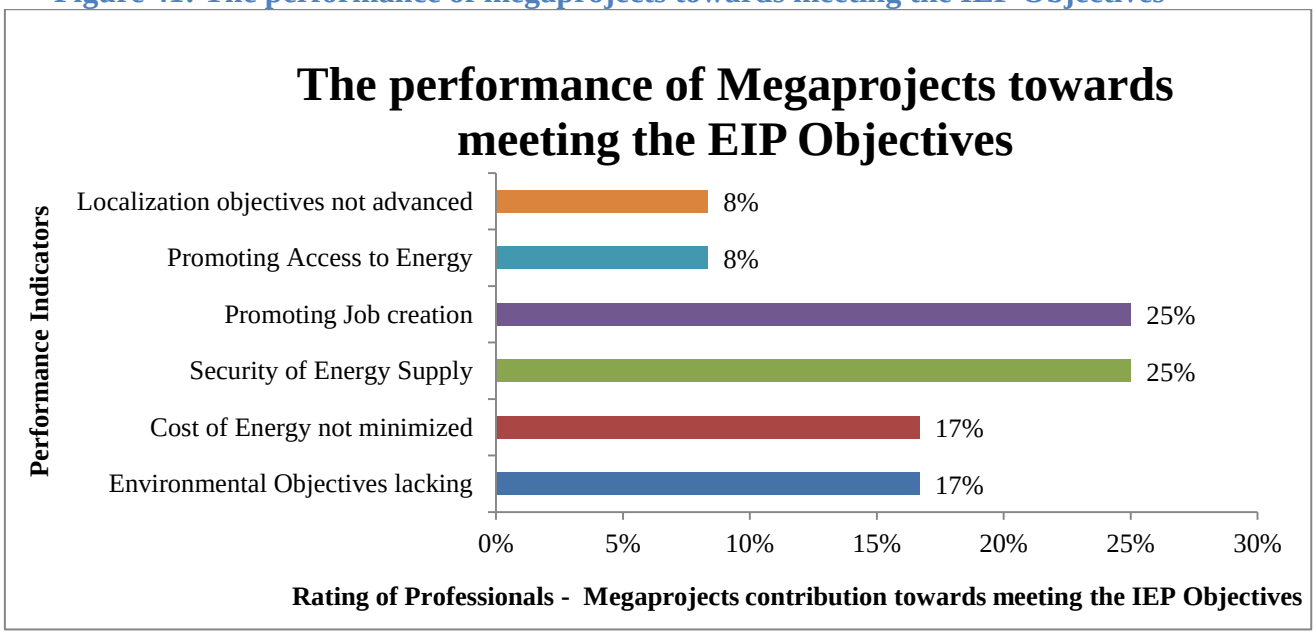
4.4.2 The energy megaproject decision making process through the lenses of professionals in the energy sector

- 88% of the respondents are of the view that decisions on energy megaprojects are taken largely by the state and parastatal with limited participation by ordinary members of the public
- 13% of the respondents perceive decision making to be largely influenced by lobby groups State Officials and Lobby Groups than ordinary members of the public.

4.4.3 In light of the energy Megaproject being built currently in SA – Would you say that the 8 key objectives of the Integrated Energy Plan [IEP] are met? [Please Elaborate]. These objectives are as follow: Security of Energy Supply; minimizing the cost of energy; promoting job creation and localization; minimizing environmental impacts; minimizing water consumption; diversifying supply resources; promoting energy efficiency; and promoting access to energy

The perceptions of the respondents have been largely spread-out on this matter. The general perception is that more effort should be made to achieve all the objectives. The pertinent matters are as outlined in figure 39 below.

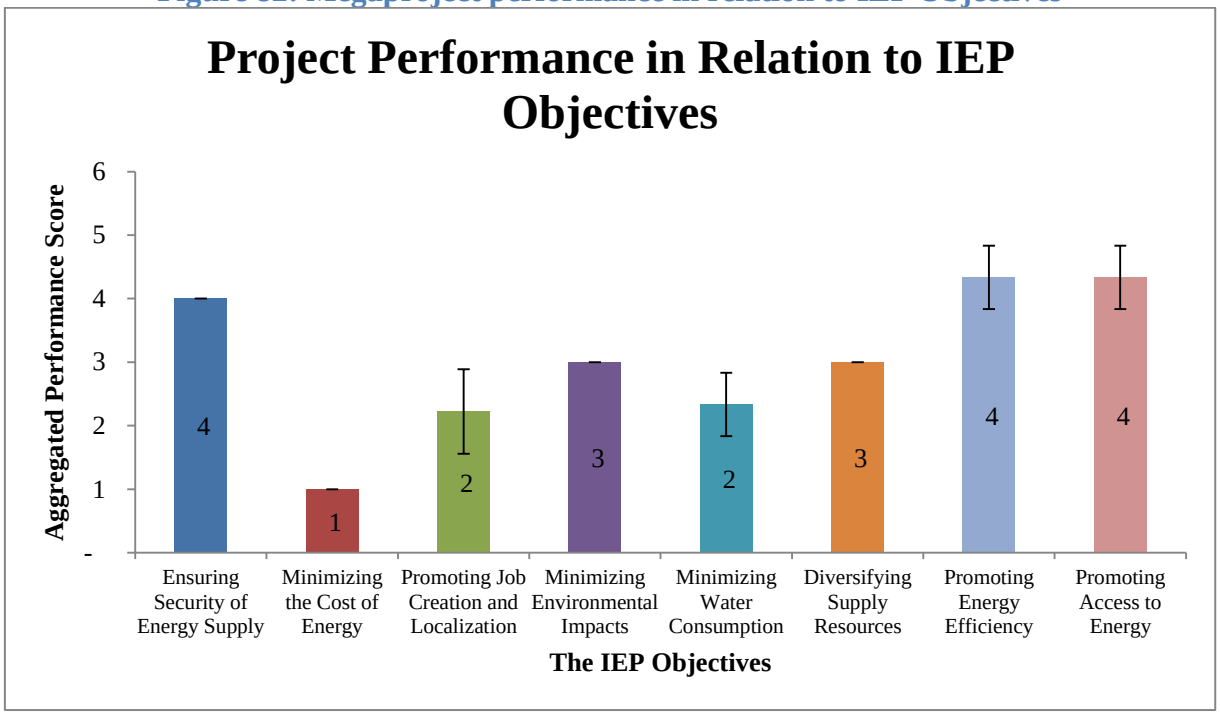
Figure 41: The performance of megaprojects towards meeting the IEP Objectives



The respondents are of the view that not all IEP objectives are promoted through the development of the energy megaprojects. In particular, 17% of the respondents are of the view that these projects performs poorly towards the protection of the environment. 17% of the participants expressed that fact that IEP objective of minimizing the cost of energy is not met; in fact the majority of these participants observed that the cost of energy keeps rising. 25% affirms that these projects contribute to ensuring the security of energy supply. 25% stated that these projects contribute towards skills development and job creation. There has however been an overwhelming acknowledgement that the jobs created are largely limited to the construction phases of the projects and not long term. 8% of the respondents stressed the fact that localization is limited due to reliance on the foreign Original Equipment Manufacturers (OEM). An additional 8% are of the view that these projects contributes greatly in ensuring access to energy through generation of additional megawatts to the grid.

4.4.4 In light of the energy Megaproject being implemented (Medupi and Ingula Project) – Please rate the performance of these projects against these objectives? [Please use 1 to 5: Wherein 1 is the lowest Score (Poor) and 5 is the highest Score (Exceptional)]

Figure 82: Megaproject performance in relation to IEP Objectives



As can be seen on the graph:

- Promotion of access to energy, energy efficiency and security of the energy supply tops the performance scale at level 4 out of 5. In the opinions of the respondents,

energy megaprojects contributes towards meeting ensuring efficiency in the use of energy while expanding accessibility

- Diversification of supply resources and minimization of the environmental impacts have been rated an aggregate of 3 out of 5
- Minimization of the consumption of water , promotion of job creation and localization all fared 2 based on the analysis of respondents perceptions
- Minimizing the cost of energy was rated the least at 1. Majority of the respondents are of the view that energy megaprojects contributes poorly towards meeting this objective. In effect, the fact that the cost keeps increasing has been raised as a key concern by respondents

4.4.5 Would you say that sufficient time and resources are invested at the concept phase of the project to inform the decision making process on Energy Megaproject in South Africa?

All the respondents are of the view that sufficient time is not allowed for upfront planning. The delays in completion and associated cost overrun are to a greater extent attributable to lack of prior planning. Some of the key points raised by respondents include:

- The assertion that Medupi in particular was executed as a fast-tracked project
- SA had no sufficient skills and capabilities to undertake the project
- SA resorted to appointment of multinational consultants to lead the projects without prior consultation
- It was never clear from the onset what type of projects were required to meet the demand in terms of scale

4.4.6 In your opinion, what is the economic Impact of the Energy Megaproject to electricity Consumers in South Africa?

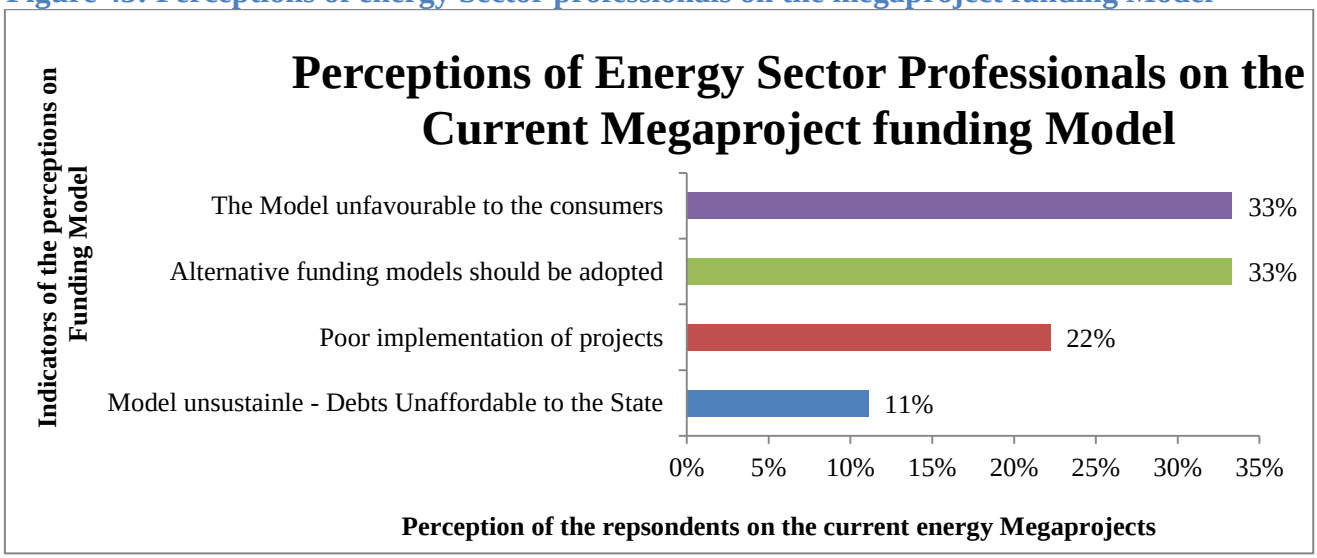
All respondents are of the view that energy megaprojects have negative economic and financial impact to the end users. Some of the key points raised by respondents include:

- The fact that the price has been consistently increasing at an above inflation rate since the inception of the megaprojects

- The need to review the current funding model that exposes the consumers and taxpayers to fund these type of projects
- The need to introduce private funding as energy megaprojects " hurt the poor"

4.4.7 Would you consider the funding model for Energy Megaproject in South Africa viable and sustainable?

Figure 43: Perceptions of energy Sector professionals on the megaproject funding Model



A seen on the chart above:

- 77% of the respondents are of the view that the current funding model is unfavorable
- 22% of the respondents points the poor implementation of these projects as the fundamental issue that requires attention rather than funding

