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Factors Affecting Private Investment in New Power Generating Capacity in South Africa

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A research project submitted to the Gordon Institute of Business Science, University of Pretoria in partial fulfilment of the requirements for the degree of **Master of Business Administration.**

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Abstract

Private Investment in electrical power generation will play a substantial role in South Africa's massive capacity expansion programme over the next 20 years. Should this investment not materialise, South Africa's security of electricity supply would be seriously compromised.

The purpose of this research was to determine whether major factors that impact on the attractiveness of a country's power sector to private investors are being catered for in South Africa and where the possible shortcomings are.

The research was qualitative in nature and the methodology followed was to survey industry role players by way of a self-administered questionnaire. Response data were analysed using descriptive statistics as well as inferential statistics (hypothesis testing) where a one tailed, one sample *t*-Test was used.

The findings of the research are that the South African legal system and the revenue generation potential of the power sector are advantages that the country can leverage off to attract power sector investors.

Major stumbling blocks to private investor participation needing immediate attention, are the lack of responsiveness of Government to private sector needs and timeframes as well as the lack of independence of the Regulatory institutions and processes from Government interference whether perceived or real.

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Declaration

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Business Administration at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University.

_______________________ Date: 14 November 2006

Christopher Forlee

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1.1. Introduction

Energy in the form of electricity has become a necessary part of our daily lives. The majority, if not all of our household appliances (cooking, entertainment, security, etc.) are powered by electricity. One just has to experience a power cut, especially at night to realise the how integral to our lives a reliable electricity supply has become.

South Africa has been fortunate enough to have a supremely reliable electricity supply system until fairly recently. There was huge over investment in power generating infrastructure by the South African Electricity Supply Utility, Eskom, during the 1970s and 80s as a result of forecast Gross Domestic Product (GDP) growth that did not materialise. The result was that during the investment phase electricity prices were much higher than they needed to be at that time, however, during the years following the investment, much time has passed and electricity prices have actually fallen in real terms due to the utility not needing to invest in the massive capital expenditure that power plant require.

The nett effect has been that until the beginning of 2006, the South African National Electricity Supply System at the Generation and Transmission level has been extremely reliable, with unplanned outages being few and far between. This has not been the case at the Distribution level where a lack of maintenance, refurbishment and expansion has seen those networks deteriorate into a severe state of disrepair resulting in a steady decline in the quality of electricity supply at that level, but that is the subject for another paper, this paper deals specifically with the Generation sector.

Given that electricity is a resource that cannot be stored in any significant quantity and must in effect be produced as it is consumed, Joskow (2006) states that the generating capacity available to supply electrical energy at any point in time must always be greater than the demand for electrical energy at that point in time. This results in the need to carry “inventory” in the form of generators providing frequency regulation and operating reserve services. This “inventory” is in the form of additional generating capacity reserves that must be available either immediately or able to start up quickly to provide energy to balance supply and demand at each location on the network in response to real time variations in demand and unplanned equipment outages (failure).

When these reserves fall below a certain level because all available generating capacity are fully utilised, system operators have to take actions to reduce demand administratively according to a pre-specified hierarchy of “operating reserve shortage” actions to prevent network failure. These culminate in rolling blackouts (electricity supply is interrupted to large blocks of consumers on a rotating basis) at which point all other options have been exhausted and the network is in imminent danger of collapsing. Should a country’s electrical network (‘grid”) be allowed to collapse, it may take many days for power to be restored and the entire country would be in “darkness” for a prolonged period. This is known as a “blackstart” condition, the nightmare every system operator strives to avoid

Due to the overinvestment during the 1970s and 80s, South Africa has up until now, had spare inventory or generating capacity that could be called upon to fulfil the countries' electricity demand requirements in any situation, for example if a generator had an unforeseen problem, then spare capacity could be brought on line to "fill the gap" as it were until the problem was sorted out.

Over the years, however there has been little or no investment in new power generating plant in South Africa and the supply/demand gap has been closing where existing generation equipment is being made to run for longer periods and at much higher loadings than previously. In fact, the demand/supply balance has reached a stage where unplanned outages combined with cold weather conditions have necessitated the implementation of "rolling blackouts" on a number of occasions during the last 2 years.

The electricity supply situation and in particular security of electricity supply in South Africa has come to the fore since late 2005. What is meant by security of supply is the availability of enough electricity generating plant to satisfy customer electricity demand at any time. In addition to this, it is also necessary to have an electricity transport infrastructure that is capable of transmitting the electrical energy from the point of production to the point of use.

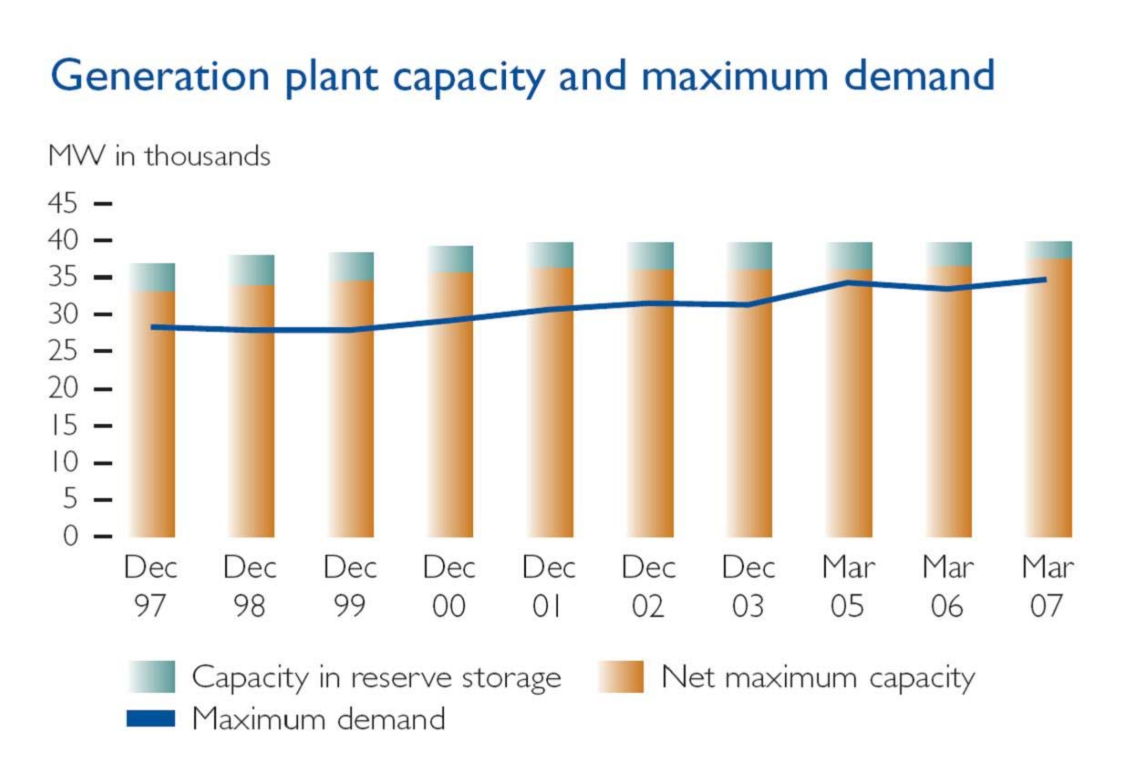
Since late 2005 when a fault at Koeberg nuclear power station resulted in one of its generating units being on an extended outage, there have been a number of instances where curtailment of load, where supply to certain areas or large customers is interrupted to cater for a shortfall in electricity generating capacity to meet customer demand, had to be implemented (Eskom, 2007a).

To cater for the variability in electricity demand, which fluctuates daily and seasonally, enough power plants have to be built to cater for the maximum that would be demanded by the consumer at any one time. To cater for the variability in demand, the national power system always needs to have a "reserve" capacity in hand. This is called the reserve margin and is the difference between the maximum power generating capacity available and the maximum or peak electricity demanded by the consumer (Joskow, 2006). This difference is considered adequate in most power systems internationally if it is around 15%.

Over the last decade, the reserve margin on the South African power system has declined below 15%, to levels where security of supply is at risk as has been evidenced by a number of incidents during 2006/7 where national "load shedding" had to be performed to ensure that the national electricity supply system remained stable. The steady decline in reserve margin over the years is illustrated in Figure 1 below.

Power stations have long lead times and have to be planned many years in advance. There is a fine balance between building too many power stations too quickly as there is a cost associated with this to the electricity consumer vs. building too few power stations too late with resultant power outages and associated blackouts, which come at a cost to the economy and customer comfort.

Figure 1. Declining Reserve Margin



Source: Eskom Annual Report (2007)

The question currently being asked is why South Africa has only started building additional power generating capacity now, when it is already experiencing supply shortages. An even greater question is who should have started building additional generating capacity.

The majority of the current power generating capacity in South Africa is owned and operated by state owned utility, Eskom, a virtual monopoly. The idea of a competitive wholesale electricity market was mooted many years ago where Eskom and other Independent Power Producers (IPPs) would compete to supply electricity and government had set targets of a 70:30 split between Eskom and the IPPs in this regard (DME, 2007).

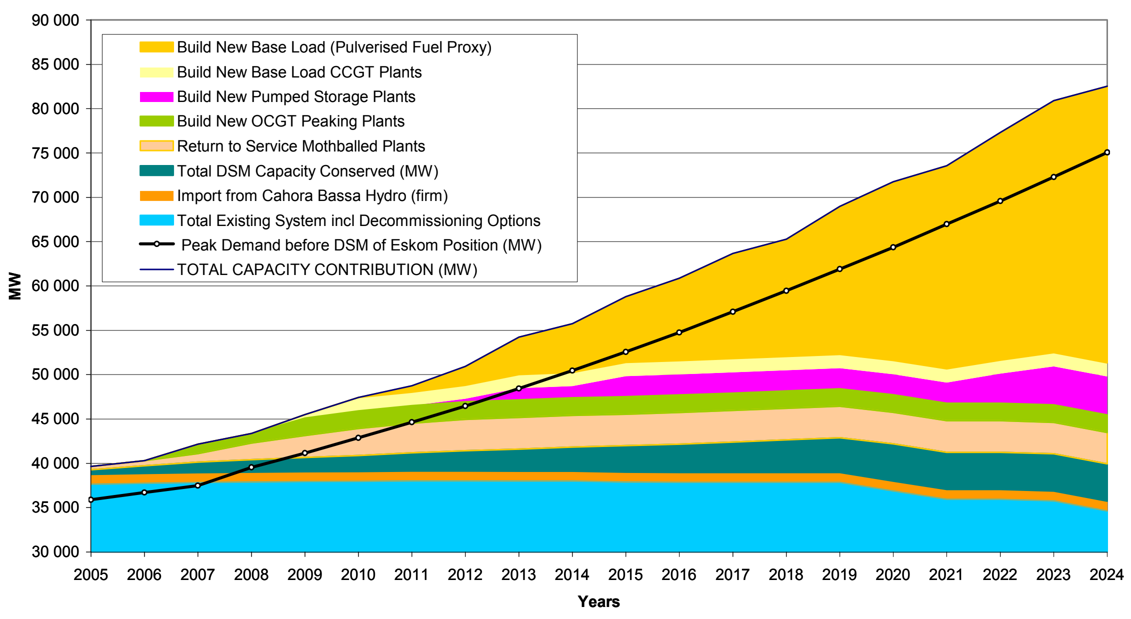
Given that South Africa is facing a fast reducing reserve margin and increased risk of power supply interruptions, the need for timeous additional power generating capacity is critical. The 30% of new generating capacity reserved for the private sector is therefore of crucial importance to South Africa's security of electricity supply. The requirements to ensure private sector participation in the build of new generating capacity are of particular interest in this context.

Eskom has embarked upon a substantial 20 year build program to restore security of supply (the necessary level of "inventory"), but power stations by their very nature take many years to construct and it will be some time before security of supply is achieved. Current forecasts are that this will only be around 2012 (five years from now) when the first of the new large coal-fired power stations is scheduled to commence operation. In the interim, some gas-fired plant, which is quicker to build, will come online to help alleviate the situation, but these are generally only used during peak demand periods and for a short time, due to their very high operational cost.

As indicated above, Government has a stated objective, that 30% of all new non-nuclear power generation should be built, owned and operated by the private sector as opposed to Eskom, the state-owned utility. It is envisaged that private sector participation will allow benchmarking of the state-owned utility and will introduce savings through increased efficiencies in operation as well as a reduction in construction costs.

The 20 year build program required to meet the country's growing electricity needs comprises some 80 000MW (MW = Megawatt) of capacity, which means that 24 000MW of new generating capacity needs to be built by the private sector. Timeframes are extremely tight for delivery of this capacity if South Africa's security of supply is not to be compromised any further. The 20 year demand forecast and the necessary generation capacity needed to meet it are illustrated in Figure 2 below.

Figure 2. South Africa: Electricity Demand/Capacity Forecast



Source: Eskom Integrated Strategic Planning Department, 2007

The timeous delivery of additional power generating capacity is crucial for the continued economic success of the country. A secure and reliable electricity supply system is necessary for investor confidence and the continued growth of the country's industrial and manufacturing sector.

1.2. The Research Problem

A stable, secure electricity supply system is one of the foundations that a healthy, growing economy needs, without it, South Africa will not achieve the Government's AsgiSA target of 6% GDP growth by 2010.

The supply/demand balance is already precarious at best and additional power generating capacity is sorely needed. It is estimated that an additional 80 000MW of power generation is needed by 2025 to meet the country's electricity demand needs.

Government has stated that 30% or 24 000MW of this must be built, owned and operated by the Private Sector, the so-called Independent Power Producers (IPPs). The process for establishing the first IPP in the country was conducted by the Department of Minerals and Energy (DME) and has been a long and protracted process. During the process, there were initially 5 bidders, but 3 dropped out and eventually only 2 were left, the others had "lost interest".

Given the tight timeframes South Africa must achieve to maintain quality of supply at its current levels and to restore full security of supply and the substantial role that IPPs will play in this, the process to establish the first IPP raises many questions and concerns. It is clear that should the same process be followed for the rest of the 24 000MW private sector participation, then security of supply will not be restored by 2012, not even by 2020.

The problem facing South Africa's electricity sector is that there appears to be a lack of interest amongst Independent Power Producers as evidenced by the DME's competitive bidding process only yielding 2 interested parties.

This study will attempt to determine whether the major factors that influence private sector investment in new power generation plant in South Africa are catered for by surveying a sample of the organisations playing a major role in this sector from both the government and private business sectors.

1.3. Objective of this Research

The objective of this research is to survey the major players in the Electricity Sector in South Africa, especially potential private investors in power generation to determine whether the major factors upon which decisions to invest or not to invest in a power project are based are catered for in South Africa.

Once identified, action can be taken to address these factors to create the necessary environment to attract private sector investment in new power generating capacity in South Africa.

Chapter 2: Literature Review

2.1. Structure of the South African Electricity Supply Industry

The South African Electricity Supply Industry (ESI) remains dominated by the state-owned and vertically integrated utility, Eskom, which ranks amongst the top 11 utilities in the world in terms of electricity sales and amongst the top 10 in terms of generating capacity (Eskom, 2007b).

Eskom is a virtual monopoly in the generation sector and generates 96% of South Africa's electricity, which amounts to more than half the electricity generated on the African continent. Private generators contribute about 3% of national output (mostly for their own consumption) and municipalities contribute less than 1%. South Africa's electricity infrastructure is heavily dependent on coal (92%) with nuclear, hydro-electricity, bagasse (from sugarcane) and emergency gas turbines (running on diesel fuel) accounting for the rest (National Electricity Regulator, 2004). A breakdown of Eskom's commissioned power stations at 31 March 2007 is given in Table 1 below.

Eskom is a monopoly in the Transmission sector as it owns and controls the entire national integrated high-voltage transmission grid and distributes about 60% of electricity directly to customers. The remainder of electricity distribution is undertaken by about 185 local authorities that buy bulk-supplies of electricity from Eskom (Eskom, 2007b).

Eskom also imports power from Mozambique and to a lesser extent from the Democratic Republic of Congo and Zambia. However, the country also sells electricity to neighbouring countries (Botswana, Lesotho, Mozambique, Namibia, Swaziland, Zambia and Zimbabwe). Imports and exports constitute about 5% of the total electricity on the Eskom system (Eskom, 2007b).