4.4.8 Would you consider the decisions to pursue energy Megaproject in South Africa legitimate in light of performance of the projects pertaining to Cost, time and benefits of the projects? Please Elaborate

An overwhelming majority of the respondents are of the view that energy megaprojects in their current state are yields more of undesirable outcome than the positive impact, at least in the short to medium term. The analysis of the results shows that as high as 89% of the respondents are not entirely in favour of these megaprojects, 11 percent believes strongly that these projects contributes towards job creation and development of scarce skills. Parts of the reasons for this outcome are as follow:

- Delays and Cost Overrun are of great concern
- Delays, Cost Overrun, Community Unrest, Contractual Claims
- Project Complexities, Lack of skills
- Long lead projects undesirable, Lack of skills
- General infrastructure backlog, high electricity prices
- Lack of adequate funding
- Projects promote employment
- Projects promote employment and Skills development
- Funding and delivery model unsustainable

CHAPTER 5: DISCUSSION, CONCLUSION AND RECOMMEDATION

5.1 DISCUSSION

The discussion primarily looks at the factors pertinent to and impacting on the legitimacy of energy megaprojects. These factors are primarily the key objectives of this study. These include:

- The capital cost and cost performance of megaprojects
- The state of electricity supply and the effect of the cost of electricity to end users
- Localization in energy megaprojects
- Jobs creation in energy megaprojects
- Training and skills development in energy megaprojects
- The State of electricity supply in South Africa
- Participation of the consumers in the decision making processes
- The usage of public funds to finance energy megaproject

The capital cost of energy projects and associated cost performances

As established through critical literature review, megaprojects are projects that are induced predominantly through a promise of economic benefits, abundance job opportunities and improved quality of life to communities in which these projects are commissioned. In contrast, the literature further encapsulated the synonymity of megaprojects with major financial losses, time overrun and delayed delivery of much needed services to the end users.

One of the reasonable points of contention in both the academic and public at large is effectiveness of megaprojects as modes of delivery for provision of public infrastructure as opposed to the reasonably scaled infrastructure projects. There is clearly a variety of opinions with regard to the effective mode of public infrastructure delivery.

These differences of preferences are further exacerbated when conducting an analysis from a global vantage point. As a case in point, Ansar et al (2013) advices that developing countries should opt for agile alternative that can be built within a reasonably short period as opposed to megaprojects which takes too long to plan, execute and commission.

One of the notable revelations discussed in literature is that nine out of ten megaprojects completed experienced over 50% cost overrun. Flyvberg (2005) established that cost overruns of over 100% are common in megaprojects.

This study bears testimony to this revelation. The analysis of the results shows unambiguously that the megaprojects generally perform dismally in terms of costs. The results show that the cost performance indices of Medupi and Ingula energy megaprojects are 0.58 and 0.33 respectively. On the other hand, the CPI of 0.89 is recorded for the Sere energy Wind Farm.

The study shows that once completed, Medupi project will exceed its budget by at least R 56.4 billion; Ingula Pumped Storage Scheme exceeded its budget by R 17.9 billion and the Sere energy Wind Farm exceeded its budget by R 0.289 billion.

It is clear from the analysis of the CPI's of the three energy projects covered in this study that the Sere energy Wind Farm project is the least cost project in terms of the project value, the project performed much better financially at a CPI of 0.89. Furthermore, the project was completed within the approved project schedule.

The study further established that the capital cost per megawatt for the Sere energy Wind Farm is the most economic at R 18 Million as opposed to R 20 Million for Ingula pumped storage project and R 28 Million/MW for Medupi energy megaproject.

These revelations show that an energy megaproject defies the concept of the economics of scale principle. McConnell et al. (2009) state that the economics of scale refers to the phenomenon where the average cost per unit reduces with the increase in the scale of production. Ansar et al. (2017) state that "building big" has traditionally been seen as necessary to secure efficient economies of scale. However, In the case of energy megaproject development, the higher the project value, the higher the average cost per unit.

The state of electricity supply and the effect of the cost of electricity to end users

As high as 87% of the electricity consumers are satisfied with the state of electricity supply in South Africa. Eskom financial report (2017) stated that an excess peak time power of 5400MW per day is recorded.

The bone of contention has however been highlighted as the cost of electricity to the end users. The study established that as high as 88% of the electricity consumers regard the cost of

electricity as being very high. The study further established that the cost of electricity rose sharply by over 100% between 2007 and 2017. The cost increased dramatically from over R0.60/KWh in the years 2007 to over R1.50/KWh in the year 2017. This aggressive increase is attributable to the country's investment in energy megaproject. At least 46% of the electricity consumers pay between R 1.20 and R 1.80/KWh for electricity.

It is common knowledge that high cost of production yields undesired and counterproductive result to most sectors of the economy. The rise in the unit cost of electricity induces a reduction in the demand for goods and services, and consequently a reduction in the demand for electricity. This statement is informed by the *Law of Demand*. A fundamental characteristic of the law of demand is this: Other things equal, as prices falls, the quantity demanded rises, and as price rises, the quantity demanded fall (McConnell et al., 2009).

The high production costs reduce demand for goods and services, and consequently it slows down industrial growth and development. It affects the end users and consumers of various products negatively since the costs are often passed to end users through the sale of goods and services.

In production lines, the cost of electricity would be regarded as an explicit-variable cost. A firms explicit costs are the monetary payments (or cash expenditure) it makes to those who supply labor services, materials, fuel, transportation services, and the like (McConnell et al., 2009). McConnell et al (2009) defines variable costs as those costs that change with the level of output.

In conformity to the Law of Demand, the increase in price of any commodity induces a reduction in demand for the associated goods and services. Consequently, the higher the cost of electricity per KWh will induce a reduction in the consumption of electricity.

Given the importance of electricity to its consumers, the price increase may not necessarily be noticeable immediately; its impact may be felt in a long run. The actual elasticity of the demand as a result of price hike may be influenced by variety of factors which may include:

- The importance of the product and the dependency of consumers to the product; and
- Availability of alternatives and the price thereof

Deloitte (2017) report titled "*An Overview of electricity consumption and pricing in South Africa*" state that electricity sales fell at an average rate of -0.3% year on year over the first

three years MYPD3 period (from 2013.14 to 2017/18). Deloitte's report (2017) further state that this reduction is contrary to Eskom's forecast of a 1.8% annual consumption growth.

This anomaly may be attributable to the negative demand elasticity to the price increase as per the Law of Demand. One may reasonably conclude that the persistent electricity tariff hike, leads to a reduction in electricity consumption. This is informed by the fact that "...between 2008 and 2013 NERSA approved several sharp increases in annual tariffs and electricity prices more than doubled real terms (Inflation – adjusted) rising by a cumulative 114% (Deloitte, 2017).

Expenditure in local products and services in the energy megaprojects [Localisation]

The study lays bare that the energy megaprojects in the form of Medupi and Ingula projects contributes immensely to the country's localisation strategy. Medupi and Ingula projects performed exceptionally better than Sere Wind Farm pertaining to the expenditure on local suppliers and service providers.

An analysis of the project expenditure trends through the lenses of the participants shows that the dominant view is that at least 30% of the project value has been expended on procurement of goods and services local to South Africa at the Sere Wind Farm Project.

The same pool of the respondents is of the view that more than 50% of the Medupi project value has been expended locally. An analysis on Ingula shows that 29% of the respondents are of the view that at least 50% of the contract value has been expended locally.

One of the concerns consistently pointed out by over two thirds of the respondents is that local business opportunities are limited to construction activities including material and general consumables as opposed to specialized equipment manufacturing.

Although the local businesses benefits, the biggest - direct beneficiaries of the government' investment in the energy megaprojects are the original equipment manufacturers (OEM's) and the big local construction companies trading at the Johannesburg Stock Exchange. Most of the equipment are designed and fabricated abroad, in the countries where OEM's are originates. These equipment are ferried to various construction sites in South Africa, assembled and erected. The benefit of local players is limited largely to the construction phases of the energy megaprojects.

The study uncovered that the energy megaprojects contributes by a considerable margin to the local economies when weighed against the small scale energy projects such as the Sere energy Wind Farm. The analysis of the Sere Wind Farm project shows that a bigger piece of the expenditure pie is expended in areas other than those in the vicinity of the project location.

An overwhelming 58% of the respondents are of the view that local firms on national scale benefits from the energy megaprojects. It must be noted that the benefit in this context refers to economic and or business opportunities.

On the basis of this, one may deduce that the bigger the project in terms of value and complexity, the better the performance in relation to localisation.

Creation of optimum, sustainable Jobs

The operative word in this question is "optimum". This means the best possible number of jobs is created. The results show overwhelmingly that energy megaprojects contribute to the creation of multitudes of temporary jobs for the benefits of skilled workforce in the main.

The assessment of the results shows that 51% of the respondents are of the view that job opportunities created through the development of energy megaprojects are not optimal in relation to the scale of the project and the capital outlaid. An aggregated 49% of the respondents are of the view that optimum job opportunities are created through the development of energy megaprojects.

The common concern with regard to this question has been the quantity and longevity of the jobs created. The respondents are of the view that majority of jobs created are suitable to people who are skilled. These are the group of people with better prospects of securing employment even outside the ambit of energy megaprojects. A considerable number of respondents are of the view that these projects targets people with specialised skills such as Welding, Boiler Making, and Pipe Fitting as opposed to absorbing and upskilling the unemployed. Furthermore, the respondents are of the view that the jobs created through the investment in energy megaprojects are characterised by limited duration. People employed in these projects are demobilised once the sectional construction phases are completed.

The fact that 51% of the respondents disagree with the notion of optimum job creation cannot be under-estimated. Medupi and Ingula projects are inherently national project and as a result, it would be reasonably acceptable for one to expect the extension of their benefits to South Africa in its entirety. *The benefits in this regard are not limited to supply of electricity.* This is

unfortunately not the case; hence the results are marginally skewed to pessimism. Also, the notably legitimate concern in relation to job creation is the longevity of employment versus the funds expended in delivering the projects.

At Medupi energy megaproject as a case in point, R 135 billion would be spent while only 15 000 direct jobs are created, majority of which are limited to the construction phase of the project.

On the basis of this assessment one may reasonably deduce that energy megaprojects do not contribute to the creation of sustainable jobs for the unemployed, but rather limits the benefit of long term employment to the skilled personnel.

Training and skills development

Training and upskilling of the unemployed people is one of the apex priorities of the government through the Department of Higher learning (DHL). An investment in training of people in rare and specialised skill, improves the prospects of securing job opportunities to all beneficiaries beyond the completion dates of the respective megaproject.

The study shows that:

- At least 3000 people are beneficiaries of training and upskilling opportunities provided by Eskom
- At most 1000 people benefitted from training opportunities presented at Ingula project
- At most 100 people benefitted from training opportunities through the construction of the Sere energy wind farm

The overall analysis of the results points to the satisfactorily performance of the energy megaprojects in relation to training and development. As high as 58% of the respondents are of the view that considerable effort has been made through the development of the energy megaproject to train and upskill the unemployed. This sentiment is also shared by the respondents within the organised labour fraternity.

These skills are beneficial to the energy sector in its entirety as majority of skilled personnel are destined for absorption within projects other than the energy sector.

The State of electricity supply in South Africa

The results show that majority of electricity consumers including the professionals are satisfied with the current state of electricity supply in South Africa. In its 2017 financial statement, Eskom reported that it has an excess capacity of 5400/MW on a daily basis. This negates at least in a short to medium term any prospect of load shedding.

The International Energy Agency (IEA) regards energy security as vital to ensuring well-functioning, modern economies. Apart from its societal benefit, electricity is also a driving in the economy (National Treasury SA, 2007). In light of the continued technological revolution, the stable supply of electricity is vital to ensuring prosperous economies. It is a catalyst to attracting FDI and bettering the quality of life.

The fact that the supply of electricity is regarded as stable by the respondents, points to positive economic prospects. The validity of this assertion is guaranteed only when viewed in isolation to other factors such as costs and accessibility.

Participation of the Consumers in the decision making processes

The participation of the end users, consumers and financiers of electricity plants is of paramount importance to its price determination processes. The study finds at least 23% of the consumers are aware of the public participation processes conducted by NERSA in the course of adjusting the electricity tariffs.

The fact that only 23% of the respondents are aware of the NERSA public participation processes cast doubt on the transparency and inclusivity of the process. It implies to a reasonable extent that the public interest is not the apex priority of the National Energy Regular of South Africa.

The results of the survey should not be mistaken to mean that the public participation is disregarded in its entirety. However, it is clear that only an elite section of the population is privileged to part-take in the processes. This assertion is based on the publication by NERSA in its invitation for public participation that the roadshows would cover the following affluent suburban centres: Cape Town, Port Elizabeth, Bloemfontein, Midrand, Durban, Kimberly, Polokwane, and City of Matlosana.

The limited consultation and inclusivity of the processes is contrary to one of the strategic objectives of NERSA that is to:

"*Promote accessible and affordable energy for all citizens"*

This is more so because only those in urban centres of the society are incentivised to participate in an interactive fashion. Transparency and inclusivity are key to ensuring an informed, holistic review and decision making. The facts, as uncovered in this study delegitimizes NERSA's objective of promoting accessible and affordable energy for all citizens.

Limitation in public participation has the potential of limiting innovation in the energy generation industry and contradicting the objectives of the IEP to reduce the cost of electricity. In a layman's point of view, the lack of broader consultation by the independent regulatory body, weakens its legitimacy and may lead to investment in projects that are not aligned to the interest of the taxpayers, electricity consumers and the public at large.

The usage of public funds to finance energy megaproject

The electricity industry in South Africa is dominated by one gigantic player in the form of Eskom. It has been explained in literature that Eskom generates and supply at least 95% of the electricity consumed in South Africa. The state is the only shareholder of Eskom. The affairs of Eskom are managed independently of the state. Therefore all things being equal, logic dictates that Eskom should be in a position to plan, manage and fund its expansion programmes without unfairly burdening the state. This is the sentiments shared by most participants who believe that the government funds should not be used to finance the energy megaprojects. One may extend this by stating that in the absence of reliance on the fiscus, Eskom would be in a position to plan and invest in line with its financial capacity.

The study finds that as high as 62% of the respondents, which include professionals, organised labour and general electricity consumers are of the view that the fiscus should not be used to finance the energy megaprojects. Furthermore, the respondents strongly believe that State Owned Power Utility (Eskom) should be able to manage and finance its expansion programme without over burdening the fiscus.

The impact of energy megaprojects to the consumers

The impact of energy megaprojects to energy consumers within SA comes across as a mix bag of the good and the bad. The energy megaprojects are said to be one of the contributors to job creation while it is simultaneously considered as a major contributor to the consumption of foreign manufactured products.

They are considered to be leading in the provision of training and development of specialised skills and on the other hand they are said to be the driving forces to the rising cost of electricity and the cost of living.

The analysis of the aggregated impact of the energy megaprojects to electricity consumers and end users is greatly inclined to pessimism. On the basis of this, one may reasonably conclude that the energy megaprojects commissioned in recent years have negative impact to energy consumers in South Africa.

5.2 SUMMARY OF THE RESEARCH FINDINGS

As outlined in Chapter One, the objectives of the study were to:

- To investigate the motivation behind undertaking the energy megaprojects
- To investigate the economic impact of energy megaprojects to energy consumers in South Africa.
- To investigate the economic benefits derived from the implementation of the energy Megaproject vis-à-vis localization of equipment
- To investigate the economic benefits derived from the implementation of the energy megaproject vis-à-vis job creation
- To conduct a comparative analysis of capital cost per megawatt between the power generation megaproject and the ordinary small – scale power generation projects.

The above stated objectives were used fundamentally in the collection of data. This included conducting interviews, survey and questionnaires. These objectives have been fulfilled.

5.2.1 The motivations behind undertaking energy megaproject in South Africa

- The motivation behind undertaking the energy megaprojects in the years 2007 to 2017 is the generation and supply deficiency that the country experienced between the years 2005 to 2008. This necessitated an injection of new energy generation capacity to stabilize the grid and power South Africa's economy.
- The study found that the regressive shortage in supply which stood at over 2000 MW during peak time in the years 2005 to 2008 contributed to a hurried decision to investment in the energy Build Programme which includes Ingula, Medupi and Kusile Projects. This is supported by both the National Treasury report titled "*2011 Local*

government budget and expenditure Review (2011) and the Deloitte report titled "An *Overview of electricity consumption and pricing in South Africa* (2017).

- A sequence of events leading up to the approval of the energy megaproject is riddled with signs of emergency than a well thought strategic energy security plan.
- The study found that the investment of resources to the concept, pre-feasibility, feasibility and planning phases of the energy megaprojects is non-existent at worst and minimal at best.
- The study found no strategic planning for maximization of the project benefits to SA at the initiation phase of the project.

5.2.2 The economic impact of energy megaprojects to electricity consumers in South Africa

- The impact of energy megaprojects to energy consumers is largely negative. This is largely as a result of the aggressive hikes in electricity tariffs between the years 2008 to 2017. The National Energy Regular of South Africa (NERSA) approved a series of above CPI electricity on an annual basis since the inception of the energy megaprojects. This consequently reduced the disposable income of all households in South Africa, thus impacting the consumers negatively.
- As high as 88% of the electricity consumers regard the cost of electricity as being very high.

5.1.3 The impact of energy megaproject to localization

- The big local construction companies are major local beneficiaries of the energy megaprojects being implemented in South Africa. The benefit of these companies is largely limited to construction activities.
- The original equipment manufacturers are major beneficiaries of the energy megaprojects. These are in the main, foreign owned that owns energy generation technology and the patent rights to the design.
- Local small to medium firms benefits through firms' provision ancillary non-technical items, including consumables and spares.

5.1.4 The impact of energy megaproject to Job Creation

- The energy megaprojects have minimal impact on the creation sustainable jobs in South Africa.
- The multitude of jobs created through the development of energy megaprojects are temporary jobs limited largely to the sectional construction phase of the project
- A limited number of highly skilled technical personnel is absorbed into the operations and maintenance phases of the power plant
- The total value of the investment in energy projects exacerbates the pessimism of the analysis. At Medupi, at least R 135 Billion would be expended, however only 15000 people are directly employed and most of them are contracted for a limited duration.
- Over R 26 billion was expended at Ingula Pumped storage scheme project and at least 5000 people were employed at a peak of the project. Only a fraction of these people were absorbed into the operation phase of the project.

5.1.5 Comparative analysis of capital costs in the energy plants in South Africa (Megaproject vs. Small Scale energy project)

Table 13: Comparison of the Capital Cost for Energy Plants

Comparison of the Capital Costs of Energy Plants - South Africa [Excluding the Cost of Finance]					
Technology Type	**Fuel**	**Capacity (MW)**	**Capital Cost R/MW '000**	**Capital Cost for a Complete Project**	**Capital Cost/MW '000**
Medupi - Ultra Supercritical Coal (USC)	Coal	794	R 22 500 000	R 135 000 000	R 28 338
Sere Wind Farm - Onshore Wind (WN)	Wind	100	R 2 689 000	R 2 689 000	R 26 890
Ingula Pumped Storage Scheme - Pumped Storage*	Water	333	R 6 700 000	R 26 800 000	R 20 120

The capital cost of energy projects increases with an increase in size and output of energy plants. The analysis shows that the capital cost per megawatt for an Ultra – Supercritical coal (USC) is R 28.3 Million while a complete boiler unit with an output of 794 megawatts (MW) costs an approximate R 22.5 billion at most.

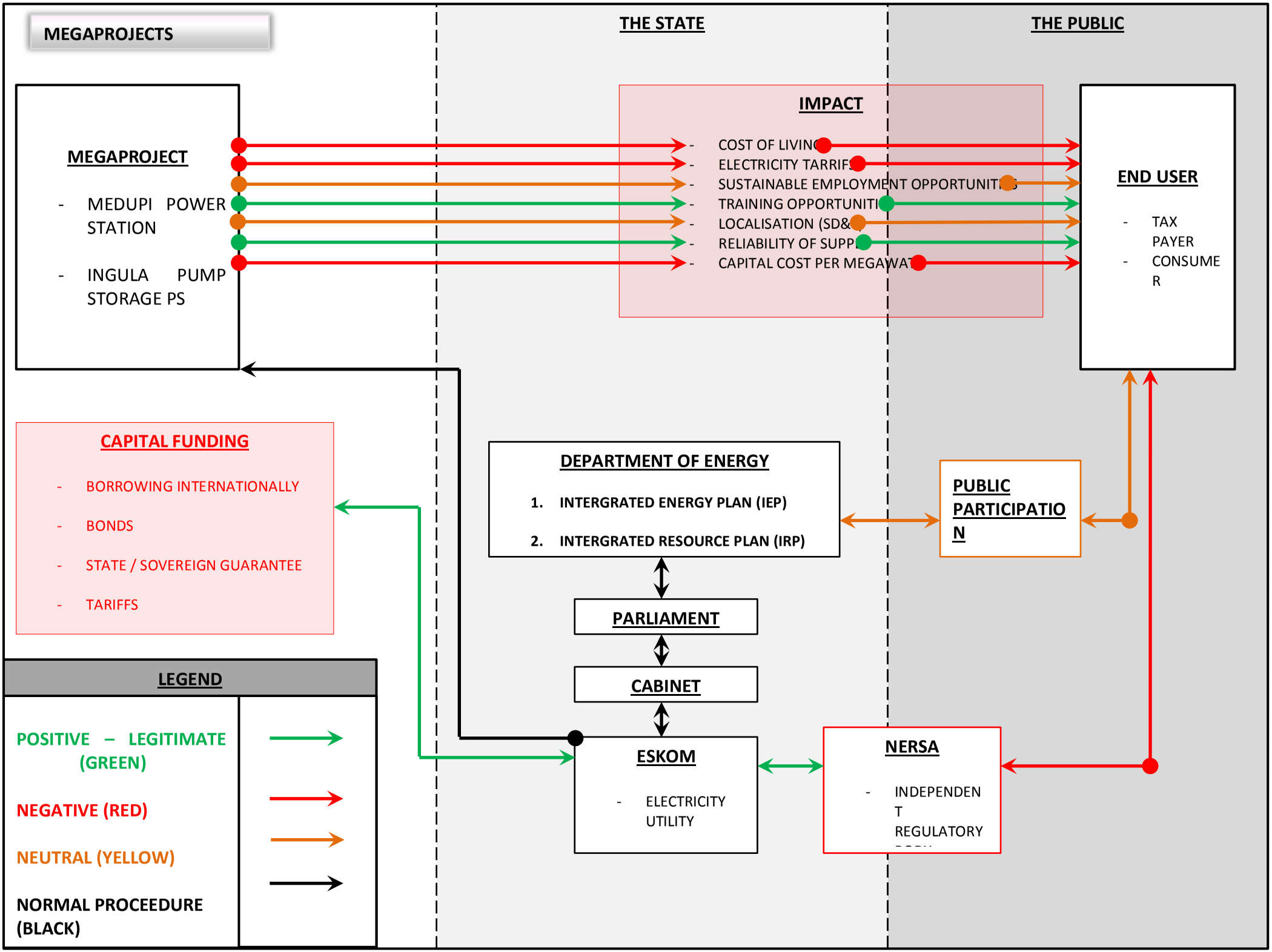
Table 13 above shows the comparative representation of energy generation plants per generation plant as a standalone projects. As clearly depicted in the graph, the Ingula Pumped Storage Scheme is the most economic model at R 20.1 Million /MW. All other sundry factors being held constant, the most expensive generating plant is the Medupi USC Plant at a cost of R 28.3 Million/MW, followed by Sere energy wind farm at a moderate cost of R 22.5 Million/MW.