Table 1. Eskom Power Stations, Commissioned as at 31 March 2007

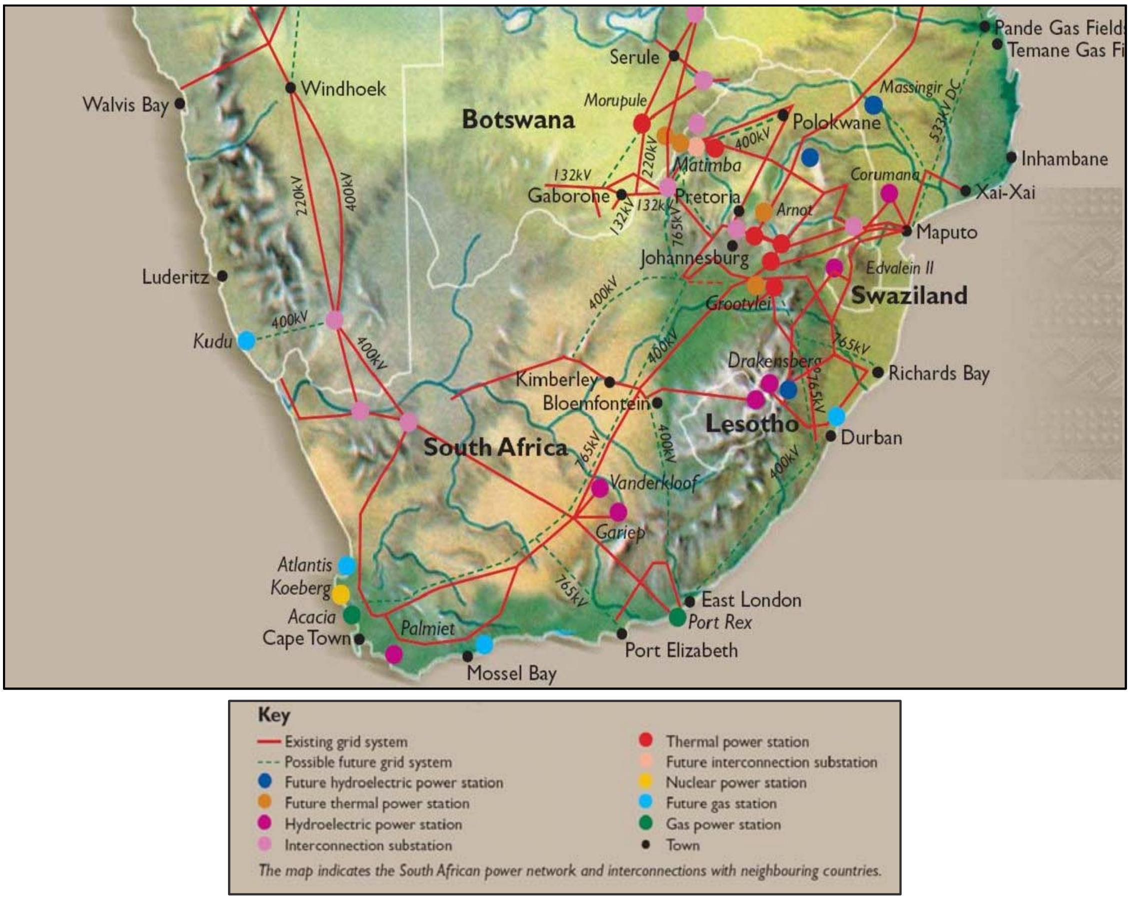
Type of Station	Name of Station	Location	Number and Capacity of Generator Sets	Total Installed Capacity	Total Available Capacity
Coal-Fired (13)	Arnot	Middelburg	4x350 ; 2x370	2 140	2 020
	Camden	Ermelo	6x200 ; 2x190	1 580	930
	Duvha	Witbank	6x600	3 600	3 450
	Grootvlei	Balfour	6x200	1 200	-
	Hendrina	Hendrina	10x200	2 000	1 895
	Kendal	Witbank	6x686	4 116	3 840
	Komati	Middelburg	5x100 ; 4x125	1 000	-
	Kriel	Bethal	6x500	3 000	2 850
	Lethabo	Sasolburg	6x618	3 708	3 558
	Majuba	Volksrust	3x657 ; 3x713	4 110	3 843
	Matimba	Lephalale	6x665	3 990	3 690
	Matla	Bethal	6x600	3 600	3 450
	Tutka	Standerton	6x609	3 654	3 510
Gas/Liquid Fuel (4)	Acacia	Cape Town	3x57	171	171
	Ankerlig	Atlantis	3x147	441	438
	Gourikwa	Mossel Bay	1x146	146	145
	Port Rex	East London	3x57	171	171
Hydroelectric (6)	Colley Wobbles	Mbashe River	3x14	42	-
	First Falls	Umtata River	2x3	6	-
	Gariep	Norvalspont	4x90	360	360
	Ncora	Ncora River	2x0.4 ; 1x1.3	2	-
	Second Falls	Umtata River	2x5.5	11	-
	Vanderkloof	Petrusville	2x120	240	240
Pumped Storage (2)	Drakensberg	Bergville	4x250	1 000	1 000
	Palmiet	Grabouw	2x200	400	400
Nuclear (1)	Koeberg	Cape Town	2x965	1 930	1 800
Total (Megawatt)				**42 618**	**37 761**

Source: Eskom Annual Report 2007

Direct electricity sales to mines and industrial customers accounted for over 40% of Eskom's electricity sales in 2006/7. Eskom also operates retail distribution services for 3.96 million customers (3.8 million of these are households) and the municipal distributors service an additional 4 million customers.

A diagram of the South African power network and the location of Eskom's power stations nationally are given in Figure 3 below.

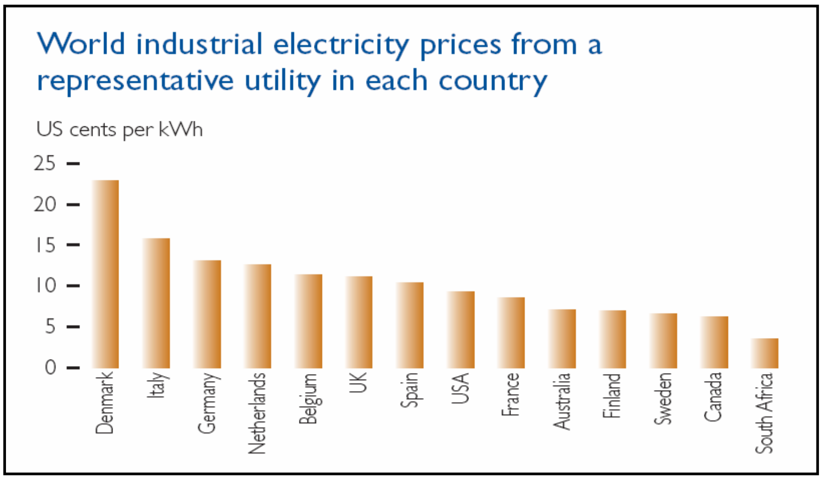
Figure 3. South African National Grid and Eskom Power Stations



Source: Eskom Annual Report 2007

About two-thirds of South Africans have access to electricity. South Africa has the cheapest priced electricity in the world (see Figure 4). The Eskom average electricity price in 2006/7 was 3.56US¢/kWh vs. its nearest rival Canada at 6.18US¢/kWh (NUS, 2007).

Figure 4. International Electricity Price Comparison



Source: NUS Consulting, 2007

2.2. Policy and Legislation

Eskom is governed via a shareholder compact with the Department of Public Enterprises. However, the countries' overall energy and electricity policy is the domain of the Department of Minerals and Energy (DME). Eskom is also subject to regulation buy the National Energy Regulator of South Africa (Nersa) which is an independent economic regulator.

Formal policy for the electricity sector is recorded in the White Paper on Energy Policy (DME, 1998) published in 1998 (currently under review). Electricity supply industry (ESI) objectives are to:

- "improve social equity by specifically addressing the energy requirement of the poor,
- enhance the efficiency and competitiveness of the South African economy by providing low-cost and high quality energy inputs to industrial, mining and other sectors, and

- achieve environmental sustainability in both the short and long-term usage of natural resources."

The White paper also envisaged:

- "giving customers the right to choose their electricity supplier,
- introducing competition into the industry, especially in the generation sector,
- permitting open, non-discriminatory access to the transmission system, and
- encouraging private sector participation in the industry."

The White Paper stated further that in the long term, Eskom would "be restructured into separate Generation and Transmission companies". Government also intended at the time "to separate power stations into a number of companies" to introduce competition and Independent Power Producers (IPPs) were also to be introduced.

These policies were confirmed in a Cabinet decision in May 2001 and government engaged consultants to design an electricity market that included a power exchange and bilateral contracts. While Distribution and Transmission were to be unbundled, Cabinet stopped short of full horizontal unbundling of Eskom's Generation plant, only 30% was to be sold and the rest were to be clustered into a number of generation units that would compete in the market. In the meantime, Eskom was prohibited from building new generation plant and was encouraged to expand its activities into the rest of Africa (Newbery and Eberhard, 2007).

According to Newbery and Eberhard (2007), the electricity market was never implemented and in 2004 Cabinet announced that Eskom would not be unbundled, nor would it be privatised. Work on the design of the electricity market was terminated and Eskom was once again authorised to invest in new capacity, while IPPs would be invited to contribute up to 30% of new generation capacity. A revised electricity policy has not formally been published. However, it is now clear that the electricity policies in the 1998 Energy Policy White Paper no longer apply, even though the White Paper has not been repudiated or formally withdrawn and is still invoked in other energy policy areas.

Newbery and Eberhard (2007) go further to say that Government sees Eskom as a "national champion" that will spearhead infrastructure investment in support of economic growth and improved welfare. Government ministers have said that Eskom's Generation and Transmission divisions will not be unbundled and that Eskom needs to take primary responsibility for security of electricity supply in South Africa.

The electricity sector is governed by the following legislation:

- The Constitution of South Africa, 1996 which grants municipalities executive authority and the right to administer "electricity reticulation".
- The Eskom Conversion Act No.13 of 2001 which clarified Eskom's status as a public company subject to the Companies Act (with certain exemptions) with 100% of its equity held by the state, governed by a Shareholder Compact and liable for payment of dividends and taxes.

- National Energy Regulation Act No. 40 of 2004 that defines the composition, powers and functions of Nersa, the electricity, gas and petroleum pipelines regulator.
- Electricity Regulation Act No. 4 of 2006 that defines the electricity regulatory functions of Nersa. An amendment to the Act deals with the regulation of electricity "reticulation" as defined in the constitution.
- National Nuclear Regulator Act No. 47 of 1999 that regulates nuclear safety issues.
- Public Finance Management Act No.1 of 1999 that provides the framework for Eskom's reporting and accounting responsibilities to government as a public enterprise.
- Municipal Finance Management Act No. 56 of 2003 that defines how municipal entities such as municipal electricity utilities should be managed.
- Local Government Municipal Systems Act No 32 of 2000 that includes sections on municipal administration of electricity reticulation and tariffs.
- National Environmental Management Act No. 107 of 1998.
- Air Quality Act No. 39 of 2004.

In summary, this legislation stipulates in some detail how Eskom or municipal distributors should be governed and how they should account to government. It specifies also how the industry should be regulated and ***empowers the Minister of Minerals and Energy to procure and contract IPPs*** and to direct the regulator to licence specific plant, including the proportion that should come from renewable energy sources. Government has also directed that poor households should receive electricity subsidies. While subject to environmental legislation there is no requirement for generating plant to meet European or North American emission standards. There are no greenhouse gas emission caps. New legislation is currently being drafted that will define the process for restructuring the electricity distribution industry.

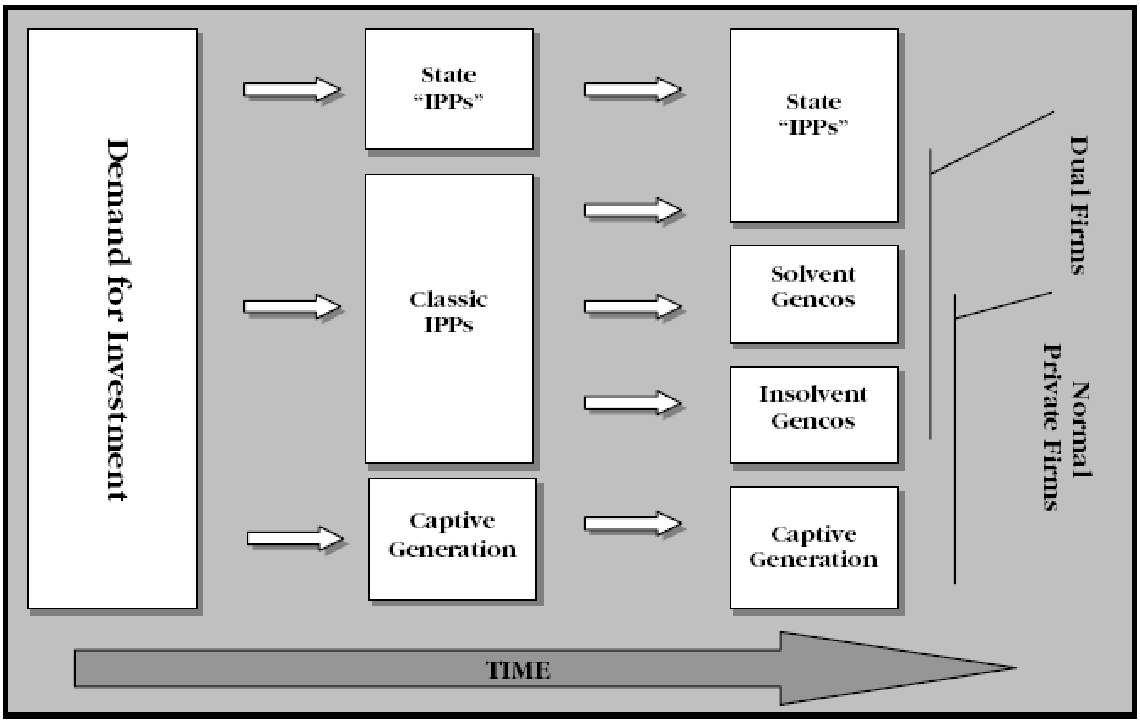
2.3. Independent Power Producers

A review of the definition of an Independent Power Producer (IPP) follows. According to Woodhouse (2005), there are three types of enterprises that are often referred to as IPPs. The three forms of "IPP" are graphically illustrated in Figure 5 below.

The first of these are State dominated firms that masquerade as private firms, and increasingly compete with their fully private brethren. These enterprises attract the moniker "IPP" for various reasons, including the fact that some plants receive favourable tax or other treatment when they are viewed as IPPs. Often these plants are managed by the "dual firms" that emerged from a country's restructuring process, and the desire to embrace something called an IPP is partly evidence of these firms' savvy in seizing the latest management concepts in the power sector. In the extreme, all five of the state-owned generation companies created in China's most recent reform of the power sector are formally called "IPPs" although each firm is actually state-owned and state-controlled. This study did not look at this type of generator because such plants do not confront many of the issues that comprise the focus of this study, such as the ability of private investors to enforce contract terms.

The second type is private generators that are not connected to the grid, often called "captive plants". In some countries, these plants are regulated under the same law that governs grid-connected IPPs and they are thus often called IPPs (In Mexico, for example, the same IPP law is used for all privately built power plants whether or not the plant is designed principally to supply bulk power to customers via the grid). Such plants are also not considered in this study because the investor faces a different type of risk. Developers of captive projects work, usually, with a single private buyer and the enforcement of contracts is much easier, particularly when projects are developed for self-supply.

Figure 5. Forms of Private Investment in the Power Sector



Source: Woodhouse (2005)

The third category is the so-called "classic IPPs", which are the subject of this research project. These plants generally sell electricity under a long-term contract and the key off-taker for the power is a state-owned (or state-regulated) electric utility, although in some cases, additional revenue is earned with sales to private distributors or large private users.

Given that the entire Transmission network in South Africa is owned by Eskom, the state-owned utility and there is no wholesale market, all IPPs would need to enter into a long-term Power Purchase Agreement (PPA) with Eskom.

Classic IPPs are usually financed on a project basis, with a special purpose vehicle established to own and manage the IPP. The company draws equity from a number of foreign and domestic investors and secures debt from a syndicate of banks on the basis of expected revenues. Most projects are highly leveraged, with debt accounting for as large a share of project finance as the bank syndicate will tolerate.

Due to the large amounts of capital involved, there is a substantial amount of risk for the IPP and developers and lenders entering into these IPP arrangements try to shift risk to the host government by relying on long term Power Purchase Agreements (PPAs) and a host of other arrangements that they believe will insulate projects from politically influenced government decision-making and unexpected changes in circumstance.

IPPs generally try to secure minimum off-take and guaranteed tariff provisions as well as government-backed guarantees to reduce their risk or perceived risk. The electricity businesses generate revenues in local currency, while many of the cost components for IPPs such as capital, equipment and fuel are set in hard currency with the result that the IPP investor is generally particularly sensitive to the allocation of currency risks.

2.4. System Planning

According to Doorman (2000), system planning starts normally with some governmental body having supervisory responsibility for expansion of the power system. This organisation basically takes responsibility for the following activities amongst others:

- prepare load forecasts (energy and/or capacity)
- identify relevant options to satisfy the demand forecast
- identify constraints
- compute least cost options that satisfy all constraints

There are three major elements that need to be taken into account when considering Generation Expansion Planning, namely:

- the type of project (choice of technology) and the size of the new plant
- the timing of the investment, and
- the location of the new plant (e.g. fuel supply for a coal fired station)

Traditionally Generation Expansion Planning only looked at the supply side of the capacity/demand equation and strove to minimise the cost of supplying a forecasted demand into the future. Due to the increasing cost of electricity supply and also environmental consideration in more recent years, the concept of integrated resource planning has come to the fore. According to Swisher et al. (1997), the objective of traditional expansion planning was to meet demand for electricity at least cost, whilst the principal goal in integrated resource planning is to meet the demand for energy services at least cost.

The accuracy of system planning impacts on the efficiency of investments made in power generating capacity. If the load forecast is not accurate, then either too little plant may be built resulting in capacity shortages or too much plant will be built too soon, which will result in unnecessarily high prices to consumers or stranded assets for investors.

2.5. Security of Supply

Potential investors in power generation assets tend to base their decisions on current electricity prices whether via a wholesale market or in a regulated monopolistic situation such as South Africa's. Due to the long timeframes for the building of new power plant (3-5+ years depending on the type of plant), decisions based on today's prices do not generally yield the desired future results. Bunn and Larsen (1992) surmise that what results is a capacity shortage or a capacity glut as investors make decisions based on current pricing without taking into account the behaviour of competitors. If the current electricity price is high due to a capacity "crunch", many investors enter the market without considering the impact that each other will have on the price of electricity, however, as all of the power generating capacity comes "online", the price of electricity will drop. This will cause the pool of new investors in power generating capacity to shrink as new investors withdraw from the market and investment in new power generating capacity will fall, resulting in an eventual capacity shortage and the cycle starts all over again with investors entering the market.

Any increase in security of supply which is brought about by an increase in power generation capacity is to the benefit of all parties connected to the National Electricity Grid as it is impossible to distinguish the flows between individual power stations and customers on the Grid. Abbot (2001) believes that in such a circumstance, it may be justified that revenue is raised by way of a general tax or levy on electricity to create a fund that could be used to provide incentives to investors to invest in new power generation capacity. Abbot (2001) goes further to state that this is indeed necessary to ensure continued security of supply since the specific benefactors of new generating capacity cannot be determined, chances are that nobody will see any need to build the next megawatt of new generation capacity until it is too late.

2.6. Criteria for Investment

A single power plant (e.g. large coal fired station) requires tens of billions of rand in capital to be built (4 500MW Coal Fired Power Station costs in the region of R80billion today). Generally, this capital is sourced from investors, private equity markets and the like. Green (2003) states that there are risks involved in power plant investment, thus for investors to participate, there needs to be a certain confidence that all their costs will be recovered as well as a reasonable (better than other investments and dependent on the amount of risk that they will take on) return on their investment.

The ability to enter into long-term power purchase agreements is of paramount importance to ensure investment in new power generation plant according to Woo et al. (2005). Without a long term pricing agreement, the investor is exposed to the volatility of the electricity market (if there is a market) or the possibility that he/she will be left with a stranded asset if forecast electricity demand does not materialise in a monopolistic situation such as that of South Africa.

Wang (2004) claims that even a perfectly efficient short-term market does not, on its own, send timely investment signals regarding the need for additional capacity and cites the experiences in California and the UK as proof. Wang (2004) suggests that there is a need for a mechanism to signal for new capacity and investment in generation and this could be in the form of a capacity market or probably long term contracts. This suggests that even wholesale electricity markets are not properly addressing the issue of timeous new generation capacity investment.

2.7. Wholesale Markets vs. Vertically Integrated

Botterud (2003) surmises that one of the fundamental trends driving the long-term development of electrical power systems is the demand for cost efficiency, which has triggered a wave of deregulation and liberalisation initiatives in various industries that used to be operated under regulation (e.g. aviation, railway, telecommunication, gas, and electricity).

According to Joskow (2006), policymakers in many countries are expressing concerns that competitive wholesale electricity markets are not providing appropriate incentives to stimulate "adequate" investment in new generating capacity at the right time, in the right places, and using the right technologies. These concerns are often expressed in the context of concerns about "supply security," "reliability," "resource adequacy," or "supply diversity". In most cases the concerns have been raised as policymakers observe growing electricity demand, shrinking reserve margins and rising prices but little evidence of investment in new generating capacity responding to balance supply and demand consistent with traditional metrics for generation resource "adequacy."

Griffin and Puller (2005) discuss the use of power plants by regulated utilities to provide services other than the production of electricity. Regulated utilities obviously use power plants primarily to produce electricity, but in many situations also use them to avoid transmission investment and to provide reliability-related services. Removing the vertical link between generation and transmission has important implications for who should provide these services and how they should be compensated, but also with respect to whether power plants are being built, maintained, and operated more efficiently now in deregulated markets than in the past.

The South African situation is unique in the sense that the majority of the country's generation is owned by Eskom the state-owned utility. The government has stated goals to introduce private sector participation into the generation sector within this monopolistic situation. It is debatable as to whether the current monopoly situation will provide the correct environment to attract private investors or whether a wholesale market should be established to incentivise investors. Debatable as Joskow (2006) indicates, current wholesale markets do not appear to be able to attract the necessary investment in power generation timeously resulting in security of supply concerns.

In the absence of a wholesale electricity market and the stated requirement of the South African Government for 30% of all new power generation to be in the hands of the private sector, what are the factors that will influence/enable investment in power generating capacity in South Africa.

2.8. Efficiency Gains

It is hoped that Private Sector participation will bring with it increased efficiencies and cost savings and can be a useful measure to benchmark state owned utilities that are constructing and operating similar plant.

The cost of funding an IPP project is invariably higher than that of funding a state owned utility project as economies of scale are lost and the perceived risks by investors tend to be higher. The efficiency gains are expected to more than make up for the increased funding costs, otherwise IPPs would not make financial sense from a country perspective.

2.9. Comparative Studies

Of particular relevance to this study is a survey the World Bank conducted in early 2002 of 48 international firms involved in the power sector that had made investments outside of their countries of origin in developing countries. The objective of the survey was to determine the conditions that investors considered important in making the decision to invest or to judge the performance of their existing investments in a country.

According to the Lamech and Saeed (2003), when assessing country conditions, the top priorities that investors consider:

- A legal framework defining investors' rights and obligations
- Payment discipline and enforcement
- The availability of a guarantee from the government or a multilateral agency
- Independence of Regulatory Institution and Processes from arbitrary Government interference

Lamech and Saeed (2003) also state that investors consider the following factors most important in the success or failure of investments:

- Retail Tariffs and Collection Discipline must be adequate to meet cash flow needs of the sector
- Fair adjudication of Tariff Adjustments and disputes
- Operational control and management freedom
- Regulatory commitment sustained through a long term contract

Lamech and Saeed (2003) also showed that investors overall considered the following factors to be of paramount importance when making the decision to invest in a country or not:

- Adequacy of cash flows in the sector
- Stability and enforcement of laws and contracts
- Government responsiveness to the needs and timeframes of investors
- Investors' control over their investments
- Regulatory Independence
- Availability of credit enhancement or risk guarantee

The factors that investors did not consider as important are:

- Vertical Integration
- Competitive selection process
- Domestic borrowing costs and tenors
- Transition to a competitive market structure

The World Bank study indicated that most investors were more concerned about cash flows and the stability of the regulatory environment which directly impact on the profitability of the venture and in turn return on investment. This was to be expected, given that business generally focuses on the bottom line with all other considerations being secondary.

2.10. Current Study

This study will attempt to determine whether the top priority factors for investors currently with a presence in South Africa that could potentially be IPPs are being catered for the study will include Government and financial institutions. It is hoped that the study will establish the perspectives of priorities from the various players in the sector to determine where the "mis-matches" are, if any. Having identified the status of those factors important to business to participate in the power sector, aligning Government's priorities (if they are different) would go a long way to ensuring the necessary, timeous investment in power generation in South Africa to achieve the 30% private sector participation target that Government has set.

Chapter 3: Research Hypotheses

The objective of this research is to determine the factors that investors consider a top priority in making the decision of whether to invest in new power generation plant in South Africa or not.

The literature review highlighted a wide range of factors that investors consider when looking at investment in power generation, some of them country factors and others investment specific.

Of particular relevance to this study is a survey done by the World Bank (Lamech and Saeed, 2003) in early 2002 in which 48 companies were canvassed to determine their top priority factors when looking to invest in power generation in a developing country.

The World Bank (Lamech and Saeed, 2003) study highlights the following six as the top priority factors that investors surveyed considered most important when deciding on whether to invest in a country's power generation sector or not.

1) **Adequacy of cash flows in the sector:** Investors gave a clear priority to adequate cash flows for ensuring a reasonable prospect of recovering costs and making an investment a success.
2) **Stability and enforcement of laws and contracts:** The test of a good legal framework is its clarity and the enforceability of contracts, particularly contracts with government agencies. Investors want to see that the rights

and obligations of private investors are clearly defined and that applicable laws and contracts are enforced.

3) **Government responsiveness to the needs and timeframes of investors:** Delays in government approvals and licensing have an opportunity cost for international investors responding to concession auctions and solicitations for bids.

4) **Investors' control over their investments:** Investor satisfaction is enhanced by allowing investors greater management and operational control over their investments and permitting them to derive the maximum value from their assets.

5) **Regulatory Independence:** Independence of regulatory institutions and processes from government interference.

6) **Availability of credit enhancement or risk guarantee:** The existence of a guarantee alone is not enough to determine an investment decision, but it is a key consideration in finalising deals in markets where cash flow is influenced by a government entity (such as a state-owned purchaser of power) or a new regulator.

The literature has highlighted these six factors as the top priority considerations for investors in the power sector in developing countries. This study will attempt to determine the status of these factors in South Africa and where the shortfalls are, if any in creating a favourable climate for attracting international investment into the South African power sector.

3.1. Research Hypotheses

The following hypotheses were formulated based on the literature reviewed and an analysis of the issues at hand. Of the six factors identified in the World Bank study of 2002 (Lamech and Saeed, 2003) detailed above, factors 4 and 6 were not considered for this study as these are moot points in the South African context, given that all IPP operations are to be Build-Own-Operate (BOO) and the state-owned utility (Eskom) functions “at arms length” from government and is currently required to provide any guarantees (at its discretion) without direct government involvement, this is unlikely to change in the future, but is possible.

Hypothesis 1:

In South Africa, there are adequate cash flows for ensuring a reasonable prospect of recovering costs and making an investment in the power generation sector a success.

Hypothesis 2:

In South Africa, there is a good legal framework, the rights and obligations of private investors in power generation are clearly defined and all applicable laws and contracts are enforced.

Hypothesis 3:

In South Africa, Government is responsive to the needs and timeframes of investors in the power sector.

Hypothesis 4:

In South Africa there is independence of regulatory institutions and processes from government interference

Chapter 4: Research Methodology

4.1. Research Design

According to Zikmund (2003), a research design is a master plan specifying the methods and procedures for collecting and analysing the needed information. It is a framework or blueprint that plans the action for the research project.

Zikmund (2003) states that there are four basic research methods that can be used to conduct descriptive and causal research, namely, surveys, experiments, secondary data studies and observation.

Zikmund (2003) also states that descriptive studies are based on some previous understanding of the nature of the research problem whereas causal studies can only be conducted when a problem is sharply defined.

This research used the results from the exploratory research done by the World Bank (Lamech and Saeed, 2003) to determine those factors given the highest consideration by investors when considering investments in power generation in developing countries.

This research sought to empirically determine whether the factors identified in the World Bank study are sufficiently present or absent in South Africa thereby allowing an assessment of the current investment environment. This would enable an assessment of whether the investment climate is conducive to attracting private sector investment in power generation to the country or not.

This research was therefore descriptive in nature. Additionally, the research provided only qualitative data as no precise measurement was made regarding the existence or absence of any of the factors under consideration.

4.2. Unit of Analysis

According to Zikmund (2003), the unit of analysis specifies at which level the investigation will focus, namely, the entire organisation, departments, work groups, individuals or objects.

In this research, the unit of analysis was each of the individuals that responded to the questionnaire. The intention was to group individuals into different categories for the purposes of the analysis (e.g. Government, Utilities, Investors, etc.)

4.3. Population of Relevance

Zikmund (2003) defines a population as any complete group of people, companies, hospitals, stores, college students, or the like that share some set of characteristics. Population is a finite group, versus a universe which is infinite.

The population of relevance to this research study was all parties that play a role in private investment in power generation in South Africa. This included all potential investors in new power generating plant worldwide that are active in South Africa, as capital investment could conceivably emanate from all parts of the globe. Included were individuals and organisations from Government to Utilities to Financiers to Developers, etc.

A requirement for participation in the study was that the organisation had an office in South Africa and was active in the power generation sector.

4.4. Sample Size and Sampling Method

Zikmund (2003) defines sampling as any procedure using a small number of items or parts of the whole population to make conclusions regarding the whole population. Zikmund (2003) goes further to say that a sample is a subset, or some part, of a larger population.

Sampling is performed to enable inferences to be drawn about the population from a smaller group as in most cases it is impractical and/or impossible to include the entire population in the study. Sampling is normally performed due to budget and/or time constraints (Zikmund, 2003).

It was not possible to obtain a probability sample for the population defined in this case and nonprobability sampling was used. Zikmund (2003) states that the selection of sampling units in nonprobability sampling is quite arbitrary, as researchers rely heavily on personal judgement. Note that according to Zikmund (2003) there are no appropriate statistical techniques for measuring random sampling error from a nonprobability sample which means that it was not possible to project the data beyond the sample with any statistical confidence.

In this case judgment sampling which is a nonprobability sampling technique was used (Zikmund, 2003). The author's knowledge of the electricity industry in South Africa as well as that of colleagues in the industry was used to select the sample. The criteria for inclusion was loosely based on the requirement that the individual targeted should either personally or through an organisation need to play a meaningful role in enabling or enacting private sector investment in power generation in South Africa.

The sample included representatives from the following industry sectors:

- Government
- Financiers (e.g. Banks, Venture Capitalists)
- Developers (potential IPP Builder-Owner-Operators)
- Utilities (state-owned)
- Utilities (large municipalities/metros)
- Regulation

Thus, the sample chosen was a non-probabilistic, judgemental sample.

Zikmund (2003), indicates that the size of the sample is determined by the estimated variance of the population, the magnitude of acceptable error and the confidence level desired. The more homogeneous the population, the smaller the sample size required for the same variance and confidence level.

Given that this was a non-probability sample, which means that the data cannot be extrapolated to the population with any statistical confidence, the sample size was not of crucial importance, but it was important to cover as much of the different sector participants and role players as possible.

In this context, the general rule of thumb that a minimum sample size of 30 is needed to perform statistical analyses was followed and a sample size of 30 targeted.

4.5. Research Instrument

The research instrument used was that of a self-administered questionnaire. The questionnaire was based on the World Bank Study by Lamech and Saeed (2003), which identified a number of top priority considerations by investors when looking at investment in the power sector in developing countries.

The questionnaire was designed to utilise the questions that the World Bank study posed related to four of the top six considerations identified as per the hypotheses developed in Chapter 3. The considerations were:

1) **Adequacy of cash flows in the sector**
2) **Stability and enforcement of laws and contracts**
3) **Government responsiveness to the needs and timeframes of investors**
4) **Regulatory Independence**

The questionnaire comprised of eight statements that respondents were asked to rate on a 5 point Likert Scale ranging from Strongly Disagree to Disagree to Neutral to Agree to Strongly Agree.

A Likert scale (pronounced 'lick-ert') is a type of psychometric response scale often used in questionnaires, and is the most widely used scale in survey research today. When responding to a Likert questionnaire item, respondents specify their level of agreement to a statement. The scale is named after Rensis Likert, who published a report describing its use in 1932.

The statements and the hypothesis each relates to are:

1. In South Africa retail tariff levels and collection discipline are adequate to meet the cash flow needs of the power sector (Hypothesis 1)
2. In South Africa there is high consumer payment discipline and enforcement (Hypothesis 1)
3. In South Africa there is a good legal framework defining the rights and obligations of private investors (Hypothesis 2)
4. In South Africa all applicable laws and contracts are enforced (e.g., disconnections, payment by counter-parties, etc.) (Hypothesis 2)
5. In South Africa, the Government is responsive to the needs and timeframes of investors (Hypothesis 3)
6. In South Africa, Government efficiently administers the processes to provide the necessary approvals and licenses for private sector investment in the power sector (Hypothesis 3)

7. In South Africa, there is independence of the regulatory institution and processes from arbitrary government interference (Hypothesis 4)
8. In South Africa, there is regulatory commitment which is sustained through long-term contracts (Hypothesis 4)

The statements were not given in this order, they were “mixed up” so that the Hypotheses test statements were not all in order or together, this was to reduce the risk of acquiescence bias. See Appendix 1 for a sample of the questionnaire.

4.6. Details of Data Collection

The empirical data was collected by way of a self-administered questionnaire, which was distributed by way of email. This form of distribution was deemed to be the quickest and most cost-effective manner in which to distribute the questionnaire. The questionnaire was in the form of a Microsoft Word document, which respondents could fill in electronically and either return via email or by facsimile.

According to Zikmund (2003), the worst case response rate for mail questionnaires is 15%, in this case it was expected that the response rate would be much higher, given that the questionnaire was distributed electronically and that individuals targeted were industry role players with a vested interest. The questionnaire was also short, comprising only 8 statements, it was hoped that this would increase the response rate.

Respondents were not asked to provide any personal information, the only information requested in addition to the 8 questions was the industry sector they represented.

Questionnaires were emailed to 50 respondents who were identified as individuals that would play a direct role in attracting/enabling private sector investment in the South African power sector.

Where possible, respondents were contacted telephonically to explain the nature of the study and to assure them of anonymity in an attempt to increase the response rate by personalising the request.

Respondents were given the opportunity to return the completed questionnaires electronically or via post or facsimile. Anonymity was guaranteed to all respondents.

4.7. The Process of Data Analysis

The analysis of the data was divided into two parts, namely a section on descriptive statistics where basic data analysis was performed and then a section on inferential statistics where the hypotheses formulated in Chapter 3 was tested.