The costs of completed unit of power generation plant are as listed below:

- The complete boiler Unit generating794MW costs approximately R 22.5 billion to build.
- The complete Solar power Plant generating 100MW costs approximately R 2.689 billion
- The complete water pumped power plant generating 333MW costs approximately R 6.7 billion

5.3 SCHEMATIC DIAGRAM OF THE STUDY AND FINDINGS

The high level schematic diagram of the stakeholders within the energy Megaproject is as follow:


MEGAPROJECTS
THE STATE
THE PUBLIC
MEGAPROJECT
- MEDUPI POWER STATION
- INGULA PUMP STORAGE PS
IMPACT
- COST OF LIVING
- ELECTRICITY TARRIFS
- SUSTAINABLE EMPLOYMENT OPPORTUNITIES
- TRAINING OPPORTUNITIES
- LOCALISATION (SD&
- RELIABILITY OF SUPPL
- CAPITAL COST PER MEGAWAT
END USER
- TAX PAYER
- CONSUME R
CAPITAL FUNDING
- BORROWING INTERNATIONALLY
- BONDS
- STATE / SOVEREIGN GUARANTEE
- TARIFFS
DEPARTMENT OF ENERGY
1. INTERGRATED ENERGY PLAN (IEP)
2. INTERGRATED RESOURCE PLAN (IRP)
PUBLIC PARTICIPATIO N
PARLIAMENT
CABINET
ESKOM
- ELECTRICITY UTILITY
NERSA
- INDEPENDEN T REGULATORY
LEGEND
POSITIVE – LEGITIMATE (GREEN)
NEGATIVE (RED)
NEUTRAL (YELLOW)
NORMAL PROCEEDURE (BLACK)

Narrative of the Schematic Diagram

- The energy security, generation and supply are all matters that falls within the ambit and administrative control of the Department of Energy (DoE). The department was established following the promulgation and enactment of the 1998 White Paper on energy (DoE, 2008)
- The DoE uses the IEP and the IRP to ensure energy security in SA
- The IEP entails investigation of the electricity generation capacity and security of supply in a long term. It determines the future energy requirements and recommend actions to be taken by DoE
- Once the IEP has is promulgated following the legislative processes including cabinet approval, the IRP process commences
- The IRP is essentially the National Electricity Plan. The IRP in the main investigates the type of technology to deployed so as to meet the requirements promulgated in the IEP
- Both these processes involves public participation and this study has found that:
    - The participation of the public is not extensively inclusive
    - The awareness of the processes is poorly executed
    - The processes are inherently infiltrated with lobby groups advocating for their preferred type of technology with limited public interest
    - *This observation is denoted by a neutral marking to signify the challenges in the process flow*
- Once both the IEP and IRP are enacted, the DoE decides on the mode of delivery
- SA follows the SOE approach to energy generation, as a result the DoE grants Eskom permission to commence the process of procuring the technology in conformity to the IRP
- Megaproject for the purpose of this study is a delivery mode identified by the state Utility Eskom
- To implement the project, Eskom requires funding
- In the context of the current build Programme, the energy Megaproject are being funded through a Mixture of :
    - Loans from international organization such as the World Bank
    - Government bonds through the bond retail markets
    - Consumers through Tariff collection

- The loans enjoys sovereign guarantee which impacts the government's ability to borrow for other societal needs

- The Tariff collection is one of the contentious method of raising capital funding for energy Megaproject
- This electricity tariff adjustment process is regulated by NERSA through public consultation :
  - *The engagements between NERSA and the PUBLIC in this diagram are denoted by a neural line.*
  - These points to a biased consultation process by NERSA.
  - The study established that NERSA's roadshows are largely limited to affluent cities with no inclusion of people from underdeveloped areas

- The diagram shows the impact of energy Megaproject to the public and end users of electricity, it shows energy Megaproject have :
  - Negative impact to the cost of living
  - Negative impact to the cost electricity
  - Minimum contribution to the creation of sustainable of job opportunities
  - Positive impact to Training and development
  - Considerable impact to localization [This is limited largely to construction contracts benefitting the big construction firms]
  - Positive impact to the reliability of energy supply
  - The Capital cost per MW is higher than that of a small scale energy project

5.4 CONCLUSION

The study concludes that energy megaprojects are not legitimate and viable intervention to energy generation and supply challenges in South Africa.

The findings of the study have proven that the energy megaprojects yields undesired negative impact to end users, who are key stakeholders in relation to the State's legitimacy on power generation and delivery. These negative impacts render the energy megaprojects as not being legitimate interventions to deal with the power generation challenges in South Africa.

The study shows that in the context of South Africa, the decision making processes on energy megaprojects are not as inclusive as envisaged in the National Energy Act 1998 as amended and that applies to sub-set legislations and policies which include the Integrated Energy Plan and the Integrated Resource Plan. It became evident through the analysis of data that participation of the members of the public, who are financiers and consumers of electricity, is not prioritised when decisions on energy megaprojects are taken. The public consultation forums for the purposes of adopting the IEP and IRP is often limited to major cities and largely dominated by lobby groups and civil society organisations that may not necessarily have the interest of the end users as a priority.

The study further depicts that training and upskilling opportunities created through the implementation of the energy megaprojects are lauded by the end users of electricity and the public in general. At Medupi Power Station as a case in point, at least 3000 people benefited from a variety of training opportunities on offer during the construction phase of the project. The training provided will contribute to the skills pool in the skills scarce environment thus ensuring sustainable employment of beneficiaries.

The study found that the multitudes of jobs created through the development of energy megaprojects are not sustainable but rather limited to sectional completion of the respective construction activities.

One of the relevant pieces of information established during the course of this study is that the capital cost per megawatt in megaproject is higher than that of a small scale energy megaproject. It cost R 28 Million/MW to commission megaproject as opposed to R 26 Million/MW on a relatively small project. This bears testimony to the fact that the

megaprojects are not cost effective projects to delivering the much needed electricity generation plants.

As already established in literature, energy megaprojects involve expenditure in excess of R 10 Billion or US$ 1 Billion. One of the key questions relevant to the study has been whether these funds are expended through procurement of local goods and service within South Africa or to foreign companies. As noted in the analysis section of this study. As high as 55% of the funds at both Medupi and Ingula projects where expended through the procurement of local goods and services. This shows that the local communities and businesses do benefit economically through procurement of services and goods. However, like employment creation, these contracts and benefits are limited to the actual construction of the energy plants. The manufacturing portion with lucrative employment creation potential is allocated to the Original Equipment Manufacturers (OMEs).

The study further revealed the exponential rise in the cost of electricity per kilowatt hour since the inception of the energy megaproject build programme. The average cost of electricity rose from R 0.60/Kwh over the past decade to R 1.50/Kwh as of end of December 2017. It was expected that when investment into new power plants is made, the cost of electricity would spike reasonably, however, the persistent delays in completion of the energy megaprojects exacerbate the unit cost of electricity, thus impacting the consumers of electricity negatively. The unprecedented rise in the cost of electricity goes against the objectives of the Integrated Energy Plan (IEP).

On the basis of these findings and the multiplicity of risks associated with the energy megaprojects, it is clear that energy megaprojects:

- benefit the local businesses as over 55% of the project budget is expended locally
- benefit considerable number of job seekers for a limited duration and assist in providing training to a considerable number of unskilled
- benefit considerable number of job seekers and assist in providing training to a considerable number of unskilled people in relation to 8 Million unemployed people and 12.5 Million people who are not economically active in South Africa
- Are the least cost effective mode of electricity delivery in South Africa
- Are extremely expensive and takes longer duration to execute and complete thus burdening the electricity consumers through the persistent tariff hikes
- Leads to the rise in the cost of electricity per unit.

Legitimacy is defined by Suchman (1995) as a generalised perception or assumption that actions of the entity (The State in this regard) are desirable, proper, or appropriate within a socially constructed system of norms, values, beliefs, and definitions.

A deduction made on the basis of this definition, vividly shows that to the extent that the decisions and actions of the entity (State) are perceived to be contrary to the interest of the public, such decisions and actions would prove to be illegitimate. This is supported by Patel et al. (2005) in stating that organizational legitimacy is controlled by those outside the organization and thus relies on the organization maintaining a union of loyal stakeholders who have legitimacy determining power.

5.5 RECOMMENDATIONS

- In a country with limited financial resources, scarcity of skills and competing demands for the scarce monetary resources, energy megaprojects should be considered only as a last resort
- Energy security should be aligned to realistic economic development plans.
- Small to Medium scale energy projects should be pursued as opposed to megaproject - This will ensure successful project and power delivery
  - It will ensure agile response to power generation demand in an environment of economic uncertainty
- The development of mega energy plants (Power Stations such as Medupi) should be gradual self-funding processes. One unit at a time should be built instead of six. This is in conformity to the theory of logical incrementalism introduced by Quinn (1978)
- There is a need to develop and introduce the energy projects research and advisory body within the Department of Energy. This body or committee should be empowered to participate on all forms of energy projects from the conception to commissioning phase
- The IEP and the IRP should be prioritised and used effectively so as to ensure security of electricity generation in South Africa. These plans should manage and utilised as per the requirements of the National Energy Act 1998 as amended.
- The operation of existing electricity plants should be optimised and maintained in accordance to the technical requirements
- The consumers of electricity and tax payers should be involved when decisions on energy projects are taken.

5.6 BENEFITS/IMPORTANCE OF THE FINDINGS

The research findings would benefit all responsible stake holders within the energy sector; these include the companies responsible for energy generation, transmission and distribution; financiers of power plants; the government; policy makers within energy sector; energy project managers in general and most importantly the energy consumers.

The paradigm shift in concept, planning and development of energy projects would benefit each of the stakeholders as follow:

Financiers

- The elected projects would be more cost effective, thus requiring minimum cost of capital with a reasonably reduced payback period
- Project would be completed on time and within the budget, thus ensuring agility in and reliability repayment of borrowed funds
- A realistic budget for multiple long term projects for various plants would be drawn
- The plants would be evidently self-funding.
- The risk associated with currency fluctuation would be minimised as a result of the short-term project delivery
- Lessons learnt would be noticeable and implementable in other projects to ensure continuous improvement

Policymakers

- Project would be planned and executed in shorter period thus affording policymakers the opportunity to witness and consider the impact of their policy decisions
- The IEP and IRP would be updated on the basis of the prevailing energy conditions , thus limiting the risk of over investment and under investment
- The impact of the IEP and IRP would be realised within reasonable time frames, thus improving their effectiveness and enhancing agility in energy availability
- Localisation would be enhanced due to the sustained demand of the projects
- Job creation would improve as there would be certainty of energy generation and supply
- Consistency and balance between demand and supply would be realised since the electricity would be affordable

Government

- The generation and supply of electricity would be significantly improved, thus supporting the government's programme of electrification
- The spill over benefits to the economy would be maximised, investors in general would be induced to invest due to availability of energy
- Localisation would improve, thus growing the energy and manufacturing sectors of the economy. Smaller projects
- Job creation would improve as there would be certainty of energy generation and supply
- Electricity prices would be affordable, thus incentivizing the consumers to improve consumption.
- Consistency and balance between demand and supply would be realised since the electricity would be affordable
- There cost impact on consumers would be minimal as there would be no need for aggressive capital collection

General members of the public and consumers

- The inflation related price increase would ensure affordability to electricity consumers
- There would be no need for above inflation increases in the cost of electricity, ensuring affordability to consumers
- Security of energy generation and supply

5.7 EVALUATION OF THE RESEARCH APPROACH UNDERTAKEN

The study in the main focused on the three geographical areas within South Africa. This is the Cape region, Central region and the Northern regions. The data collection approach was based on the surveys and interviews of respective participants. These approach and associated benefits and challenges is discussed below.