A Likert scale was chosen for the questionnaire. According to Wikipedia (2007), responses to a single Likert item are normally treated as ordinal data, because one cannot assume that respondents perceive the difference between adjacent levels as equidistant. When treated as ordinal data, Likert responses can be collated into bar charts, central tendency summarised by the median or the mode (but not the mean), dispersion summarised by the range across quartiles (but not the standard deviation), or analysed using non-parametric tests such as the Chi-square, Mann-Whitney, Wilcoxon signed-rank or Kruskal-Wallis test.

Responses to several Likert questions may be summed, providing that all questions use the same Likert scale and that the scale is a defendable approximation to an interval scale, in which case they may be treated as interval data measuring a latent variable. If the summed responses fulfil these assumptions, parametric statistical tests such as the analysis of variance can be applied.

4.7.1 Descriptive Statistics

According to Zikmund (2003), descriptive statistics are statistics used to describe or summarise information about a population or sample. Descriptive statistics were employed in this case to analyse the data at a basic level and to discern any trends. The descriptive statistical elements (Albright, Winston and Zappe, 2006) given in Table 2 were initially analysed for the statements related to each Hypothesis.

Note that the mean was included, even though it is understood that it has no significance given the ordinal nature of the data. However, for the purposes of the descriptive statistics analysis, uniform distance between the Likert scale categories was assumed and the scale was therefore deemed to be interval in nature.

Table 2. Descriptive Statistical Elements used in the Analysis

Statistical Element	Definition
Mean	Average of observations
Median	Middle Observation after observations are sorted from high to low
Mode	Most frequently occurring observation
Standard Deviation	The square root of the variance that provides and indication of the variability or spread of the data
Sample Variance	Measure of variability (average of squared deviations from the mean)
Skewness	The lack of symmetry of a distribution of values. Positive = skewed to the right, Negative = skewed to the left, i.e. direction of the "tail".
Kurtosis	The amount of peakedness of a distribution
Range	Difference between largest and smallest observations
Minimum	Smallest observation
Maximum	Largest observation
Sum	The sum of all the observations
Count	The number of observations

A correlation was then performed between the two questions related to each hypothesis to see whether the responses were comparable.

Based on the correlation results, the decision was taken to summate the responses for all the questions related to a particular Hypothesis (2 each) and the descriptive statistics in Table 2 were again calculated for the summated data for the questions for each Hypothesis.

The mean, median and mode were used to analyse the central tendency of the observations per question/hypothesis (Zikmund, 2003). Of additional interest was the tendency of the observations to depart from the central tendency (measures of dispersion), to analyse this, the range, sample standard deviation and sample variance were used (Zikmund, 2003). The shape of the frequency distribution of the observations was represented by the skewness reading where a negative reading indicated a “tail” to the left (negatively skewed) and a positive reading a “tail” to the right (positively skewed), the closer the reading was to zero the closer the distribution was to a normal distribution. The peakedness of the distribution was represented by the kurtosis reading, the higher the figure, the more peaked the shape of the distribution.

The frequency distributions for the summated questions per Hypothesis were also plotted and a visual analysis of the sample tendencies was performed.

4.7.2 Inferential Statistics

According to Zikmund (2003), inferential statistics are statistics used to make inferences or judgements about a population on the basis of a sample. Notwithstanding the fact that the sample for this research was a judgemental sample and as such its results could not be inferred on the population with any statistical significance, the Hypotheses formulated were tested to prove or disprove the statements posed with the sample as the basis.

4.7.2.1 Hypothesis Testing

There are two groupings of statistical procedures, namely, parametric and non-parametric which are used in hypothesis testing. According to Zikmund (2003), when the data are interval- or ratio-scaled and the sample size is large, then parametrical statistical procedures are appropriate. Parametrical procedures are based on the assumption that the population and/or sample is normally distributed. Zikmund (2003), states further that when researchers do not make the assumption of normality, it is appropriate to use nonparametric statistical procedures.

The parametric statistical test selected to test the Hypotheses was the one sample *t*-Test, which is the most suitable for small sample sizes, which is any sample less than 30, according to Zikmund (2003). The one sample test was used because the summated observations for each Hypothesis were used per test.

The hypothesised population mean was chosen as 3 because a 5 point Likert scale was used where 3 is the mid-point which corresponds to a “neutral” stance on the statements presented. It is assumed that the population would be normally distributed around this mid-point.

The null hypothesis would fail to be rejected for observation means/medians equal to or less than 3 as that would indicate neutrality or disagreement. Only if the mean/median is greater than 3 could the null hypothesis be rejected and the alternative hypothesis upheld. As a result, the one-tailed test was used in this instance.

A significance level of 1% was chosen for the *t*-Tests to reduce the risk of a Type I error (rejecting the null hypothesis when it is true), thereby ensuring that a high level of confidence could be placed on the result. . Type I and II errors are related and by decreasing the risk of a type I error, the risk of a type II error is increased. However, according to Albright *et al.* (2006), type I errors have traditionally been regarded as more serious than type II errors, the decision was therefore taken to favour caution in terms of rejecting the null hypothesis.

In addition to the *t*-Test for difference in means, the NCSS (Number Crunching Statistical Software) software also performed the Wilcoxon Signed-Rank Test for difference in medians which is a nonparametric test. Having used a Likert scale, which, although ordinal in nature was deemed to be interval for the purposes of this analysis, the Wilcoxon test results were used to ratify the *t*-Test results. Should the results of the two tests differ, then the treatment of the Likert scale data as interval would be brought into question.

The procedure followed for testing each of the hypotheses was as follows:

- Stating of the Null Hypothesis (H_0)
- Stating of the Alternative Hypothesis (H_a)

- Formulation of the Null and Alternative Hypotheses
- Choose a hypothesised population mean/median
- Choose a significance level (α)
- Run the one sample *t*-Test on the summated observations for the Hypothesis using a software package (NCSS – Number Cruncher Statistical System)
- Examine the test report to determine whether the null hypothesis can be rejected
- If the null hypothesis can be rejected, examine the ρ-value and compare to the significance (α) level.
    - If $\rho \geq \alpha$, the null hypothesis (H_0) is not rejected
    - If $\rho < \alpha$, the null hypothesis (H_0) is rejected

The ρ-value is defined by Albright *et al.* (2006) as the probability of seeing a sample with at least as much evidence in favour of the alternative hypothesis actually observed. This means that the smaller the ρ-value, the more evidence there is in favour of the alternative hypothesis.

Albright *et al.* (2006) go further to say that there is a strong connection between ρ-value and α-level approach and that the null hypothesis can only be rejected at a specified level of significance (α) only if the ρ-value is less than α.

If the null hypothesis was rejected, then the alternative Hypothesis (as per Chapter 3) was upheld in each case. If the test failed to reject the null Hypothesis, then the Hypothesis as per Chapter 3 cannot be upheld, but that does not prove that it is incorrect either.

4.8 Limitations of the Research

The sample canvassed was a judgemental sample, subject to researcher bias and was not representative of the population of all the role players in the investment in new power plant by private investors. The results from the study can therefore not be inferred on the population with any statistical confidence. Also, being a judgemental sample, it only included known participants in the industry and did not include any potential participants who are not currently active, but who might be should certain industry conditions change or be present.

A Likert scale was used for data collection. According to Wikipedia (2007) Likert scales may be subject to distortion from several causes. Respondents may avoid using extreme response categories (central tendency bias), agree with statements as presented (acquiescence bias), or try to portray themselves or their organisation in a more favourable light (social desirability bias).

The questionnaire did not contain any reverse coded (negative) questions, which is purported to increase the reliability of the data collected this way.

Another limitation of the study was that the timeframe allowed for respondents to return completed questionnaires was very short (2 weeks), which contributed to the low response rate.

The inclusion of only one independent power producer developer is of concern and the inclusion of the dominant number of respondents from the government and regulation sectors is a concern as the results would undoubtedly have affected by this.

The research had originally hoped to analyse the observations by industry sector as well as a group to discern the varying perceptions between the sectors, but the low response rate meant that this could not be done with any reliability and it was not attempted.

The statements selected for testing from the World Bank study (Lamech and Saeed, 2003) were done so by the researcher with the result that the questionnaire contains researcher bias and it was possible that the questions put forth would lead respondents in their answers. The questionnaire was not tested beforehand due to timing constraints.

Chapter 5: Results

A total of 50 questionnaires were distributed via email. Respondents were given a 2 week period in which to respond. A response rate of 34% (17 completed questionnaires) was achieved. This lower than the expected response rate of 60%, is partly attributed to the short response timeframe given to respondents.

At this point we are reminded of the Hypotheses developed in Chapter3 that will be tested:

Hypothesis 1:

In South Africa, there are adequate cash flows for ensuring a reasonable prospect of recovering costs and making an investment in the power generation sector a success.

Hypothesis 2:

In South Africa, there is a good legal framework, the rights and obligations of private investors in power generation are clearly defined and all applicable laws and contracts are enforced.

Hypothesis 3:

In South Africa, Government is responsive to the needs and timeframes of investors in the power sector.

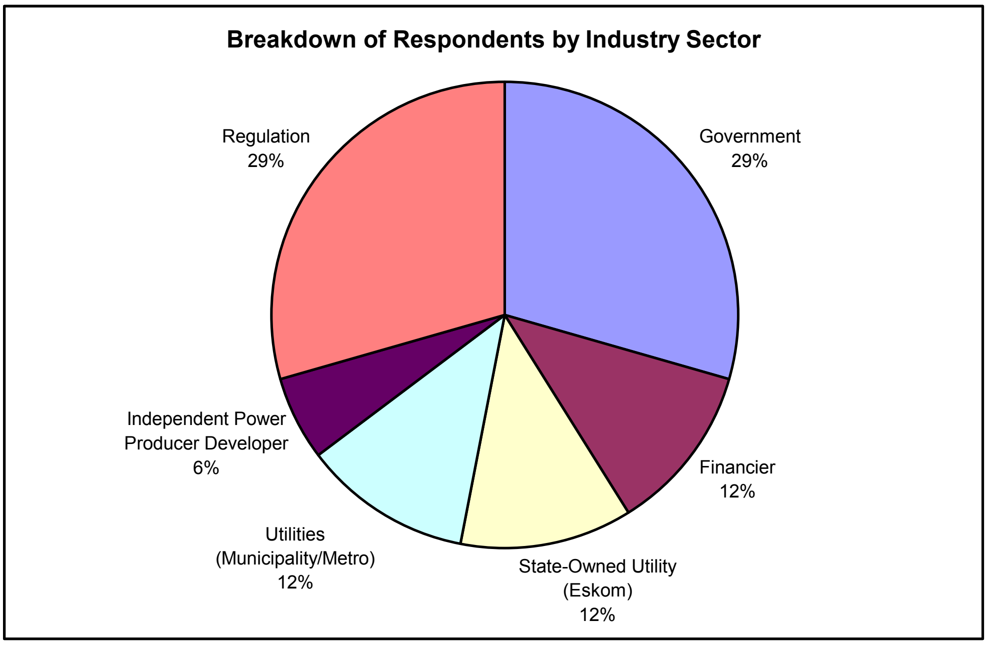
Hypothesis 4:

In South Africa there is independence of regulatory institutions and processes from government interference.

5.1. Descriptive Statistical Analysis

Firstly, it is prudent to look at the breakdown of respondents by sector. This is given in Figure 6 below. It is clear that the sample is dominated by representatives from the Government and Regulation sectors which may be a concern.

Figure 6. Breakdown of Respondents by Sector



5.1.1 Analysis of Individual Questions

Next, using the data analysis function in Microsoft Excel, the descriptive statistics for each question is calculated, these are given in Table 3 below.

A cursory examination of the descriptive stats for the dataset reveals that the mean, median and mode appear to be close together for all of the questions, indicating that most of the observations tend to the centre. However, given that this is Likert scale data, it is worth looking at the median more closely. What is apparent is that the median and mode are the same for most of the statements.

In addition, the distributions are mostly negatively skewed indicating a tendency for observations to be toward the upper end of the scale. The skewness readings are, however, very low which is an indication that the distributions could approach normality.

Table 3. Descriptive Statistics for each question, grouped by Hypothesis

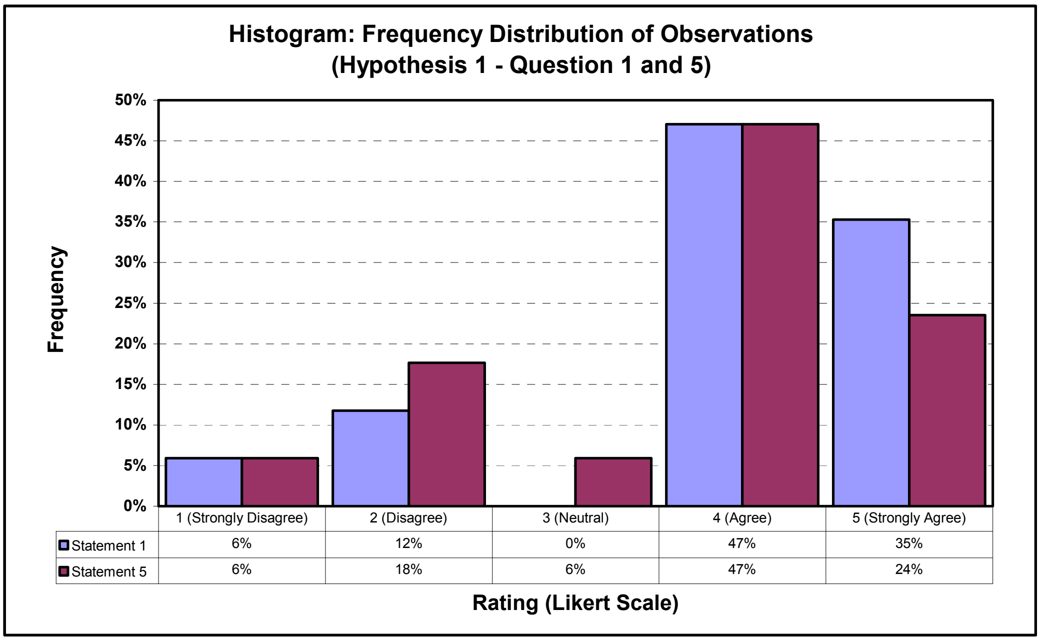
	Hypothesis 1		*Hypothesis 2*		*Hypothesis 3*		*Hypothesis 4*	
	Q 1	*Q 5*	*Q 2*	*Q 6*	*Q 3*	*Q 7*	*Q 4*	*Q 8*
Mean	3.94	3.65	3.88	3.82	3.29	2.88	3.71	3.71
Median	4	4	4	4	4	3	4	3
Mode	4	4	4	4	4	3	5	3
Standard Deviation	1.20	1.22	0.60	0.53	0.92	1.27	1.16	1.10
Sample Variance	1.43	1.49	0.36	0.28	0.85	1.61	1.35	1.22
Kurtosis	1.25	-0.19	0.23	0.74	0.87	-0.69	-1.47	-1.49
Skewness	-1.36	-0.85	0.02	-0.26	-1.22	0.04	-0.16	0.03
Range	4	4	2	2	3	4	3	3
Minimum	1	1	3	3	1	1	2	2
Maximum	5	5	5	5	4	5	5	5
Sum	67	62	66	65	56	49	63	63
Count	17	17	17	17	17	17	17	17

5.1.1.1 Question 1 and 5 (Hypothesis 1)

Looking at Table 3, the means of the observations for Questions 1 and 5 are 3.94 and 3.65 respectively. More importantly, the median and mode for each question are all the same at a rating of 4. This would indicate that there is support for these statements as a rating of 4 was portrayed as "agree" on the questionnaire.

The range is quite wide at 4 for both questions, which is the widest it could be with the 5 point Likert scale used. Both distributions are negatively skewed, which indicates a bias of the observations towards the upper end of the scale. The histogram of the observations for Questions 1 and 5 is given in Figure 7 below.

Figure 7. Hypothesis 1 (Adequate cash flows)



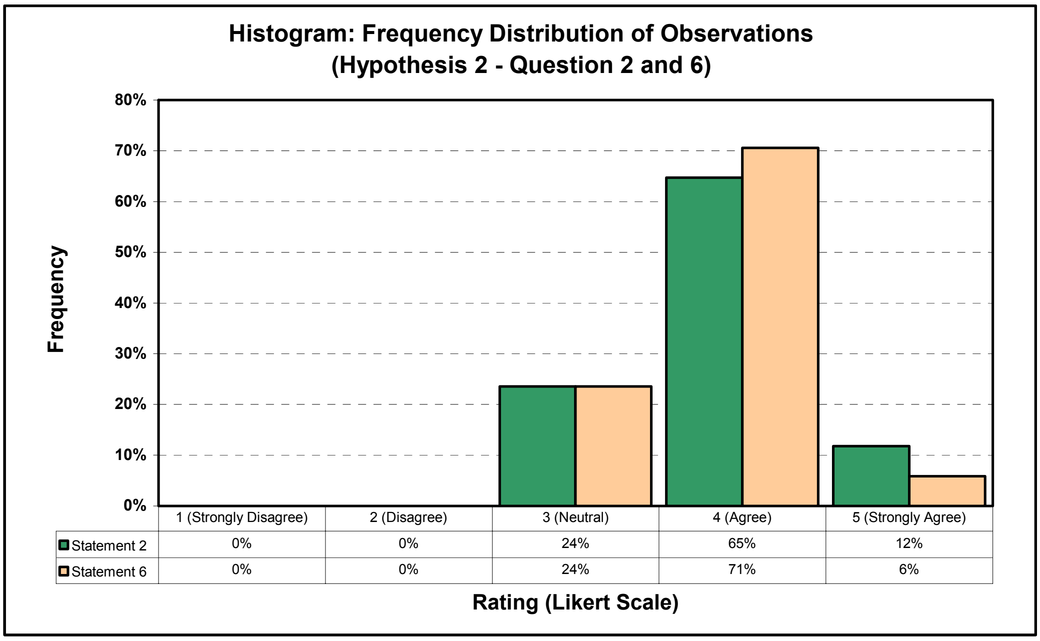
A visual examination of the frequency distribution for Questions 1 and 5 which relate to Hypothesis 1 shows that most of the responses fall in the categories above Neutral (3), 82% and 71% for Questions 1 and 5 respectively.