Stratified Random Survey on Electricity Consumers

A stratified random survey was conducted to gather the opinions of the electricity consumers regarding the cost of electricity, security of electricity supply and the impact of energy megaprojects to their livelihood. Contrary to a target of 120 stated in chapter 3, a representative sample of 109 electricity consumers participated in the survey. The geographical spread is as follow: 36 participants from Gauteng; 23 participants from

Mpumalanga and 13 people from KwaZulu Natal Province and 21 from Limpopo and the balance of 16 Online through Survey Monkey.

The spread of locations has been key to ensuring divergent view, thus ensuring reliability and validity of the findings. It is commonly understood that participants within the areas where energy projects are commissioned would have different views and opinion to a participant from an area where there is no such development. As an example, an ordinary layman in Johannesburg would have a limited understanding of the impact of energy megaprojects than a person in Lephalale where Medupi is being built.

Convenience Sampling [Survey questionnaire – Professionals within the Energy Sector]

A convenience random survey was adopted to gather the opinions of the professionals within the energy megaprojects and energy sector in general. A questionnaire was used to probe the opinions and perceptions of these professionals as experts involved in electricity sector on matters pertinent to energy megaprojects in South Africa. A total number of 23 professionals completed the questionnaire.

Purposive Sampling [Interviews – Professionals within the Energy Sector]

The purposive sampling technique, also called judgement sampling, was adopted to selecting the participants on the structured – Interview part of the data collection. As stated explained by Estikan et al. (2016), it is deliberate choice of a participant due to the qualities they possesses.

Out of a total of twenty three professionals that participated in completing the questionnaire referred to above, nine agreed to participate in a semi-structured interview part of the data collection process. These professionals involved in the energy sector where interviewed with a view of obtaining a broader understanding of the dynamics of the megaproject phenomena in the context of South Africa. These interviews were semi-structured so as to broaden the probe on matters that arise during the course of the interviews.

Purposive Sampling [Questionnaire – Representatives of organised labour]

A questionnaire was sent to the representatives of labour unions were with a view of obtaining their opinions and experience on the energy megaprojects with regard to job creation; procurement from local businesses and the benefits derived by communities from these megaprojects.

5.8 CHALLENGES EXPERIENCED UNDERTAKING THE STUDY

Accessibility of the megaproject officials has proven to be mountainous task and as a result the information was sourced from the professionals within the energy megaprojects and the energy sector in general. The leadership changes within the political spheres, the country and the State Owned Enterprises may be some of the reasons that limited accessibility of officials as envisaged.

Obtaining the accurate cost information in relation to these projects has proven to be challenging than initially envisaged. It is partly for this reason that reliance was placed on the professionals to formulate solutions to the research questions. Alternative sources of official information such as the Audited Financial Statements assisted greatly in providing cost information.

The information obtained from primary sources has proven to be more useful than the information contained in the media.

5.9 POSSIBILITIES FOR FURTHER RESEARCH

The phenomenon of energy megaprojects is notably an unchartered territory in the context of the South African energy sector. As established in literature, megaproject are characterised by disruption, in both economic and social spheres, they bring with unspoken promise of hope, prosperity and unprecedented economic growth. Literature further informed us that the key risk in relation to these types of projects is that they may be causes of mega indebtedness, infrastructure stagnation and poverty in developing countries.

It is recommended that further research be conducted on the economic funding model and the efficient implementation of the energy projects in general. These should deliberately include the analysis of alternatives to energy megaprojects.

The success of such a research studies would contribute to the reduction on the capital cost of finance, sovereign debt and the cost of electricity. The study would also contribute to ensuring efficiency in the implementation of energy projects.

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APPENDICES

This section outlines the instruments used to collect data. These are as follow

APPENDIX A

- A1 - Questionnaires: Medupi Energy Megaproject – Professionals at Medupi Project and professionals in the energy sector
- A2 - Questionnaires: Ingula Energy Megaproject – Professionals who participated in the execution phase of the project and professionals in the energy sector
- A3 - Questionnaires: Sere Energy Wind Farm – Professionals who participated in the execution phase of the project and professionals in the energy sector

APPENDIX B

- B1 - Questionnaires: Organised Labour – Officials of the labour unions within the energy sector

APPENDIX C

- C1 - Survey to End users and consumers of electricity in South Africa

APPENDIX D

- D1 - Semi-Structured Interviews: Professionals in the energy sector
- D2 - Analysis of the semi structured interviews using data analysis spiral method

A1 - Questionnaires: Medupi Energy Megaproject - Professionals

The University of the Witwatersrand
Faculty of Engineering and Built Environment
School of Construction Economics and Management

Programme: MSc Construction Project Management

All data collected in this Questionnaire will be used for academic research purpose only. Your responses are therefore confidential. No individual details will be used in reports in the report in any form.

Please fill in this questionnaire and return it by no later than 05 March 2018

FEEL FREE TO FORWARD YOUR QUERIES about this research, or any other question you may have regarding this questionnaire to us or to the School of Construction Economics and Management (University of the Witwatersrand).

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Administrator CEM: (011) 717 7651

Your participation and input in this study is greatly valued and the outcome of the study will be available at the University should you be interested.

Medupi Energy Megaprojects Power Station

1. What was the approved budget for Medupi Power Station [Billion Rands]?

☐ 30 - 60 ☐ 60 - 75 ☐ 75 - 85 ☐ 85 – 110 ☐ 110 – 150

2. What is the highest number of direct Jobs created by Medupi Power Project?

☐ 500 - 1000 ☐ 1000 - 5000 ☐ 5 001 – 10 000 ☐ 10 001 – 20 000

3. Of this number, how many where Local to South Africa?

☐ 10% - 30% ☐ 30% - 50% ☐ 50% - 75% ☐ 75%+

4. What is the Estimated Final Cost of Medupi Power Station [Billion Rands]?

☐ 30 - 60 ☐ 60 - 75 ☐ 75 - 85 ☐ 85 – 110 ☐ 110 – 150

5. Of this value, how much would be expended to Local South African businesses? (These are businesses registered as Local businesses with the registrar of companies)

☐ 10% - 30% ☐ 30% - 50% ☐ 50% - 75% ☐ 75%+

6. Of this value, how much would be expended to the Local communities (The communities within the Waterberg district)?

☐ 0% - 5% ☐ 5% - 10% ☐ 10% - 20% ☐ 20%+

7. How would you rate the socio-economic impact of Medupi Power Station to the Lephalale and the broader Waterberg district? Please explain the reason.

☐ 5. Positive ☐ 1. Negative

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8. How many people have been trained through Medupi Power Project (Training Programmes Accredited by the SAQA)?

☐ 0 - 500 ☐ 500 - 2000 ☐ 2000 - 3000 ☐ 3000+

9. In light of the energy Megaproject being built currently in SA – Would you say that the 8 key objectives of the Integrated Energy Plan [IEP] are met? [Please choose One – Focusing on Medupi]

☐ Yes ☐ No

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10. With reference to Medupi project – Please rate the performance against these objectives? [Please use 1 to 5: Wherein 1 is the lowest Score (Poor) and 5 is the highest Score (Exceptional)]

10.1 Ensuring Security of Energy Supply

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.2 Minimizing the Cost of Energy

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.3 Promoting Job Creation and Localization

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.4 Minimizing Environmental Impacts

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.5 Minimizing Water Consumption

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.6 Diversifying Supply Resources

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.7 Promoting Energy Efficiency

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.8 Promoting Access to Energy

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

11. In your opinion, would you consider Medupi Megaproject as being successful? [In relation to Project Time, Project Cost]

☐ 1. Yes ☐ 2. No

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12. In your opinion, would you consider Medupi Megaproject as being successful? [In relation to benefits to Local communities and broader South Africans]

☐ 1. Yes ☐ 2. No

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12. Would you say that sufficient time and resources are invested at the concept phase of the project to inform the decision making process on Energy Megaproject in South Africa?

☐ 1. Yes ☐ 2. No

A2 - Questionnaires: Ingula Energy Megaproject

Research topic: An exploratory study on the legitimacy of energy megaprojects in South Africa

The University of the Witwatersrand
Faculty of Engineering and Built Environment
School of Construction Economics and Management

Programme: MSc Construction Project Management

All data collected in this Questionnaire will be used for academic research purpose only. Your responses are therefore confidential. No individual details will be used in reports in the report in any form.

Please fill in this questionnaire and return it by no later than 05 March 2018

FEEL FREE TO FORWARD YOUR QUERIES about this research, or any other question you may have regarding this questionnaire to us or to the School of Construction Economics and Management (University of the Witwatersrand).

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Your participation and input in this study is greatly valued and the outcome of the study will be available at the University should you be interested.

A2 - Ingula Power Station

1. What was the approved budget for Ingula Power Station [Billion Rands]?

☐ 30 - 60 ☐ 60 - 75 ☐ 75 - 85 ☐ 85 – 110 ☐ 110 – 150

2. What is the highest number of direct Jobs created by Ingula Power Project?

☐ 1 000 – 5 000 ☐ 5 001 – 10 000 ☐ 10 001 – 15 000 ☐ 15 001 – 20 000

3. Of this number, how many where Local to South Africa?

☐ 10% - 30% ☐ 30% - 50% ☐ 50% - 75% ☐ 75%+

4. What is the Estimated Final Cost of Ingula Power Station [Billion Rands]?

☐ 30 - 60 ☐ 60 - 75 ☐ 75 - 85 ☐ 85 – 110 ☐ 110 – 150

5. Of this value, how much would be expended to Local South African businesses? (These are businesses registered as Local businesses with the registrar of companies)

☐ 10% - 30% ☐ 30% - 50% ☐ 50% - 75% ☐ 75%+

6. Of this value, how much would be expended to the Local communities (The communities within the Thabo Mofutsanyana / UThukela district Municipalities)?

☐ 0% - 5% ☐ 5% - 10% ☐ 10% - 20% ☐ 20%+

7. How would you rate the socio-economic impact of Ingula Power Station to the Thabo Mofutsanyana / UThukela district Municipalities? Please explain the reason.

☐ 5. Positive ☐ 1. Negative

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8. How many people have been trained through Ingula Power Project (Training Programmes Accredited by the SAQA)?

☐ 0 - 500 ☐ 500 - 2000 ☐ 2000 - 3000 ☐ 3000+

9. In light of the energy Megaproject being built currently in SA – Would you say that the 8 key objectives of the Integrated Energy Plan [IEP] are met? [Please choose One – Focusing on Ingula]

☐ Yes ☐ No

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9. With reference to Ingula project – Please rate the performance against these objectives.
[Please use 1 to 5: Wherein 1 is the lowest Score (Poor) and 5 is the highest Score (Exceptional)]

10.1 Ensuring Security of Energy Supply

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.2 Minimizing the Cost of Energy

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.3 Promoting Job Creation and Localization

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.4 Minimizing Environmental Impacts

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.5 Minimizing Water Consumption

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.6 Diversifying Supply Resources

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.7 Promoting Energy Efficiency

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.8 Promoting Access to Energy

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

11. In your opinion, would you consider Ingula Megaproject as being successful? [In relation to Project Time, Project Cost]

☐ 1. Yes ☐ 2. No

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12. In your opinion, would you consider Ingula Megaproject as being successful? [In relation to benefits to Local communities and broader South Africans]

☐ 1. Yes ☐ 2. No

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12. Would you say that sufficient time and resources are invested at the concept phase of the project to inform the decision making process on Energy Megaproject in South Africa?

☐ 1. Yes ☐ 2. No

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A3 - Questionnaires: Sere Wind Farm Energy Project - Professionals

The University of the Witwatersrand
Faculty of Engineering and Built Environment
School of Construction Economics and Management

Programme: MSc Construction Project Management

All data collected in this Questionnaire will be used for academic research purpose only. Your responses are therefore confidential. No individual details will be used in reports in the report in any form.

Please fill in this questionnaire and return it by no later than 05 March 2018

FEEL FREE TO FORWARD YOUR QUERIES about this research, or any other question you may have regarding this questionnaire to us or to the School of Construction Economics and Management (University of the Witwatersrand).