5.1.1.2 Question 2 and 6 (Hypothesis 2)

From Table 3, the means of the observations for Questions 2 and 6 are 3.88 and 3.82 respectively, almost the same. More importantly, the median and mode for each question are all the same at a rating of 4. This would indicate that there is support for these statements as a rating of 4 was portrayed as "agree" on the questionnaire.

The range is narrow at 2 for both questions indicating that most of the responses were within a narrow band. Both distributions are negatively skewed, but very small. This indicates a bias of the observations towards the upper end of the scale, but that the shape of the distribution approaches normality. The histogram of the observations for Questions 2 and 6 is given in Figure 8 below.

Figure 8. Hypothesis 2 (Good Legal Framework)



A visual examination of the frequency distribution for Questions 2 and 6 which relate to Hypothesis 2 shows that there are no responses in the strongly disagree and disagree categories. All of the responses fell in the categories from Neutral (3) and above, in fact, 88% and 77% of the responses fell in the categories above neutral (Agree/Strongly Agree) for Questions 2 and 6 respectively.

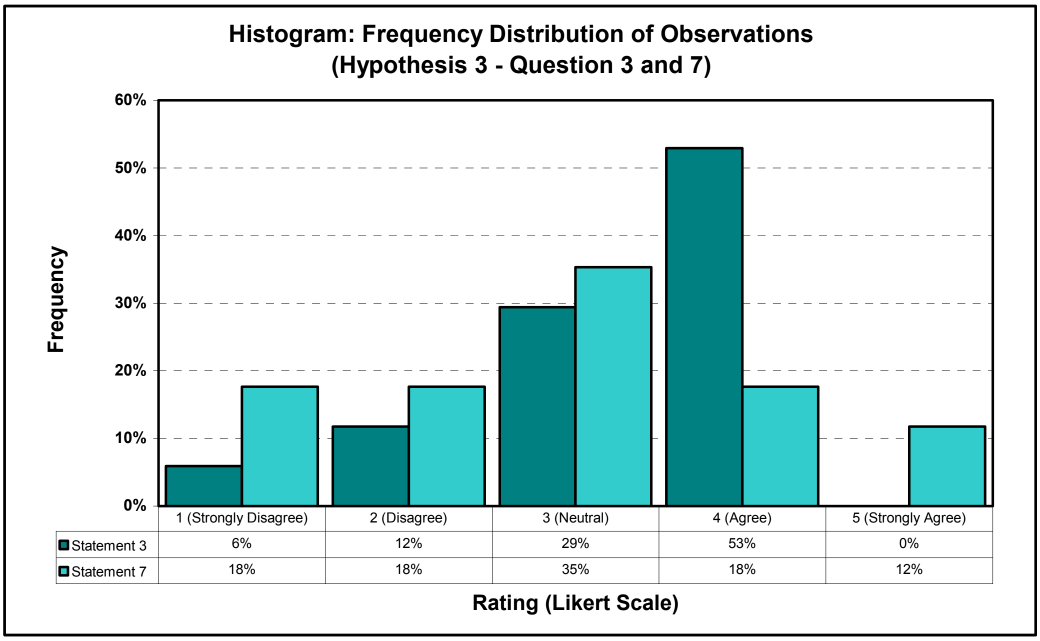
5.1.1.3 Question 3 and 7 (Hypothesis 3)

From Table 3, the means of the observations for Questions 3 and 7 are 3.29 and 2.88 respectively, indicating a difference between the two questions. More importantly, the median and mode for Question 3 are the same with a rating of 4 and are also the same for Question 7 at a rating of 3. This indicates that there was support for the statement in Question 3 as a rating of 4 was portrayed as “agree” on the questionnaire, but that respondents were neutral about the statement in Question 7.

The range is narrower for Question 3 than for Question 7, indicating that there was more consensus of respondents for Question 3 than Question 7. The distribution for Question 3 is negatively skewed, indicating a bias for the responses toward the “agree” side of the scale. The distribution for Question 7 is positively skewed, but so small that it could be considered a normal distribution. The histogram of the observations for Questions 3 and 7 is given Figure 9 in below.

A visual examination of the frequency distribution for Questions 3 and 7 which relate to Hypothesis 3 shows that the responses to both statements have quite a wide spread. Even though the average for Question 3 tends towards “agree”, it must be noted that 47% of the responses for that statement were either neutral or on the “disagree” side. The responses to the statement in Question 7 are distributed normally, but of note is that only 30% of the responses are on the agree side whereas 70% fell on the neutral and “disagree” side.

Figure 9. Hypothesis 3 (Government responsive to power sector needs)



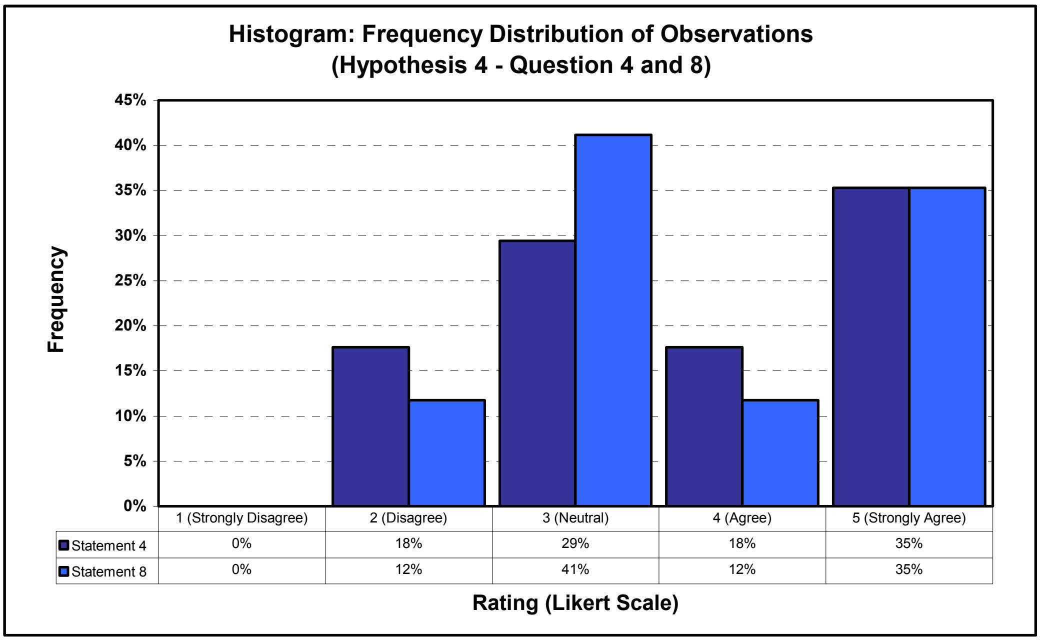
5.1.1.4 Question 4 and 8 (Hypothesis 4)

From Table 3, the means of the observations for Questions 4 and 8 are identical at 3.71, this would indicate that the responses were on average the same. However, looking at the median and mode for each tells a different story. The median and mode are 4 and 5 respectively for Question 4 and are both 3 for Question 8.

This indicates that there was support for the statement in Question 4 as a rating of 4 was portrayed as "agree" and rating 5 "strongly agree" on the questionnaire, but that respondents were neutral about the statement in Question 8. This is a very different picture from that which the means indicate.

The range is 3 for both Questions with a minimum of 2 and maximum of 5. This would indicate that no respondents were vehemently opposed to these statements, but that the spread of responses is quite wide. The distribution for Question 4 is negatively skewed and positively skewed for Question 8, but the readings are so small that the distributions can be considered normal. The histogram of the observations for Questions 4 and 8 is given in Figure 10 below.

Figure 10. Hypothesis 4 (Independence of Regulatory Institutions)



A visual examination of the frequency distribution for Questions 4 and 8 which relate to Hypothesis 4 shows that the responses to both statements have quite a wide spread between “disagree” and “strongly disagree”, there were no observations for either question in the “strongly disagree” category. Even though the average for both questions tends towards “agree” at 3.71, it must be noted that 47% of the responses for that Question 4 and 53% of the responses for Question 8 were either neutral or on the “disagree” side.

5.1.2 Correlation Analysis

The correlation between each of the two questions related to each of the Hypotheses was calculated to determine whether the responses to the questions related to the same Hypothesis could be summated. The results are given in Table 4 below.

Table 4. Correlation between questions related to each Hypothesis

	Correlation
Question 1 vs. 5 (Hypothesis 1)	71%
Question 2 vs. 6 (Hypothesis 2)	52%
Question 3 vs. 7 (Hypothesis 3)	51%
Question 4 vs. 8 (Hypothesis 4)	85%

It is clear that the questions for Hypothesis 1 and Hypothesis 4 are highly correlated whilst those for Hypothesis 2 and 3 are less so.

Taking this analysis into account and the fact that the scales were the same for all the questions, the decision was taken to summate the observations for the questions related to each Hypothesis.

5.1.3 Analysis of Summated Observations per Hypothesis

The descriptive statistical analysis detailed in Table 2 was performed on the summated data. The results are given in Table 5 below.

An analysis of the means in Table 5 shows that all of them are on the positive side of 3 indicating that all of the Hypotheses have a bias toward the “agree” side of the scale. Of note is the mean for Hypothesis 3, which is very close to 3, which indicates neutrality. It is prudent, however to also look a the median in this case, given that the data is based on a Likert scale. Looking at the median, the results for Hypothesis 1, 2 and 4 are equal to "agree" or 4 on the Likert scale, indicating agreement with the statements made. However, the median for Hypothesis 3 is "neutral" or 3, indicating uncertainty.

Table 5. Descriptive Statistics for each Hypothesis (summated questions)

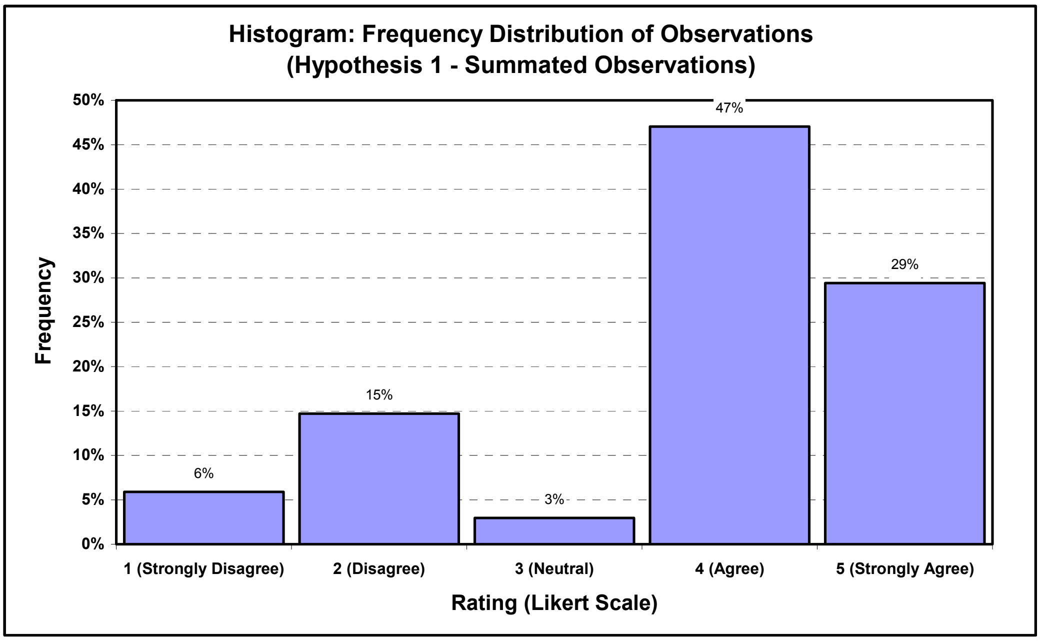
	Hypothesis 1 (Q 1 & Q 5)	*Hypothesis 2 (Q 2 & Q 6)*	*Hypothesis 3 (Q 3 & Q 7)*	*Hypothesis 4 (Q 4 & Q 8)*
Mean	3.79	3.85	3.09	3.71
Standard Error	0.21	0.10	0.19	0.19
Median	4	4	3	4
Mode	4	4	4	5
Standard Deviation	1.20	0.56	1.11	1.12
Sample Variance	1.44	0.31	1.23	1.24
Kurtosis	0.12	0.25	-0.48	-1.44
Skewness	-1.03	-0.07	-0.46	-0.07
Range	4	2	4	3
Minimum	1	3	1	2
Maximum	5	5	5	5
Sum	129	131	105	126
Count	34	34	34	34

5.1.3.1 Hypothesis 1 (Adequate cash flows)

From Table 5, the mean of the summated observations for Questions 1 and 5 is 3.79. This indicates that the responses were on average toward the "agree" side of the scale. The median and mode are also on the "agree" side, both being 4. This indicates that support for Hypothesis 1 as a rating of 4 on the Likert scale corresponds with "agree".

The range is 4, which is quite wide. The distribution is negatively skewed, which indicates that the observations are biased toward the "agree" side of the scale. The histogram of the summated observations for Hypothesis 1 is given in Figure 11 below.

Figure 11. Histogram of Summated Responses for Hypothesis 1



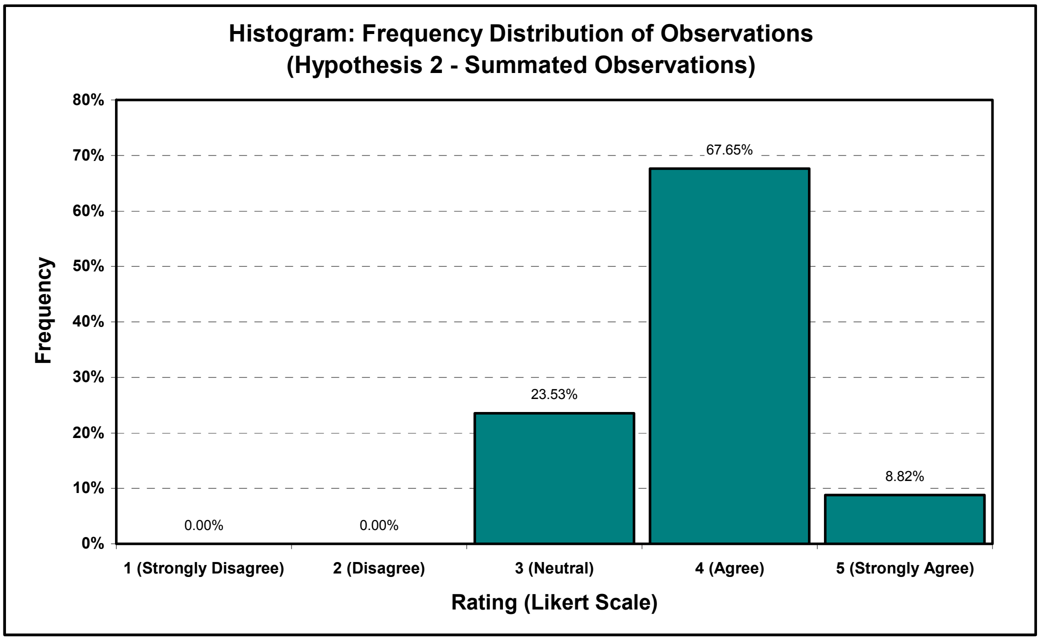
A visual examination of the frequency distribution for Hypothesis 1 above shows that 76% of the observations fall in the categories "agree" and "strongly agree". This would indicate that there is strong support within the sample for this Hypothesis that *in South Africa, there are adequate cash flows for ensuring a reasonable prospect of recovering costs and making an investment in the power generation sector a success.*

5.1.3.2 Hypothesis 2 (Good Legal Framework)

From Table 5, the mean of the summated observations for Questions 2 and 6 is 3.85. This indicates that the responses were on average toward the "agree" side of the scale. The median and mode are also on the "agree" side, both being 4. This indicates that support for Hypothesis 1 as a rating of 4 on the Likert scale corresponds with "agree".

The range is narrow at 2 indicating that most of the responses were within a narrow band. The distribution is negatively skewed, but the reading is so small that the distribution can be considered normal. This indicates a bias of the observations towards the "agree" side of the scale, but that the shape of the distribution approaches normality. The histogram of the summated observations for Hypothesis 2 is given Figure 12 in below.