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Your participation and input in this study is greatly valued and the outcome of the study will be available at the University should you be interested.

A3 - Sere Wind Farm Power Station

1. What was the approved budget for Sere Wind Farm Power Station [Billion Rands]?

☐ 30 - 60 ☐ 60 - 75 ☐ 75 - 85 ☐ 85 – 110 ☐ 110 – 150

2. What is the highest number of direct Jobs created by Sere Wind Farm Power Project?

☐ 1 000 – 5 000 ☐ 5 001 – 10 000 ☐ 10 001 – 15 000 ☐ 15 001 – 20 000

3. Of this number, how many where Local to South Africa?

☐ 10% - 30% ☐ 30% - 50% ☐ 50% - 75% ☐ 75%+

4. What is the Estimated Final Cost of Sere Wind Farm Power Station [Billion Rands]?

☐ 30 - 60 ☐ 60 - 75 ☐ 75 - 85 ☐ 85 – 110 ☐ 110 – 150

5. Of this value, how much would be expended to Local South African businesses (These are businesses registered as Local businesses with the registrar of companies?

☐ 10% - 30% ☐ 30% - 50% ☐ 50% - 75% ☐ 75%+

6. Of this value, how much would be expended to the Local communities (The communities within the Vredendal / Matzikama Municipality district)?

☐ 0% - 5% ☐ 5% - 10% ☐ 10% - 20% ☐ 20%+

7. How would you rate the socio-economic impact of Sere Wind Farm Power Station to the Vredendal / Matzikama Municipality district? Please explain the reason.

☐ 5. Positive ☐ 1. Negative

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8. How many people have been trained through Sere Wind Farm Power Project (Training Programmes Accredited by the SAQA)?

☐ 0 - 500 ☐ 500 - 2000 ☐ 2000 - 3000 ☐ 3000+

9. In light of the energy projects being built currently in SA – Would you say that the 8 key objectives of the Integrated Energy Plan [IEP] are met? [Please choose One – Focusing on Sere Wind Farm]

☐ Yes ☐ No

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With reference to Sere Wind Farm project – Please rate the performance against these objectives. [Please use 1 to 5: Wherein 1 is the lowest Score (Poor) and 5 is the highest Score (Exceptional)]

10.1 Ensuring Security of Energy Supply

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.2 Minimizing the Cost of Energy

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.3 Promoting Job Creation and Localization

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.4 Minimizing Environmental Impacts

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.5 Minimizing Water Consumption

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.6 Diversifying Supply Resources

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.7 Promoting Energy Efficiency

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

10.8 Promoting Access to Energy

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

11. In your opinion, would you consider Sere Wind Farm Projects as being successful? [In relation to Project Time, Project Cost]

☐ 1. Yes ☐ 2. No

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12. In your opinion, would you consider Sere Wind Farm Projects as being successful? [In relation to benefits to Local communities and broader South Africans]

☐ 1. Yes ☐ 2. No

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12. Would you say that sufficient time and resources are invested at the concept phase of the energy projects to inform the decision making process on Energy Projects in South Africa?

□ Agree □ strongly agree □ Dis-agree □ Strongly-Disagree

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B1 - Questionnaires to the Labour Organizations

The University of the Witwatersrand
Faculty of Engineering and Built Environment
School of Construction Economics and Management

Programme: MSc Construction Project Management

All data collected in this Questionnaire will be used for academic research purpose only. Your responses are therefore confidential. No individual details will be used in reports in the report in any form.

Please fill in this questionnaire and return it by no later than 05 March 2018

FEEL FREE TO FORWARD YOUR QUERIES about this research, or any other question you may have regarding this questionnaire to us or to the School of Construction Economics and Management (University of the Witwatersrand).

Researchers Details

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Your participation and input in this study is greatly valued and the outcome of the study will be available at the University should you be interested.

1. How would you rate the cost of electricity in South Africa?

   □ Very High □ High □ Fair □ Low □ Very Low

2. How would you describe /rate the state of Electricity Supply in South Africa?

   □ 6. Excellent □ 5.Very good □ 4.Good □ 3. Fair □ 2. Poor □ 1.Very poor

3. Are you aware of the public consultation process conducted by NERSA on electricity tariff hikes?

   □Yes □ No

4. Does your organization participate in the public consultation forums/discussions on electricity price increases?

   □ Yes □ No

5. Do you think that the public reaps benefits through construction of the projects such as Medupi and Ingula Projects?

   □Yes □ No

Please share your opinion on the following statements

6. Optimum Job opportunities are created through the construction of projects such as Medupi and Ingula Projects for the benefit of local unemployed people.

   □Agree □ strongly agree□ Dis-agree □ Strongly-Disagree

7. Optimum training opportunities are created through the construction of projects such as Medupi and Ingula for the benefit of local unemployed and unskilled people.

   □Agree □ strongly agree□ Dis-agree □ Strongly-Disagree

8. Local businesses reap the benefits from the projects such as Medupi and Ingula

   □Agree □ strongly agree□ Dis-agree □ Strongly-Disagree

9. Local businesses benefits more than foreign businesses through the commissioning of energy Megaproject in South Africa.

   □Agree □ strongly agree□ Dis-agree □ Strongly-Disagree

10. It is justifiable to use the public funds to develop energy Megaproject [Medupi and Ingula]

□Agree □ strongly agree□ Dis-agree □ Strongly-Disagree

11. Any other comment pertaining to the impact of energy Megaproject in South Africa.

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C1 - Questionnaires to Electricity Consumers in South Africa

The University of the Witwatersrand
Faculty of Engineering and Built Environment
School of Construction Economics and Management

Programme: MSc Construction Project Management

All data collected in this Questionnaire will be used for academic research purpose only. Your responses are therefore confidential. No individual details will be used in reports in the report in any form.

Kindly fill in this questionnaire and return it by no later than 05 March 2018

FEEL FREE TO FORWARD YOUR QUERIES about this research, or any other question you may have regarding this questionnaire to us or to the School of Construction Economics and Management (University of the Witwatersrand).

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Your participation and input in this study is greatly valued and the outcome of the study will be available at the school should you be interested.

C1 - Questionnaires to Electricity Consumers in South Africa

1. Do you have access to Electricity at Home?

   □ Yes □ No

2. How long have you been an electricity consumer?

   □ More than 12 Years □ Less Than 12 Years

3. How would you rate the cost of electricity in South Africa?

   □ Very High

   □ High

   □ Fair

   □ Low

   □ Very Low

4. How much are you paying for Electricity now?

   □ R0 – R0.60/kilowatt

   □ R 0.60 – R 1.20/Kilowatt

   □ R 1.20 – R 1.80/Kilowatt

   □ >R 1.80/Kilowatt

5. How much where you paying 6 years ago?

   □ R0 – R0.60/kilowatt

   □ R 0 – R 1.20/Kilowatt

   □ R 1.20 – R 1.80/Kilowatt

   □ >R 1.80/Kilowatt

6. How would you describe /rate the state of Electricity Supply in South Africa?

   □ 6. Excellent □ 5.Very good □ 4.Good □ 3. Fair □ 2. Poor □ 1.Very poor

7. Are you aware of the public consultation process conducted by NERSA on electricity tariff hikes?

   □Yes □ No

8. Have you ever participated in the public consultation forums/discussions on electricity price increases?

   □ Yes □ No

9. Do you think that the public reaps benefits through construction of the projects such as Medupi and Ingula Projects?

   □Yes

   □ No

Please share your opinion on the following statements

10. Optimum Job opportunities are created through the construction of projects such as Medupi and Ingula Projects for the benefit of local unemployed people.

    □Agree

    □ strongly agree

    □ Dis-agree

    □ Strongly-Disagree

11. Optimum training opportunities are created through the construction of projects such as Medupi and Ingula Projects for the benefit of local unemployed and unskilled people.

    □ Agree

    □ strongly agree

    □ Dis-agree

    □ Strongly-Disagree

12. Local businesses reap the benefits from the projects such as Medupi and Ingula?

    □Agree

    □ strongly agree

    □ Dis-agree

    □ Strongly-Disagree

13. It is justifiable to use the public funds to develop energy Megaproject [Medupi and Ingula]?

- Agree
- strongly agree
- Dis-agree
- Strongly-Disagree

14. What would you consider to be the impact of energy Megaproject to the electricity consumers and the broader public (Medupi, Kusile and Ingula)?

- They lead to the reduction in the cost of Electricity
- They create job opportunities for the locals
- they open up business opportunities for the local
- They contribute to training and development of specialized skills in the energy sector
- They contribute to globalization through consumption of foreign manufactured products and services
- They contribute to the development of the local manufacturing sector
- They contribute to the rising cost of electricity
- They contribute to the rise in the cost of living
- They contribute to closure and down-scaling of energy intensive businesses due to the high cost of electricity
- They indirectly contribute to joblessness
- They are of no benefit to South Africa

15. Any other comment pertaining to the financial impact of electricity cost in South Africa.

……

……

……

D1 - Semi- Structured Interviews to the Professionals in the energy sector

Research topic: An exploratory study on the legitimacy of energy megaprojects in South Africa

The University of the Witwatersrand
Faculty of Engineering and Built Environment
School of Construction Economics and Management

Programme: MSc Construction Project Management

All data collected through this Interview will be used for academic research purpose only. Your responses are therefore confidential. No individual details will be used in reports in the report in any form.

Please fill in this questionnaire and return it by no later than 5 March 2018

FEEL FREE TO FORWARD YOUR QUERIES about this research, or any other question you may have regarding this questionnaire to us or to the School of Construction Economics and Management (University of the Witwatersrand).

Researchers Details

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Your participation and input in this study is greatly valued and the outcome of the study will be available at the University should you be interested.

Research topic: An Exploratory Study on the legitimacy of energy megaproject in South Africa

D1 - Semi- Structured Interviews to the Professionals in the energy sector

1. Briefly share your impression of the impact of energy Megaproject being commissioned in South Africa to the country in generally (Social and economic).

……

……

……

……

2. What is your opinion on the decision making process on Energy Projects in South Africa?

……

……

……

……

3. Based on your observation – Which of the following two factors weighs heavily when decisions on energy projects are taken? [Please choose One and elaborate]

☐ 1. Financial Factors (Cost)

☐ 2. Energy Security

4. In your opinion – Which of these factors would you consider to weigh heavily when decisions on energy projects are taken? [Please choose one]

☐ 1. Social Economic Factors (Cost)

☐ 2. Energy Security

5. In light of the energy Megaproject being built currently in SA – Would you say that the 8 key objectives of the Integrated Energy Plan [IEP] as are met? [Please choose one and elaborate]. These objectives are as follow: Security of Energy Supply; minimizing the cost of energy; promoting job creation and localization; minimizing environmental impacts; minimizing water consumption; diversifying supply resources; promoting energy efficiency; and promoting access to energy

☐ 1. Yes

☐ 2. No

……

……

……

……

6. In light of the energy Megaproject being implemented (Medupi and Ingula Project) – Please rate the performance of these projects against these objectives? [Please use 1 to 5: Wherein 1 is the lowest Score (Poor) and 5 is the highest Score (Exceptional)]

6.1 Ensuring Security of Energy Supply

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

6.2 Minimizing the Cost of Energy

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

6.3 Promoting Job Creation and Localization

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

6.4 Minimizing Environmental Impacts

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

6.5 Minimizing Water Consumption

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

6.6 Diversifying Supply Resources

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

6.7 Promoting Energy Efficiency

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

6.8 Promoting Access to Energy

☐ **1** ☐ **2** ☐ **3** ☐ **4** ☐ **5**

7. Which of the above IEP objectives would you consider to be the most important/deal makers when decisions on Energy Megaproject are taken? [Please List Five in the order of priority]

7.1……

7.2……

7.3……

7.4……

7.5……

8. In your opinion, would you say it is justified to commission the energy Megaproject in South Africa? [Please elaborate]

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9. Would you say that sufficient time and resources are invested at the concept phase of the project to inform the decision making process on Energy Megaproject in South Africa?

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10. Is Public participation embraced in the decision making processes on energy Megaproject? [Please Elaborate]

☐ 1. Yes ☐ 2. No

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11. What is your impression of the public participation in the decision making processes on energy projects?

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12. In your opinion, what is the economic Impact of the Energy Megaproject to electricity Consumers in South Africa?

- Negative [The Cost is High]
- Positive [Reduction in Cost to Consumers]

13. Would you consider the funding model for Energy Megaproject in South Africa viable and sustainable? Please Elaborate

☐ 1. Yes ☐ 2. No

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14. Would you consider the decisions to pursue energy Megaproject in South Africa legitimate in relation to performance of the projects pertaining to Cost, time and benefits of the projects? Please Elaborate

☐ 1. Yes ☐ 2. No

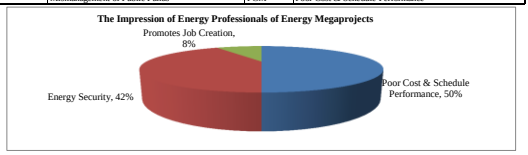
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4.2.4.1 The impression of energy Megaprojects by professionals

Respondents	Responses	Common Themes	Codes	Primary Theme
Respondent 1	Medupi project is long overdue, there seems to be a deep rooted challenge with implemenetation of such projects. On a positive side, it has assisted to avert loadshedding in recent months, especially since the completion of two units at Medupi and One at Kusile	Delayed Completion	PCM	Poor Cost & Schedule Performance
		Contributed positively to energy Security	Esecu	Energy Security
Respondent 2	These projects have contributed greatly to ensuring power supply to power the economy. One key matter to note however is that they are running behind schedule and are as media reports suggests, overbudget	Contributed positively to energy Security	Esecu	Energy Security
			PCM	Poor Cost & Schedule Performance
Respondent 3	Medupi and Kusile are important for the growth and development of the economy. We need sufficient energy supply to grow various economic sectors and issue the emergence of new industrialists.	Contributed positively to energy Security	Esecu	Energy Security
Respondent 4	Medupi project is important for security of supply. Sectors such as mining and manufacturing which are back bones of the economy requires sufficient energy supply to thrive. So these projects are very important	Contributed positively to energy Security	Esecu	Energy Security
Respondent 5	Kusile and Medupi have been used as proxies to loot state coffers. The economic benefits derived out of these projects are limited, majority of people are still unemployed and are likely to remaining so even after the completion of these projects.	Mismanagement of Public Funds	PCM	Poor Cost & Schedule Performance
Respondent 6	My impression is that these projects are important for as long as they are executed responsibly and with utmost accountability for the public funds. My impression is that Medupi was started without proper planning and as a result decisions were made in the dark, hence the results we see today. It must however be acknowledged that the power generated through these projects is welcomed although expensive	Contributed positively to energy Security	Esecu	Energy Security
			PCM	Poor Cost & Schedule Performance
Respondent 7	These projects have been hijacked are used as vehicles to promote corruption. There was absolutely no need to build two of these project. One big project could have sufficed. These project are yet to be completed tens years since the respective start dates	Mismanagement of Public Funds	PCM	Poor Cost & Schedule Performance
Respondent 8	In terms of skills development and training of young technicians and engineers, these projects have assisted greatly. Yes, they are late in terms of project deliverables, however, the benefits in terms of skills and power generation will last for ever.	Promotes Job Creation	PJC	Promotes Job Creation
Respondent 9	My impression is that renewables through public funding could have been executed instead of Medupi and Kusile. As it stands, these projects are not completed and Eskom is alleging that has run out of funds. These projects are welcomed, as long as they are not funded by the taxpayer	Mismanagement of Public Funds	PCM	Poor Cost & Schedule Performance

Codes	Statistics	
	Frequency	
PCM	Poor Cost & Schedule Performance	6
Esecu	Energy Security	5
PJC	Promotes Job Creation	1
		12

Proportion	
Poor Cost & Schedule Performance	50%
Energy Security	42%
Promotes Job Creation	8%
	100%



4.2.4.2. What is your opinion on the decision making process on Energy Projects in South Africa?

Question	Responses	Common Themes	Codes	Primary Theme
Respondent 1	These process is limited to government officials and Eskom. Members of the public do not get to participate directly	Limited to State Officials	SO	State Officials and Parastatals
Respondent 2	The decisions are taken by the government	Limited to State Officials	SO	State Officials and Parastatals
Respondent 3	The process is driven by the Deprtment of Energy through the IEP and the National Electricity plan. I am not sure if ordinary members of the public get to participate	Limited to State Officials	SO	State Officials and Parastatals
Respondent 4	The process is not open to public scrutiny. We only get to hear that projects so and so has been approved, or in most instances awarded	Limited to State Officials	SO	State Officials and Parastatals
Respondent 5	The process is not inclusive, although the Department of Energy conducts the roadshows, these roadshows accommodates the views of lobby groups such as OUTA and Greenpeace more than the individual members of the public	Limited to State Officials and Looby Groups	SL	State Officials and Lobby Groups
Respondent 6	The decision making process is only privy to the state officials, that is the Department of Energy and the Cabinet. Decisions are taken at those levels	Limited to State Officials	SO	State Officials and Parastatals
Respondent 7	The decision making process is limited to the Department of Energy and Eskom. The public is generally not invited to participate. Members of the public are only invited when policies are drafted but not on electing specific projects	Limited to State Officials	SO	State Officials and Parastatals
Respondent 8	The decision is taken by Eskom and government officials.	Limited to State Officials	SO	State Officials and Parastatals
Respondent 9	As I have already mentioned, these projects are welcomed, as long as they are funded by the private companies and not the state	Other		

Statistics

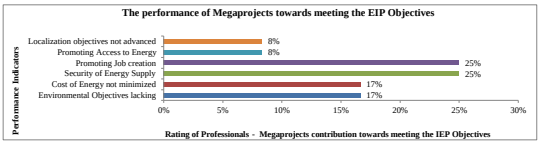
Frequency	
State Officials and Parastatals	7
State Officials and Lobby Groups	1
	8

Proportion	
State Officials and Parastatals	88%
State Officials and Lobby Groups	13%
	100%

4.2.4.3 **In light of the energy Megaproject being built currently in SA – Would you say that the 8 key objectives of the Integrated Energy Plan [IEP] as are met? [Please Elaborate]. These objectives are as follow: Security of Energy Supply; minimizing the cost of energy; promoting job creation and localization; minimizing environmental impacts; minimizing water consumption; diversifying supply resources; promoting energy efficiency; and promoting access to energy**

Question	Responses	Themes of Corncern	Codes	Primary Theme	Codes
Respondent 1	Yes, but not entirely. The projects have created only a handfull job opportunities for the locals, the impact to the environment has been dire, look at Ingula as a case in point, there has been massive displacement of naturals species. Medupi and Kusile are coal powered and therefore do not advance the diversification aspiration.	Environmental Objectives lacking	EOL	Environmental Objectives not promoted	1
Respondent 2	No. The Cost of electricty keeps rising, sometimes prices increases twice a year, the security of energy supply stands on a shaky ground as we are made aware of the possibility of loadshedding from time to time	Cost of Energy not minimized	CEM	Cost of Energy not minimized	1
Respondent 3	Yes, there has been no loadshedding for about a year now. Thanks to the completion of some units at Medupi and Kusile, Over 20 000 people have been employed and more and more people are connected to the grid.	Security of Energy Supply	SES	Security of Energy Supply	1
		Promoting Jobs creation	PJC	Promoting Job creation	1
Respondent 4	Not all objectives have been met but there has been some considerable headway especially with regards to promoting access to energy and effeciency in energy usage. Supply has somewhat improved. The rest of the objectives have not been met. For example, the employment opportunities created were largely for fixed term positions with only few people expected to be employed permanently. On localization, most of the specialised engineering equipment from the OME's has been imported from western Countries	Promoting Access to Energy	PATE	Promoting Access to Energy	1
		Localization objectives not advanced	LONA	Localization objectives not advanced	1
Respondent 5	Not all objectives have been met. The energy supply has improved, the cost of energy has increased heavily, some jobs have been created, although largely on temporary basis, localization is very minimal because most equipments are from other countries such as Germany, the environment has obviously been impacted, but local communities have benefitted, two of the these three projects are coal fired, so no diversification there	Security of Energy Supply	SES	Security of Energy Supply	1
Respondent 6	The objectives have somewhat been met but not entirely. I am of the opinion that meeting these eight objectives is impossible as energy plants are complex projects. The impact to the environment is often a given in these types of projects. There cannot be fire without smoke, so air polution has been one of the negative impacts. In stead of building these coal based projects, renewables could have been built	Environmental Objectives lacking	EOL	Environmental Objectives not promoted	1
Respondent 7	Yes, some of the objectives have been met, for example : the energy supply has stabilised, more jobs have been created and local communities have benefited.	Security of Energy Supply	SES	Security of Energy Supply	1
		Promoting Jobs creation	PJC	Promoting Job creation	1
Respondent 8	To say that an effort to meet these has not been made would be unfair. Since the beginning of these projects more and more people benefited through employment and training opportunities, the towns that were previously small has grown to mini-cities and there has been more people have received electricity	Promoting Jobs creation	PJC	Promoting Jobs creation	1
Respondent 9	Some objectives have been met. The point of contention with regard to these projects is the amount of money expended. These could have been used to build schools, new roads and new settlements. The government could have outsourced these to the private sector and rather focus on improving the infrastructure	Cost of Energy not minimized	CEM	Cost of Energy not minimized	1
					12

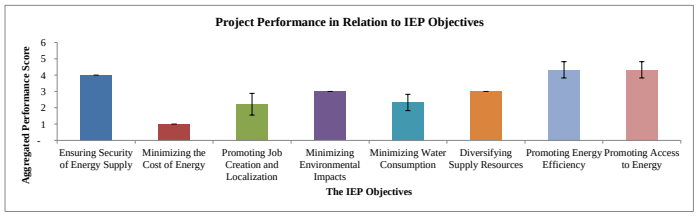
	Count	Statistics	Observations (x)
		Frequency	
	EOL	Environmental Objectives not promoted	2
	CEM	Cost of Energy not minimized	2
	SES	Security of Energy Supply	3
	PJC	Promoting Job creation	3
	PATE	Promoting Access to Energy	1
	LONA	Localization objectives not advanced	1
			12
			6
		Proportion	
	EOL	Environmental Objectives lacking	17%
	CEM	Cost of Energy not minimized	17%
	SES	Security of Energy Supply	25%
	PJC	Promoting Job creation	25%
	PATE	Promoting Access to Energy	8%
	LONA	Localization objectives not advanced	8%
			100%



4.2.4.4 In light of the energy Megaproject being implemented (Medupi and Ingula Project) – Please rate the performance of these projects against these objectives? [Please use 1 to 5: Wherein 1 is the lowest Score (Poor) and 5 is the highest Score (Exceptional)]

The Project performance Against the 8 Objectives of the IEP

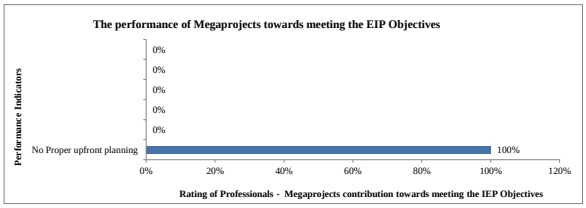
Objectives	MEAN	Respondents 1	Respondent 2	Respondent 3	Respondent 4	Respondents 5	Respondent 6	Respondent 7	Respondent 8	Respondents 9
Ensuring Security of Energy Supply	**4**	4	4	4	4	4	4	4	4	4
Minimizing the Cost of Energy	**1**	1	1	1	1	1	1	1	1	1
Promoting Job Creation and Localization	**2**	3	3	3	2	2	2	2	2	1
Minimizing Environmental Impacts	**3**	3	3	3	3	3	3	3	3	3
Minimizing Water Consumption	**2**	2	2	2	2	3	3	3	2	2
Diversifying Supply Resources	**3**	3	3	3	3	3	3	3	3	3
Promoting Energy Efficiency	**4**	4	4	5	4	4	4	5	4	5
Promoting Access to Energy	**4**	4	4	4	5	4	4	4	5	5