Figure 12. Histogram of Summated Responses for Hypothesis 2



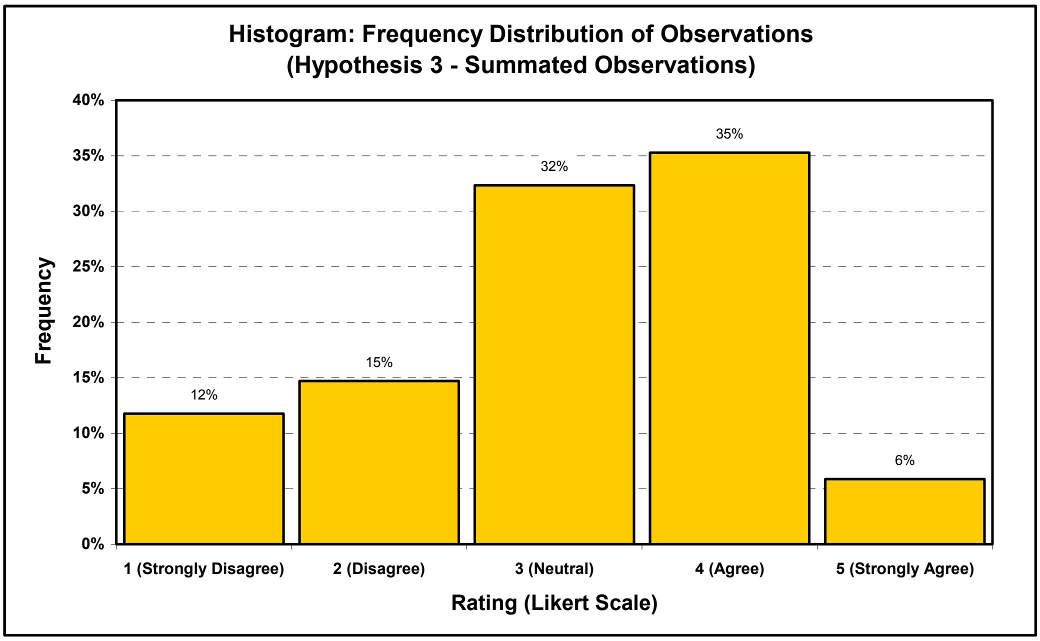
A visual examination of the frequency distribution for Hypothesis 2 above shows that over 75% of the observations fall within the categories "agree" and "strongly agree", the balance are in the "neutral" category. This indicates strong support within the sample for this Hypothesis that *in South Africa, there is a good legal* *framework, the rights and obligations of private investors in power generation are clearly defined and all applicable laws and contracts are enforced.*

5.1.3.3 Hypothesis 3 (Government responsive to power sector needs)

From Table 5, the mean of the summated observations for Questions 3 and 7 is 3.09. The median is 3, representing "neutral" and the mode is 4, representing "agree".

The range is 4, which is quite wide. The distribution is negatively skewed, which indicates that the observations are biased toward the "agree" side of the scale. The histogram of the summated observations for Hypothesis 3 is given in Figure 13 below.

Figure 13. Histogram of Summated Responses for Hypothesis 3



A visual examination of the frequency distribution for Hypothesis 3 in Figure 13 shows that only 41% of the observations fall within the categories "agree" and "strongly agree", the balance of 59% are in the "neutral", "disagree" and "strongly disagree" categories. This indicates that the Hypothesis that *in South Africa, Government is responsive to the needs and timeframes of investors in the power sector* is not supported by the sample. There are, however more supporters (41%) than detractors (27%) with the rest being neutral (32%).

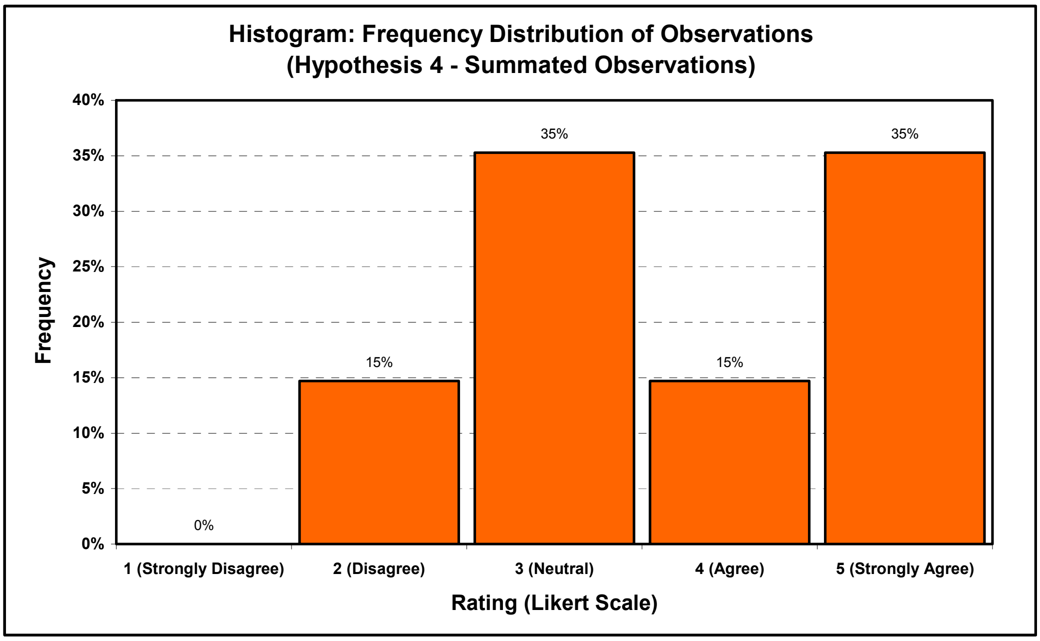
5.1.3.4 Hypothesis 4 (Independence of Regulatory Institutions)

From Table 5, the mean of the summated observations for Questions 4 and 8 is 3.71. This indicates that the responses were on average toward the "agree" side of the scale. The median and mode are also on the "agree" side, both being 4 and 5 respectively. This indicates that support for Hypothesis 1 as a rating of 4 on the Likert scale corresponds with "agree" and a rating of 5 with "strongly agree".

The range is 3 from a maximum of 4. This indicates that the responses were quite varied. The distribution is negatively skewed, but the reading is so small that the distribution can be considered normal. There is a bias of the observations towards the "agree" side of the scale, but the shape of the distribution approaches normality. The histogram of the summated observations for Hypothesis 4 is given in Figure 14 below.

A visual examination of the frequency distribution for Hypothesis 4 in Figure 14 shows that 50% of the observations fall within the categories "agree" and "strongly agree", the balance of 50% is split between "neutral" with 35% and "disagree" with 15%, there were no observation in the "strongly disagree" category. This indicates that the Hypothesis that *in South Africa, there is independence of regulatory institutions and processes from government interference*, is supported by the sample, but there are a significant number of respondents "sitting on the fence".

Figure 14. Histogram of Summated Responses for Hypothesis 4



5.2. Inferential Statistical Analysis

An analysis of the descriptive statistics has given an indication of the support (or lack thereof) for each of the Hypotheses formulated in Chapter 3. The next step is to perform hypothesis testing to statistically prove or disprove each of the Hypotheses.

The summated observations for each Hypothesis were used to perform the hypothesis testing.

5.2.1 Hypothesis 1: Adequate cash flow

The first task in hypothesis testing is to formulate the Null and Alternative Hypotheses.

The Null Hypothesis (H_0) statement is:

In South Africa, there are not adequate cash flows for ensuring a reasonable prospect of recovering costs and making an investment in the power generation sector a success.

The Alternative Hypothesis (H_a) statement is:

In South Africa, there are adequate cash flows for ensuring a reasonable prospect of recovering costs and making an investment in the power generation sector a success.

The Hypotheses to be tested are: **H_0: $\mu \leq 3$** **H_a: $\mu > 3$** where **μ** is the sample mean and 3 is the hypothesised population mean rating

Note that a significance level (**α**) of 0.01 (**1% statistical significance level**) is stipulated.

The test performed is a one-tailed, one sample, *t*-Test which is a parametric difference of means test. The Wilcoxon signed-rank test, which is a nonparametric difference of medians test is also performed by the NCSS

software. This conveniently allows a comparison of the results from a non-parametric and parametric test.

The full test report for Hypothesis Statement 1 is given in Appendix 2. The abbreviated NCSS one sample *t*-Test results are given in Table 6 below.

Table 6. Abbreviated NCSS one-sample *t*-Test results: Hypothesis 1

Hypothesis Statement 1 (Summated Observations)		
Statistical Variable	***t*-Test**	**Wilcoxon**
Sample Size (*n*)	34	
Sample Mean (*μ*)	3.79	
Sample Std Dev (*s*)	1.2	
Hypothesized Population Mean	3	
Alternative Hypothesis (H_a)	$\mu > 3$	median > 3
Standard Error of Mean	0.21	
p-Value	0.00025	0.00072
Significance Level (*α*)	0.01	0.01
Result at 1% Significance Level	Reject H_0	Reject H_0

The test results in Table 6 above indicate that the *p*-Value (0.00025) is less than the significance level (0.01) with the result that **the null hypothesis is rejected** for Hypothesis Statement 1. This is confirmed by the Wilcoxon Signed-Rank Test, which also yields a result of a *p*-Value (0.00072) < *α*-Level (0.01).

The alternative hypothesis for Hypothesis Statement 1 is therefore proven to be statistically significant at the 1% level.

5.2.2 Hypothesis 2: Good Legal Framework

The first task in hypothesis testing is to formulate the Null and Alternative Hypotheses.

The Null Hypothesis (H_0) statement is:

In South Africa, there is not a good legal framework, the rights and obligations of private investors in power generation are clearly defined and all applicable laws and contracts are enforced.

The Alternative Hypothesis (H_a) statement is:

In South Africa, there is a good legal framework, the rights and obligations of private investors in power generation are clearly defined and all applicable laws and contracts are enforced.

The Hypotheses to be tested are:
H_0: $\mu \leq 3$
H_a: $\mu > 3$
where **μ** is the sample mean and 3 is the hypothesised population mean rating

Note that a significance level (**α**) of 0.01 (**1% statistical significance level**) is stipulated.

The test performed is a one-tailed, one sample, *t*-Test which is a parametric difference of means test. The Wilcoxon signed-rank test, which is a nonparametric difference of medians test is also performed by the NCSS

software. This conveniently allows a comparison of the results from a non-parametric and parametric test.

The full test report for Hypothesis Statement 2 is given in Appendix 3. The abbreviated NCSS one sample *t*-Test results are given in Table 7 below.

Table 7. Abbreviated NCSS one-sample *t*-Test results: Hypothesis 2

Hypothesis Statement 2 (Summated Observations)		
Statistical Variable	***t*-Test**	**Wilcoxon**
Sample Size (*n*)	34	
Sample Mean (*μ*)	3.85	
Sample Std Dev (*s*)	0.6	
Hypothesized Population Mean	3	
Alternative Hypothesis (H_a)	μ > 3	median > 3
Standard Error of Mean	0.10	
p-Value	< 0.0001	< 0.0001
Significance Level (*α*)	0.01	0.01
Result at 1% Significance Level	Reject H_0	Reject H_0

The test results in Table 7 above indicate that the *p*-Value (<0.0001) is negligible and far smaller than the significance (*α*) level of 0.01 with the result that **the null hypothesis is rejected** for Hypothesis Statement 2. This is confirmed by the Wilcoxon Signed-Rank Test, which also yields a result of a *p*-Value (<0.0001) < *α*-Level (0.01).

The alternative hypothesis for Hypothesis Statement 2 is therefore proven to be statistically significant at the 1% level.

5.2.3 Hypothesis 3: Government responsive to power sector needs

The first task in hypothesis testing is to formulate the Null and Alternative Hypotheses.

The Null Hypothesis (H_0) statement is:

In South Africa, Government is not responsive to the needs and timeframes of investors in the power sector.

The Alternative Hypothesis (H_a) statement is:

In South Africa, Government is responsive to the needs and timeframes of investors in the power sector.

The Hypotheses to be tested are:
H_0: $\mu \leq 3$
H_a: $\mu > 3$
where **μ** is the sample mean and 3 is the hypothesised population mean rating

Note that a significance level (**α**) of 0.01 (**1% statistical significance level**) is stipulated.

The test performed is a one-tailed, one sample, *t*-Test which is a parametric difference of means test. The Wilcoxon signed-rank test, which is a nonparametric difference of medians test is also performed by the NCSS

software. This conveniently allows a comparison of the results from a non-parametric and parametric test.

The full test report for Hypothesis Statement 3 is given in Appendix 4. The abbreviated NCSS one sample *t*-Test results are given in Table 8 below.

Table 8. Abbreviated NCSS one-sample *t*-Test results: Hypothesis 3

Hypothesis Statement 3 (Summated Observations)		
Statistical Variable	***t*-Test**	**Wilcoxon**
Sample Size (*n*)	34	
Sample Mean (μ)	3.09	
Sample Std Dev (*s*)	1.1	
Hypothesized Population Mean	3	
Alternative Hypothesis (H_a)	$\mu > 3$	median > 3
Standard Error of Mean	0.19	
p-Value	0.32317	0.24767
Significance Level (α)	0.01	0.01
Result at 1% Significance Level	Fail to Reject H_0	Fail to Reject H_0

The test results in Table 8 above indicate that the *p*-Value (0.32317) is larger than the significance (α) level of 0.01 with the result that **the test fails to reject the null hypothesis** for Hypothesis Statement 3. This is confirmed by the Wilcoxon Signed-Rank Test, which also yields a result of a *p*-Value (0.24767) > α-Level (0.01).

Even at significance levels of 5% and 10% (α-Level = 0.05 or 0.10) the *p*-Value of 0.32317 is still larger and the test fails to reject the null hypothesis.

What this means is that the alternative hypothesis is not statistically significant at the 1% (or 5% or 10%) significance level (α). It is important to note that this does not constitute acceptance of the null hypothesis in statistical terms.

5.2.4 Hypothesis 4: Independence of Regulatory Institutions

The first task in hypothesis testing is to formulate the Null and Alternative Hypotheses.

The Null Hypothesis (H_0) statement is:

In South Africa there is no independence of regulatory institutions and processes from government interference.

The Alternative Hypothesis (H_a) statement is:

In South Africa there is independence of regulatory institutions and processes from government interference.

The Hypotheses to be tested are:
H_0: $\mu \leq 3$
H_a: $\mu > 3$
where **μ** is the sample mean and 3 is the hypothesised population mean rating

Note that a significance level (α) of 0.01 (**1% statistical significance level**) is stipulated.

The test performed is a one-tailed, one sample, *t*-Test which is a parametric difference of means test. The Wilcoxon signed-rank test, which is a nonparametric difference of medians test is also performed by the NCSS software. This conveniently allows a comparison of the results from a non-parametric and parametric test.

The full test report for Hypothesis Statement 4 is given in Appendix 5. The abbreviated NCSS one sample *t*-Test results are given in Table 9 below.

Table 9. Abbreviated NCSS one-sample *t*-Test results: Hypothesis 4

Hypothesis Statement 4 (Summated Observations)		
Statistical Variable	***t*-Test**	**Wilcoxon**
Sample Size (*n*)	34	
Sample Mean (μ)	3.71	
Sample Std Dev (*s*)	1.1	
Hypothesized Population Mean	3	
Alternative Hypothesis (H_a)	$\mu > 3$	median > 3
Standard Error of Mean	0.19	
p-Value	0.00040	0.00126
Significance Level (α)	0.01	0.01
Result at 1% Significance Level	Reject H_0	Reject H_0

The test results in Table 9 above indicate that the *p*-Value (0.0004) is negligible and far smaller than the significance (α) level of 0.01 with the result that **the null hypothesis is rejected** for Hypothesis Statement 4. This is confirmed by the

Wilcoxon Signed-Rank Test, which yields a *p*-Value (<0.0001) < *α*-Level (0.01) and the same result.

The alternative hypothesis for Hypothesis Statement 4 is therefore proven to be statistically significant at the 1% level.

5.3. Summarised Results

The results from the descriptive statistical analysis and the hypothesis testing are summarised in Table 10 below.

Table 10. Summarised Results

	Sample Mean	Sample Median	t-Test Result
Hypothesis 1	3.79	4	Reject H_0
Hypothesis 2	3.85	4	Reject H_0
Hypothesis 3	3.09	3	Fail to Reject H_0
Hypothesis 4	3.71	4	Reject H_0

The results from the hypothesis testing are borne out when looking at the mean and median results from the descriptive statistical analysis. The Sample means for Hypotheses 1, 2 and 3 are highly biased toward the “agree” category and this is supported by the median (a better indicator for Likert data which is ordinal in nature) for all three which is the rating of 4, which corresponds to “agree” on the Likert scale.

The hypothesis test result for Hypothesis 3 is also supported, even though the mean tends slightly toward the “agree” side of the scale, the median yields a rating of 3, which indicates neutrality.

Chapter 6: Discussion of Results

The objectives of this research were:

- To survey the major players in the Electricity Sector in South Africa, especially potential private investors in power generation to determine the whether the major factors upon which decisions to invest or not to invest in a power project are based are catered for in South Africa.
- Having identified which of the major factors are catered for or not catered for as the case may be, recommendations would be made regarding actions to be taken to address shortcomings and to build on strengths to attract the necessary private sector investment in new power generating capacity in South Africa.