4.2.4.5 **Would you say that sufficient time and resources are invested at the concept phase of the project to inform the decision making process on Energy Megaproject in South Africa?**

Question	Responses	Themes of Corncern	Codes	Primary Theme	Codes
Respondent 1	Medupi was started hastily, this is because of the loadshedding experienced in 2008. To say that there was suffucient time for planning and so forth would be a falacy	No proper upfront Planning	Npup	No Proper upfront planning	1
Respondent 2	My view is that South Africa had no skills to build these projects. We needed more time to understand the associated complexities before embarking on major investment, however, as you know - there was the issue of loadshedding which somehow forced our hand into building	No proper upfront Planning	Npup	No Proper upfront planning	1
Respondent 3	I do not think so. We were not ready, hence we employed the services of multinational consultants to carryout the engineering work	No proper upfront Planning	Npup	No Proper upfront planning	1
Respondent 4	No. Resources were not invested upfront for proper planning. The project was executed on a fast-track basis.	No proper upfront Planning	Npup	No Proper upfront planning	1
Respondent 5	No planning was done upfront on Medupi, and possibly on Kusile. These projects were executed at a sonic speed due to the power crises that was looming in 2007/2008.	No proper upfront Planning	Npup	No Proper upfront planning	1
Respondent 6	No. sufficient resources and time are not made available at a concept phase to prepare for successful implementation - Projects are often delayed and then rushed when reality hits	No proper upfront Planning	Npup	No Proper upfront planning	1
Respondent 7	No resources are ever invested in projects that are not certain. As you know, Medupi and Kusile were never certainties until the first big tenders were awarded for Civil work.	No proper upfront Planning	Npup	No Proper upfront planning	1
			Npup	No Proper upfront planning	1
Respondent 8	Had there been proper planning from the beggining, they could have been long completed	No proper upfront Planning	Npup	No Proper upfront planning	1
Respondent 9	In my opinion, suffient time was not given	No proper upfront Planning	Npup	No Proper upfront planning	1
					10

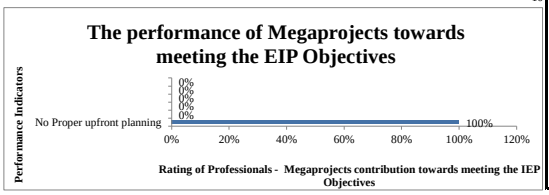
Count	Statistics	Observations (x)
	Frequency	
Npup	No Proper upfront planning	10
		0
		0
		0
		0
		0
		10
		6
	Proportion	
Npup	No Proper upfront planning	100%
		0%
		0%
		0%
		0%
		0%
		100%



4.2.4.6 **4.2.4.6 In your opinion, what is the economic Impact of the Energy Megaproject to electricity Consumers in South Africa?**

Question	Responses	Themes of Corncern	Codes	Primary Theme	Codes
Respondent 1	The cost of electricity/unit has been consistently rising at almost 20% annually since the inception of these projects. Poor people are unable to afford it, some are using other sources such as solar geysers, gas etc. for daily use. The impact is absolutely negative	The Impact is Negative to the Consumer	Neg	The Impact is Negative to the Consumer	1
Respondent 2	The impact is extremely negative to the public, more especially the poor. It may be a reason why some Muncipalities are unable to pay Eskom	The Impact is Negative to the Consumer	Neg		1
Respondent 3	The cost of electricity has been sky rocketting in recent years , these hurts the poor more than any one else	The Impact is Negative to the Consumer	Neg		1
Respondent 4	The impact to consumers has been severely negative - The electricity prices has been on an upward trend consistently over the past couple of years. To some extent these may be linked to these current projects under construction.	The Impact is Negative to the Consumer	Neg		1
Respondent 5	The impact is undoubtly negative. Even at this stage, Eskom is engaged has applied for additional increase of about 19%. The impact to the consumer is terribly negative	The Impact is Negative to the Consumer	Neg		1
Respondent 6	The impact is negative. However, one would hope that when these projects are completed, the cost will be reduced	The Impact is Negative to the Consumer	Neg		1
Respondent 7	The power plant construction is an expensive venture. When funded by the taxpayer, the impact is likely to be severe, as it is currently the case in South Africa. People are forced to limit their consumption and use alternatives such as gas and paraffin	The Impact is Negative to the Consumer	Neg		1
					1
Respondent 8	The impact has been largely negative to the consumer. The government must look at other ways to generate electricty, perhaps a cheaper and more affordable technology	The Impact is Negative to the Consumer	Neg		1
Respondent 9	The Taxpayers and Consumers are made to pay the price of inefficiency in Eskom. It is very affair to the consumers who have no alternatives, but Eskom	The Impact is Negative to the Consumer	Neg		1
					10

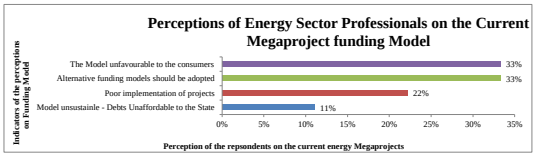
	Count	Statistics	Observations (x)
		Frequency	
	1	Neg	No Proper upfront planning	9
				0
				0
				0
				0
				0
				6
		Proportion	
	1	Npup	No Proper upfront planning	100%
				0%
				0%
				0%
				0%
				0%
				100%



4.2.4.7 Would you consider the funding model for Energy Megaproject in South Africa viable and sustainable?

Question	Responses	Common Themes	Codes	Primary Theme	Codes
Respondent 1	Eskom recently declared that it has funds suffient to last for two months. This is one of the signs that the current model either the model is unfavourable and that the debts are simply unaffordable which is worrisome	Model unsustainle - Debts Unaffordable to the State	DUA	Model unsustainle - Debts Unaffordable to the State	1
Respondent 2	The Model might be viable, however, the implementation of the projects is very poor and as a result lead to additional injection of borrowed funds	Poor implementation of projects	Piop	Poor implementation of projects	1
Respondent 3	The usage of borrowed funds to build something as big as Medupi is a risky undertaking. The government should be looking into building smaller Power Plant which reouires lesser canital unfront canital outlay	Alternative funding models should be adopted	Afm	Alternative funding models should be adopted	1
Respondent 4	The funding model is not adequate as the funds are misused. The projects must be delivered in such a way that the repayment period is shorter and the amounts and terms of funding if funded using borrowed funds must be favorable to the State. The repayment must be based solely on the proceeds from the sale of generated power. in this manner, the consumer will not feel the burden of high electricty price	Alternative funding models should be adopted	Afm	Alternative funding models should be adopted	1
Respondent 5	These projects are largely funded by international agencies. The terms appears to be disregarding the existence of the consumer at the end of the supply chain. This observation is based on the fact that the costs incurred by Eskom is recovered from the Consumer	The Model unfavourable to the consumers	muc	The Model unfavourable to the consumers	1
Respondent 6	The model is not favorable to the general public. These projects should be largely funded by the State with minimum external borrowing. This will ensure that we build what we can afford	The Model unfavourable to the consumers	muc	The Model unfavourable to the consumers	1
Respondent 7	To me what appears to be lacking is the know how on implementation. If the right people are appointed on the right positions, everything else will fall into place	Poor implementation of projects	Piop	Poor implementation of projects	1
					1
Respondent 8	Funding model do not in any way take the consumers and taxpayers' interest into consideration. Whenever Eskom wishes to increase electricity prices, the application is granted. The must be a model that would ensure a balance between the interest of the consumers, taxpayer and the general public into consideration. Key to this interests is affordability	The Model unfavourable to the consumers	muc	The Model unfavourable to the consumers	1
Respondent 9	My opinion is that the private sector should fund these projects. This will ensure innovation and consequently bring down the capital and operating cost. The winner in this model will be the consumer. The current model do not benefit the state, it does not benefit the consumer , I am not sure if it benefit the funders	Alternative funding models should be adopted	Afm	Alternative funding models should be adopted	1
					10

Count	Statistics	Observations (x)
	Frequency	
DUA	Model unsustainle - Debts Unaffordable to the State	1
Piop	Poor implementation of projects	2
Afm	Alternative funding models should be adopted	3
muc	The Model unfavourable to the consumers	3
		0
		0
		9
		6
	Proportion	
DUA	Model unsustainle - Debts Unaffordable to the State	11%
Piop	Poor implementation of projects	22%
Afm	Alternative funding models should be adopted	33%
muc	The Model unfavourable to the consumers	33%
		100%



4.2.4.8 **Would you consider the decisions to pursue energy Megaproject in South Africa legitimate in light of performance of the projects pertaining to Cost, time and benefits of the projects? Please Elaborate**

Question	Responses	Common Themes	Codes	Primary Theme	Codes
Respondent 1	As mentioned earlier, these projects has assisted greatly in recent months to avoid loadshedding to a point were in Eskom has supply power on a daily basis. One thing that stands out though is the delay in delivery. These current power was needed in the years leading up to the world cup in 2010, however, it is only delivered now. In my opinion, these projects are ok, as long as they are delivered quickly and are affordable	Delays and Cost Overrun are of great concern	Pnf	Projects not favorable	1
Respondent 2	The projects have been severly affected by delays and cost overruns, strikes and contractual claims. There is an urgent need to address and improve on project management capabilities. I would agree with the notion that reasonably scaled projects are more suitable. Take Gautrain project for instance, we did reasonably well in the execution.	Delays, Cost Overrun, Community Unrest, Contractual Claims	Pnf	Projects not favorable	1
Respondent 3	These projects are very complex in almost all aspects of delivery. It would be beneficial to put more effort in skills development and capacity enhancement before embarking on these big builds. However, it is understandable that the decision was taken when it was clear that the existing fleet of Power Stations are nearing their design life	Project Complexities, Lack of skills	Pnf	Projects not favorable	1
Respondent 4	We need investment is engineering and technical skills. The skills developed through these projects should not be lost. Should such opportunity arise in the future, I would opt for shorter duration projects. There are currently talks around nuclear, I'm afraid that this will entrench SA deeper into debts	Long lead projects undesirable, Lack of skills	Pnf	Projects not favorable	1
Respondent 5	SA has huge infrastructure backlog, especially in the townships. It is some how unfair to force consumers to pay high prices for electricity while infrastructure in their surrounding is poor	General infrastructure backlog, high electricty prices	Pnf	Projects not favorable	1
Respondent 6	Decisions to invest in such projects should only be done in an environment where resources are sufficient. We cannot fund such big projects through debts from foreign countries.	Lack of adequate funding	Pnf	Projects not favorable	1
Respondent 7	In the event were government does not spent money in such projects, jobs would not be created and there will be limited skills development	Projects promote employment	ppe	Projects promotes employment	1
					1
Respondent 8	Such projects are key to ensuring skills development and economic prosperity, however, what is happening on Medupi is extra ordinary. Perhaps is the intense level of complexity, but the project is long overdue	Projects promote employment and Skills development	Pnf	Projects not favorable	1
Respondent 9	I maintain that the government should refrain from investing in these types of projects. Private sector is capable of delivering	Funding and delivery model unsustainable	Pnf	Projects not favorable	1
					10

Count	Statistics	Observations (x)
	Frequency	
Pnf	Projects not favorable	8
ppe	Projects promotes employment	1
		0
		0
		0
		0
		9
		6

	Statistics	Observations (x)
	Proportion	
Pnf	Projects not favorable	89%
ppe	Projects promotes employment	11%
		100%