The literature review highlighted South Africa's current capacity crunch with the requisite need for a tremendous amount of new power generating capacity (80 000MW in 20 years) within a relatively short timeframe and government's commitment that 30% of the new capacity will be built, owned and operated (BOO model) by the private sector.

The problem highlighted is the lack of private sector interest in the power sector, evidenced by the competitive bidding process conducted by the Department of Minerals and Energy (DME) for an Independent Power Producer Gas Turbine Power Plant, which yielded only 2 bidders at the end of the process.

There was a need for research into the factors that investors consider of paramount importance when deciding on whether to invest in the power sector in a country. These are not decisions to be taken lightly as power sector investment by its very nature is highly capital intensive and involves billions of Rands and also tend to be long term investments that can range from 15-20 years depending on the size and nature of power plant invested in.

The literature review revealed a study conducted by the World Bank in early 2002 (Lamech and Saeed, 2003) where an international survey was done to determine the major factors that power sector investors consider when investing in developing countries. South Africa was not highlighted in the study, results reported were mainly from the South American and Asian regions.

The factors highlighted, however, were of particular interest as South Africa intends attracting investment into its power sector from international as well as local investors. Of the six factors identified by the World Bank study, 2 were discarded as either being moot or not relevant to South Africa. The factors investigated were:

1) **Adequacy of cash flows in the sector**
2) **Stability and enforcement of laws and contracts**
3) **Government responsiveness to the needs and timeframes of investors**
4) **Regulatory Independence**

A Hypothesis Statement was formulated for each of these and a questionnaire survey done to test the various hypotheses. A discussion of the results of the analysis of the questionnaire data follows for each of the factors investigated.

6.1. Hypothesis 1: Adequacy of cash flows in the sector

In South Africa, there are adequate cash flows for ensuring a reasonable prospect of recovering costs and making an investment in the power generation sector a success.

The Hypothesis above was surveyed with statements 1 and 5 in the questionnaire survey (see Appendix 1) that required respondents to indicate their agreement or disagreement on a 5 point Likert scale.

Descriptive statistics were calculated for the dataset for each question individually and then the summated dataset of the two. The results of this analysis are given in 0 below.

The descriptive statistics for the individual questions are very similar with the result that the summated result is also very similar. The main result to look at here is that the average of the observations (mean) tends toward the upper end or “agree” side of the scale. The median readings reinforce this as they are all a rating of 4 which corresponds with “agree” on the Likert scale. The distributions are all negatively skewed, which also indicates a bias toward the “agree” side.

This indicates that there is support within the sample for the Hypothesis Statement that there are adequate cash flows in the power sector in South Africa.

Table 11. Summarised Descriptive Statistics for Hypothesis 1

Variable	*Q 1*	*Q 5*	*Summated*
Mean	3.94	3.65	3.79
Standard Error	0.29	0.30	0.21
Median	4	4	4
Mode	4	4	4
Standard Deviation	1.20	1.22	1.20
Sample Variance	1.43	1.49	1.44
Kurtosis	1.25	-0.19	0.12
Skewness	-1.36	-0.85	-1.03
Range	4	4	4
Minimum	1	1	1
Maximum	5	5	5
Sum	67	62	129
Count	17	17	34

If the scale is "collapsed" to comprise of only 3 categories, namely, "disagree", "neutral" and "agree" and the frequency of observations calculated in each, then the result in Table 12 below is presented.

Table 12. Frequency Distribution of Collapsed Scale for Hypothesis 1

Hypothesis 1			
Category	**Statement 1**	**Statement 5**	**Summated**
Disagree	18%	24%	21%
Neutral	0%	6%	3%
Agree	82%	71%	76%

It is very clear from this table that the majority of the responses to these questions (over 70%) are on the "agree" side of the scale, whether the individual question responses or the summated responses are considered.

The above shows that, based on descriptive analysis, the majority of the respondents are of the opinion that cash flows are adequate in the South African power sector to ensure a reasonable prospect of recovering costs and making an investment in the power generation sector a success.

Descriptive statistics are, however not enough to prove statistically that the Hypothesis Statement is supported. In order to do this, hypothesis testing was performed on the summated dataset using a one-tailed, one-sample *t*-test which was performed using NCSS. The results are given in Table 6 above.

The outcome is that the null hypothesis is rejected for both the parametric and nonparametric tests carried out by the software package. The Hypothesis 1 Statement was posed as the alternative hypothesis and is therefore proved to be statistically significant at the 1% significance level.

There is therefore, statistical support that cash flows are adequate enough in the South African power sector to ensure a reasonable prospect of recovering costs and making an investment in the power generation sector a success.

This result must be tempered in the light of the composition of the sample, which was dominated by the government and regulation sectors which made up some 58% of the sample. It would be expected that this would be the sentiment in those sectors, but the fact that over 70% of the observations were also supportive of the statement supports the notion that cash flows are adequate in the power sector.

6.2. Hypothesis 2: Stability and enforcement of laws and contracts

In South Africa, there is a good legal framework, the rights and obligations of private investors in power generation are clearly defined and all applicable laws and contracts are enforced.

The Hypothesis above was surveyed with statements 2 and 6 in the questionnaire survey (see Appendix 1) that required respondents to indicate their agreement or disagreement on a 5 point Likert scale.

Descriptive statistics were calculated for the dataset for each question individually and then the summated dataset of the two. The results of this analysis are given in Table 13 below.

Table 13. Summarised Descriptive Statistics for Hypothesis 2

Hypothesis 2			
Variable	***Q 2***	***Q 6***	***Summated***
Mean	3.88	3.82	3.85
Standard Error	0.15	0.13	0.10
Median	4	4	4
Mode	4	4	4
Standard Deviation	0.60	0.53	0.56
Sample Variance	0.36	0.28	0.31
Kurtosis	0.23	0.74	0.25
Skewness	0.02	-0.26	-0.07
Range	2	2	2
Minimum	3	3	3
Maximum	5	5	5
Sum	66	65	131
Count	17	17	34

The descriptive statistics for the individual questions are very similar with the result that the summated result is also very similar. The main result to look at here is that the average of the observations (mean) tends toward the upper end or "agree" side of the scale. The median figures reinforce this they are all a rating of 4 which corresponds with "agree" on the Likert scale. The distributions are either negatively skewed or almost zero, the summated figure for skewness is almost zero which also indicates that the observations approximate a normal distribution.

This indicates that there is support within the sample for the Hypothesis Statement that there is stability and enforcement of laws and contracts in South Africa.

If the scale is "collapsed" to comprise of only 3 categories, namely, "disagree", "neutral" and "agree" and the frequency of observations calculated in each, then the result in Table 14 below is presented.

Table 14. Frequency Distribution of Collapsed Scale for Hypothesis 2

Hypothesis 2			
Category	**Statement 2**	**Statement 6**	**Hypothesis 2**
Disagree	0%	0%	0%
Neutral	24%	24%	24%
Agree	76%	76%	76%

It is very clear from this table that the majority of the responses to these questions (over 75%) are on the "agree" side of the scale, whether the individual question responses or the summated responses are considered. Of note is that there are no observations within the disagree scale, the rest are in the "neutral" category.

The above shows that, based on descriptive analysis, the majority of the respondents are of the opinion that that there is stability and enforcement of laws and contracts in South Africa and that none of the respondents disagreed with this.

Descriptive statistics are, however not enough to prove statistically that the Hypothesis Statement is supported. In order to do this, hypothesis testing was performed on the summated dataset using a one-tailed, one-sample *t*-test which was performed using NCSS. The results are given in Table 7 above.

The outcome is that the null hypothesis is rejected for both the parametric and nonparametric tests carried out by the software package. The Hypothesis 2 Statement was posed as the alternative hypothesis and is therefore proved to be statistically significant at the 1% significance level.

There is therefore, statistical support that there is stability and enforcement of laws and contracts in South Africa.

This result must also be tempered in the light of the composition of the sample, which was dominated by the government and regulation sectors which made up some 58% of the sample. It would be expected that this would be the sentiment in those sectors, but the fact that over 75% of the observations were supportive of the statement and none of the respondents disagreed with the statement strongly supports that there is stability and enforcement of laws and contracts in South Africa.

6.3. Hypothesis 3: Government responsiveness to power sector needs

In South Africa, Government is responsive to the needs and timeframes of investors in the power sector.

The Hypothesis above was surveyed with statements 3 and 7 in the questionnaire survey (see Appendix 1) that required respondents to indicate their agreement or disagreement on a 5 point Likert scale.

Descriptive statistics were calculated for the dataset for each question individually and then the summated dataset of the two. The results of this analysis are given in Table 15 below.

Table 15. Summarised Descriptive Statistics for Hypothesis 3

Hypothesis 3			
Variable	***Q 3***	***Q 7***	***Summated***
Mean	3.29	2.88	3.09
Standard Error	0.22	0.31	0.19
Median	4	3	3
Mode	4	3	4
Standard Deviation	0.92	1.27	1.11
Sample Variance	0.85	1.61	1.23
Kurtosis	0.87	-0.69	-0.48
Skewness	-1.22	0.04	-0.46
Range	3	4	4
Minimum	1	1	1
Maximum	4	5	5
Sum	56	49	105
Count	17	17	34

The descriptive statistics for the individual questions are varied. The average of the observations (mean) tends toward the upper end or "agree" side of the scale for Question 7 and to the "disagree" side for Question 3. This is borne out in the median figures where Question 3 has a median of 4 ("agree") and Question 7 a median of 3 ("neutral"). The mean for the summated dataset is very close to "neutral" and the median is 3 ("neutral"). The distributions are either negatively skewed or almost zero, the summated figure for skewness is negative, indicating some bias toward the "agree" side..

It is not clear from the above whether there is support within the sample for the Hypothesis Statement that Government is responsive to the needs and timeframes of investors in the power sector in South Africa or not.

If the scale is "collapsed" to comprise of only 3 categories, namely, "disagree", "neutral" and "agree" and the frequency of observations calculated in each, then the result in Table 16 below is presented.

Table 16. Frequency Distribution of Collapsed Scale for Hypothesis 3

Hypothesis 3			
Category	**Statement 3**	**Statement 7**	**Hypothesis 3**
Disagree	18%	35%	26%
Neutral	29%	35%	32%
Agree	53%	29%	41%

It is not clear from the table where the majority of the responses lie. In Question 3, the majority of the observations are on the "agree" side, but when the summated data is analyses, only 41% of the observations are on the "agree" side of the scale. The observations appear to be almost evenly spaces between the three categories, with a slight bias toward "agree".

Based on the descriptive analysis it is not possible to discern any trend, the opinions on this statement appear to be varied..

Descriptive statistics are, however not enough to prove statistically that the Hypothesis Statement is supported in any case. In order to do this, hypothesis testing was performed on the summated dataset using a one-tailed, one-sample *t*-test which was performed using NCSS. The results are given in Table 8 above.

The outcome is that the null hypothesis cannot be rejected for both the parametric and nonparametric tests carried out by the software package either at the 1%, 5% or 10% significance level. The Hypothesis 3 Statement was posed as the alternative hypothesis could not therefore be proved to be statistically significant.

There is therefore, no statistical support that, Government is responsive to the needs and timeframes of investors in the power sector in South Africa.

This was a surprising result, given that the sample was dominated by the government and regulation sectors which made up some 58% of the sample. It would appear that acknowledgement is being given of the fact that the DME competitive bidding process has left a lot to be desired.

The outcome does not mean that Government is not responsive to the needs and timing of investors in the power sector in South Africa, what if means is that we were not able to prove that it is responsive with any statistical significance. This result indicates that there is work to be done in this area if private sector investment is to be attracted to the power sector.

6.4. Hypothesis 4: Independence of Regulatory Institutions

In South Africa there is independence of regulatory institutions and processes from government interference.

The Hypothesis above was surveyed with statements 4 and 8 in the questionnaire survey (see Appendix 1) that required respondents to indicate their agreement or disagreement on a 5 point Likert scale.

Descriptive statistics were calculated for the dataset for each question individually and then the summated dataset of the two. The results of this analysis are given in Table 17 below.

The descriptive statistics for the individual questions are very similar with the result that the summated result is also very similar. The main result to look at here is that the average of the observations (mean) tends toward the upper end or “agree” side of the scale and they are identical for the two questions. The median figures do not reinforce this as they are varied, with one having a rating of 4 and the other a rating of 3 which corresponds with “agree” and “neutral” respectively on the Likert scale. The summated dataset has a median of 4.

The distributions are negatively skewed and close to zero, which indicates that the observations approximate a normal distribution.

Table 17. Summarised Descriptive Statistics for Hypothesis 4

Hypothesis 4			
Variable	***Q 4***	***Q 8***	***Summated***
Mean	3.71	3.71	3.71
Standard Error	0.28	0.27	0.19
Median	4	3	4
Mode	5	3	5
Standard Deviation	1.16	1.10	1.12
Sample Variance	1.35	1.22	1.24
Kurtosis	-1.47	-1.49	-1.44
Skewness	-0.16	0.03	-0.07
Range	3	3	3
Minimum	2	2	2
Maximum	5	5	5
Sum	63	63	126
Count	17	17	34

This above indicates that there might be support within the sample for the Hypothesis Statement that there is independence of regulatory institutions and processes from government interference in South Africa, but it is far from clear.

If the scale is “collapsed” to comprise of only 3 categories, namely, “disagree”, “neutral” and “agree” and the frequency of observations calculated in each, then the result in Table 18 below is presented.

Table 18. Frequency Distribution of Collapsed Scale for Hypothesis 4

Hypothesis 4			
Category	**Statement 4**	**Statement 8**	**Hypothesis 4**
Disagree	18%	12%	15%
Neutral	29%	41%	35%
Agree	53%	47%	50%

The table shows that around 50% of the responses to these questions are on the "agree" side of the scale. That is far from conclusive as to where the sentiment of the sample lies with respect to this Hypothesis.

The above shows that, based on the descriptive analysis, it is not possible to discern the majority opinion of the sample regarding whether there is independence of regulatory institutions and processes from government interference in South Africa or not.

Descriptive statistics are, however, in any case not enough to prove statistically whether a Hypothesis Statement is supported or not. In order to do this, hypothesis testing was performed on the summated dataset using a one-tailed, one-sample *t*-test which was performed using NCSS. The results are given in Table 9 above.

The outcome is that the null hypothesis is rejected for both the parametric and nonparametric tests carried out by the software package. The Hypothesis 4 Statement was posed as the alternative hypothesis and is therefore proved to be statistically significant at the 1% significance level.

There is therefore, statistical support that there is independence of regulatory institutions and processes from government interference in South Africa even though this is not borne out by the descriptive statistics.

This result must also be viewed in the light of the composition of the sample, which was dominated by the government and regulation sectors which made up some 58% of the sample.

It is expected that sentiment in those sectors would be positive toward this statement and the fact that the respondents were split almost evenly between neutral/disagree and agree means that this result must be looked at carefully. Indications are that support for this statement is precarious and work will need to be done in this area if private sector investment is to be attracted to the South African power sector.

6.5. Discussion of Results Summary

The literature reviewed showed that in order to create a conducive (read ideal) climate for private sector investment in South Africa's power sector, the following needs to be catered for.

There needs to be adequate cash flows which will ensure that investors have a reasonable prospect of recovering costs and making an investment in the power generation sector a success. This means that there needs to be adequate recovery of costs allowed via the tariffs and that investors will be permitted to make a reasonable profit. The term reasonable is not defined and could mean many different things for different institutions.

The test results indicated strongly that the industry (bearing in mind the skewed sample) agrees that cash flows are indeed adequate in South Africa. Although there is some work to be done in this area, especially on defining a “reasonable return”, it seems that this is not currently a barrier to private investment in the South African power sector.

In addition to the cash flows, a good legal framework is needed, where the rights and obligations of private investors in power generation are clearly defined and all applicable laws and contracts are enforced. There is strong consensus on this within the sample that South Africa does possess a good legal framework. Investors need this because power sector investments run into many millions if not billions of Rand and then need to be assured that their interest will be protected in the long run. This appears to be catered for sufficiently within South Africa’s current legal system and does not pose a barrier to investment.

A government that is responsive to the needs and timeframes of investors in the power sector was also put forward as one of the primary considerations by private investors. Government is well known (in most parts of the world) for being inefficient and lethargic. Protracted timeframes have an opportunity cost for investors and can pose a substantial barrier to investment. The survey results were inconclusive. The result shows that there is a lot of work to be done in this area to restore confidence in government's ability to address the needs and timeframes of investors. This area is definitely an obstacle to private sector investment in South Africa's power sector and needs to be addressed urgently. The protracted and convoluted DME competitive bidding process for the first IPP is a case in point.

The independence of regulatory institutions and processes from government interference is also considered important from an investor point of view. This could be a concern in South Africa, given that the National Energy Regulator of South Africa functions as an independent economic regulator, but is under the direction of the Minister of Minerals and Energy. There is much room for interference from government and the private sector is well aware of that. The survey result was that there is statistical support to claim that the regulatory institutions and processes are independent from government interference, however when looking at the frequency distributions of the responses it is clear that the sample was divided on this issue. This can be a major obstacle to private sector investment and can impact on Hypothesis 1. If there is no regulatory independence, then the private investor will be uncertain as to whether the tariff needed to sustain their investment will be sustained into perpetuity or whether they will be dealing with a constantly changing set of rules which introduces additional risk into the investment thereby requiring a higher rate of return to be viable.

The research objectives have been fulfilled in that we have identified that South Africa offers private sector investors adequate cash flows to recover costs and to make a reasonable return and also provides investors with a good legal system that is enforced thereby allowing them protection for their investments. The research has also identified that there is a severe shortcoming in government's responsiveness to investors' needs and the timeframes necessary to reduce opportunity cost and that the independence of regulatory institutions is questionable and needs to be worked on.

South Africa has strengths to build on to attract private investors to the power sector, but there are some shortcomings, notably with the government's domain that need to be addressed immediately if the necessary private sector participation in the capacity expansion programme is to be achieved without compromising South Africa's security of electricity supply.

Chapter 7: Conclusion

South Africa faces a massive challenge to expand its power generation capacity to double its current size to cater for increased demand over the next 20 years. This situation has been brought about by accelerated growth of the South African economy coupled with a lack of investment in new power generating capacity over the preceding years which has resulted in a rapid narrowing of the gap between supply and demand.

The system reserve margin is currently well below international norms and any major unplanned outages during times of increased electricity demand have necessitated "rolling blackouts" to ensure integrity of the national electricity supply network. Timeframes for bringing new capacity online are extremely tight as a result.

The South African government has a stated policy that 30% of all new power generating capacity will be built, owned and operated by the private sector. The role that the private sector needs to play to bring the necessary power generating capacity into being within the necessary timeframe to prevent even more severe power "blackouts" is therefore of crucial importance.

This research was aimed at determining whether the factors necessary to attract private sector investment into the South African power sector are adequately catered for. If the necessary environment is not created to stimulate the investment needed, then capacity expansion timeframes will suffer and the demand/supply balance will continue to deteriorate and electricity supply will become increasingly unstable.

An inadequate or unstable electricity supply will have additional consequences for other parts of the economy as investor confidence in general will suffer as a result.

The research found that investors look at six major considerations when considering investment in a country, two of those, namely the need for investors to have greater management and operational control over their investments and the availability of credit enhancement or risk guarantees were not researched as these are moot points in the South African context, given that all IPP operations are to be Build-Own-Operate (BOO) and the state-owned utility (Eskom) functions “at arms length” from government and is currently required to provide any necessary guarantees and indeed has a better credit rating that the sovereign one.

The research focused on four major considerations identified by a World Bank study in 2002, namely the need for adequate cash flows in order for cost recovery as well as a reasonable return to be effected, the existence of a good legal system that will protect the interests of all parties and uphold contracts, the responsiveness of government to investor needs and timeframes and the independence of regulatory institutions and processes from government interference.

The findings of the research are that the South African power sector is deemed to have adequate cash flows to allow investors to recover costs and to make a reasonable return on their investment. Coupled with this is a good legal In framework, the industry is comfortable that the rights and obligations of private investors in power generation are clearly defined and all applicable laws and contracts are enforced.

It was found that Government lacks responsiveness to the needs and timeframes of private investors. The problem that investors face is that if timeframes are too long, there is an opportunity cost associated with it for them. Government needs to address the process whereby private sector investment in power generation is enabled and enacted to reduce transaction costs and reduce lead times to ensure that investor opportunity cost is minimised.

The independence of South Africa's regulatory institutions and processes from Government interference is questionable. The regulator overseeing the electricity sector is an independent regulator, but is directed by the Minister of Minerals and Energy. Work needs to be done in this area to make investors comfortable that Government is not interfering in the Regulation of the industry, other than to develop the policies that the regulator implements and that these policies are clear and consistent.

In summary, the South African legal system and the revenue generation potential of the power sector appear to be advantages that the country can leverage off to attract power sector investors.

However, major stumbling blocks to private investor participation are the responsiveness of Government and the independence of the Regulatory institutions from Government. Both these factors lie squarely at Government's "feet" and need to be dealt with immediately.

It is recommended in addressing the issue of responsiveness that an alternative procurement procedure for Independent Power Production be sought, possibly an auction type process, rather than the protracted competitive bidding one currently in place. It is also possible to set up an independent "buyer" to procure the IPPs along business lines and timeframes.

The recommendation to address the issue of perceived Government interference in regulation is to ensure that all policies are clear and transparent and that any decisions taken by the Regulator are clearly explained and that the decision making process is a transparent one.

Future Research:

This challenge of attracting private investors to the South African power sector is a complex one and there are many other factors that may have been overlooked.

- Possible future research in this area is to analyse the factors by industry sector so as to determine whether different approaches need to be taken for different role players.

- Additionally, it might be useful to investigate the factors that result in deals not being concluded once an investor has been attracted to the sector.

- A study into the major factors investors take into consideration, specifically, in a South African context would also be useful as they may differ to those identified by the 2002 World Bank International Study.

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APPENDIX 1: Research Questionnaire

FACTORS AFFECTING PRIVATE INVESTMENT IN NEW POWER GENERATING CAPACITY IN SOUTH AFRICA

Research Questionnaire

Thank you for taking time to fill out this questionnaire about the factors that are likely to impact on private sector investment in new power generating capacity in South Africa. This research is in partial fulfillment of the MBA programme at the Gordon Institute of Business Science. The research intends identifying factors that are influential in ensuring that investment in new power generating capacity in South Africa takes place successfully.

The questionnaire will take you between 5 and 10 minutes to complete. Anonymity is guaranteed, upon receipt of the completed questionnaire, the original facsimile or email will be destroyed or deleted after the data has been captured.

Upon completion of the questionnaire, kindly return by fax on **(012) 342 0583** or by email at chris.forlee@dpe.gov.za by 5 November 2007.

Thank you for your cooperation.

PLEASE MARK (x) THE ORGANISATION OR GROUP YOU REPRESENT

ORGANISATION	(x)
Government	
Financier	
State-Owned Utility (Eskom)	
Utilities (Municipality/Metro)	
Independent Power Producer Developer	
Regulation	

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PLEASE MARK (x) A SINGLE RESPONSE WHICH BEST REPRESENTS YOUR VIEW ON THE STATEMENT PRESENTED BELOW.

No.	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	In South Africa retail tariff levels and collection discipline are adequate to meet the cash flow needs of the power sector					
2	In South Africa there is a good legal framework defining the rights and obligations of private investors					
3	In South Africa, the Government is responsive to the needs and timeframes of investors					
4	In South Africa, there is independence of the regulatory institution and processes from arbitrary government interference					
5	In South Africa there is high consumer payment discipline and enforcement					
6	In South Africa all applicable laws and contracts are enforced (e.g., disconnections, payment by counter-parties, etc.)					
7	In South Africa, Government efficiently administers the processes to provide the necessary approvals and licenses for private sector investment in the power sector					
8	In South Africa, there is regulatory commitment which is sustained through long-term contracts					

APPENDIX 2: One-Sample *t*-Test Report (Hypothesis 1)

Descriptive Statistics Section

Variable	Count	Mean	Standard Deviation	Standard Error	99% LCL of Mean	99% UCL of Mean
Q1_5	34	3.794118	1.20049	0.2058824	3.231384	4.356851

T for Confidence Limits = 2.7333

Tests of Assumptions Section

Assumption	Value	Probability	Decision(1%)
Skewness Normality	-2.4276	0.015199	Cannot reject normality
Kurtosis Normality	0.3952	0.692727	Cannot reject normality
Omnibus Normality	6.0494	0.048572	Cannot reject normality
Correlation Coefficient			

T-Test For Difference Between Mean and Value Section

Alternative Hypothesis	T-Value	Prob Level	Decision (1%)	Power (Alpha=.05)	Power (Alpha=.01)
Q1_5<>3	3.8571	0.000504	Reject Ho	0.962681	0.861050
Q1_5<3	3.8571	0.999748	Accept Ho	0.000000	0.000000
Q1_5>3	3.8571	0.000252	Reject Ho	0.983476	0.914673

Nonparametric Tests Section

Quantile (Sign) Test

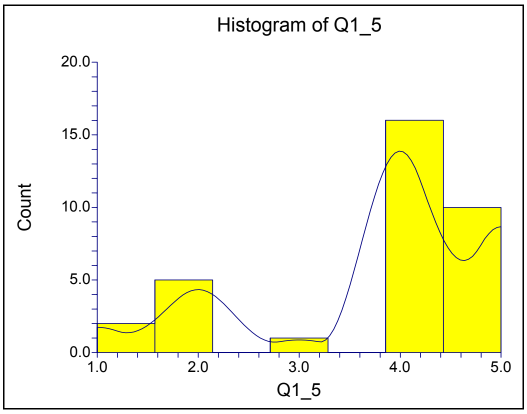
Hypothesized Value	Quantile	Number Lower	Number Higher	Prob Lower	Prob Higher	Prob Both
3	0.5	7	26	0.000659	0.999838	0.001319

Wilcoxon Signed-Rank Test for Difference in Medians

W Sum Ranks	Mean of W	Std Dev of W	Number of Zeros	Number Sets of Ties	Multiplicity Factor
477	297	56.50443	1	2	10956

	Exact Probability		Approximation Without Continuity Correction			Approximation With Continuity Correction		
Alternative Hypothesis	Prob Level	Decision (1%)	Z-Value	Prob Level	Decision (1%)	Z-Value	Prob Level	Decision (1%)
Median<>3			3.1856	0.001445	Reject Ho	3.1767	0.001489	Reject Ho
Median<3			3.1856	0.999278	Accept Ho	3.1944	0.999299	Accept Ho
Median>3			3.1856	0.000722	Reject Ho	3.1767	0.000745	Reject Ho

Plots Section



APPENDIX 3: One-Sample *t*-Test Report (Hypothesis 2)

Descriptive Statistics Section

Variable	Count	Mean	Standard Deviation	Standard Error	99% LCL of Mean	99% UCL of Mean
Q2_6	**34**	**3.852941**	**0.5577201**	**9.564821E-02**	**3.591508**	**4.114374**

T for Confidence Limits = 2.7333

Tests of Assumptions Section

Assumption	Value	Probability	Decision(1%)
Skewness Normality	-0.1771	0.859433	Cannot reject normality
Kurtosis Normality	0.5533	0.580050	Cannot reject normality
Omnibus Normality	0.3375	0.844713	Cannot reject normality
Correlation Coefficient			

T-Test For Difference Between Mean and Value Section

Alternative Hypothesis	T-Value	Prob Level	Decision (1%)	Power (Alpha=.05)	Power (Alpha=.01)
Q2_6<>3	8.9175	0.000000	Reject Ho	1.000000	1.000000
Q2_6<3	8.9175	1.000000	Accept Ho	0.000000	0.000000
Q2_6>3	8.9175	0.000000	Reject Ho	1.000000	1.000000

Nonparametric Tests Section

Quantile (Sign) Test

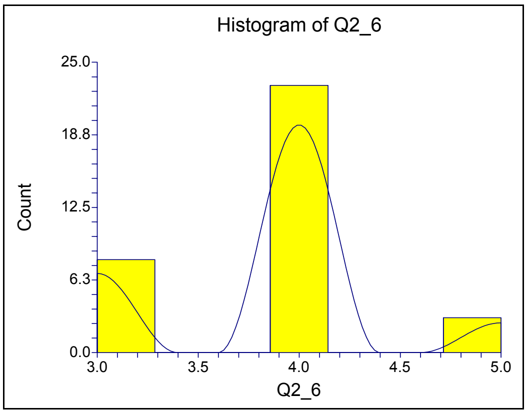
Hypothesized Value	Quantile	Number Lower	Number Higher	Prob Lower	Prob Higher	Prob Both
3	0.5	0	26	0.000000	1.000000	0.000000

Wilcoxon Signed-Rank Test for Difference in Medians

W Sum Ranks	Mean of W	Std Dev of W	Number of Zeros	Number Sets of Ties	Multiplicity Factor
559	279.5	55.82786	8	2	12168

	Exact Probability		Approximation Without Continuity Correction			Approximation With Continuity Correction		
Alternative Hypothesis	**Prob Level**	**Decision (1%)**	**Z-Value**	**Prob Level**	**Decision (1%)**	**Z-Value**	**Prob Level**	**Decision (1%)**
Median<>3			5.0065	0.000001	Reject Ho	4.9975	0.000001	Reject Ho
Median<3			5.0065	1.000000	Accept Ho	5.0154	1.000000	Accept Ho
Median>3			5.0065	0.000000	Reject Ho	4.9975	0.000000	Reject Ho

Plots Section



APPENDIX 4: One-Sample t-Test Report (Hypothesis 3)

Descriptive Statistics Section

Variable	Count	Mean	Standard Deviation	Standard Error	99% LCL of Mean	99% UCL of Mean
Q3_7	**34**	**3.088235**	**1.111037**	**0.1905413**	**2.567433**	**3.609037**

T for Confidence Limits = 2.7333

Tests of Assumptions Section

Assumption	Value	Probability	Decision(1%)
Skewness Normality	-1.1900	0.234063	Cannot reject normality
Kurtosis Normality	-0.5444	0.586188	Cannot reject normality
Omnibus Normality	1.7123	0.424787	Cannot reject normality
Correlation Coefficient			

T-Test For Difference Between Mean and Value Section

Alternative Hypothesis	T-Value	Prob Level	Decision (1%)	Power (Alpha=.05)	Power (Alpha=.01)
Q3_7<>3	0.4631	0.646349	Accept Ho	0.073476	0.017644
Q3_7<3	0.4631	0.676826	Accept Ho	0.017927	0.002794
Q3_7>3	0.4631	0.323174	Accept Ho	0.116786	0.029928

Nonparametric Tests Section

Quantile (Sign) Test

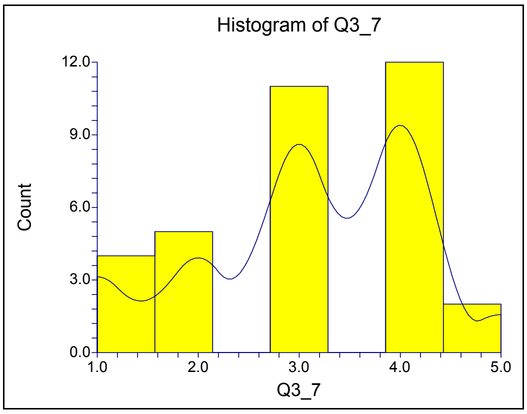
Hypothesized Value	Quantile	Number Lower	Number Higher	Prob Lower	Prob Higher	Prob Both
3	0.5	9	14	0.202436	0.894980	0.404873

Wilcoxon Signed-Rank Test for Difference in Medians

W Sum Ranks	Mean of W	Std Dev of W	Number of Zeros	Number Sets of Ties	Multiplicity Factor
303	264.5	56.4657	11	2	5106

	Exact Probability		Approximation Without Continuity Correction			Approximation With Continuity Correction		
Alternative Hypothesis	Prob Level	Decision (1%)	Z-Value	Prob Level	Decision (1%)	Z-Value	Prob Level	Decision (1%)
Median<>3			0.6818	0.495347	Accept Ho	0.6730	0.500963	Accept Ho
Median<3			0.6818	0.752327	Accept Ho	0.6907	0.755118	Accept Ho
Median>3			0.6818	0.247673	Accept Ho	0.6730	0.250482	Accept Ho

Plots Section



APPENDIX 5: One-Sample t-Test Report (Hypothesis 4)

Descriptive Statistics Section

Variable	Count	Mean	Standard Deviation	Standard Error	99% LCL of Mean	99% UCL of Mean
Q4_8	**34**	**3.705882**	**1.11544**	**0.1912964**	**3.183016**	**4.228748**

T for Confidence Limits = 2.7333

Tests of Assumptions Section

Assumption	Value	Probability	Decision(1%)
Skewness Normality	-0.1771	0.859433	Cannot reject normality
Kurtosis Normality	-3.7505	0.000176	Reject normality
Omnibus Normality	14.0975	0.000868	Reject normality
Correlation Coefficient			

T-Test For Difference Between Mean and Value Section

Alternative Hypothesis	T-Value	Prob Level	Decision (1%)	Power (Alpha=.05)	Power (Alpha=.01)
Q4_8<>3	3.6900	0.000804	Reject Ho	0.947455	0.822978
Q4_8<3	3.6900	0.999598	Accept Ho	0.000000	0.000000
Q4_8>3	3.6900	0.000402	Reject Ho	0.975464	0.886899

Nonparametric Tests Section

Quantile (Sign) Test

Hypothesized Value	Quantile	Number Lower	Number Higher	Prob Lower	Prob Higher	Prob Both
3	0.5	5	17	0.008450	0.997828	0.016901

Wilcoxon Signed-Rank Test for Difference in Medians

W Sum Ranks	Mean of W	Std Dev of W	Number of Zeros	Number Sets of Ties	Multiplicity Factor
429.5	258.5	56.58953	12	2	2706

	Exact Probability		Approximation Without Continuity Correction			Approximation With Continuity Correction		
Alternative Hypothesis	Prob Level	Decision (1%)	Z-Value	Prob Level	Decision (1%)	Z-Value	Prob Level	Decision (1%)
Median<>3			3.0218	0.002513	Reject Ho	3.0129	0.002587	Reject Ho
Median<3			3.0218	0.998743	Accept Ho	3.0306	0.998780	Accept Ho
Median>3			3.0218	0.001257	Reject Ho	3.0129	0.001294	Reject Ho

Plots Section