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Delays in the nuclear power plant procurement process in South Africa

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A Research Project submitted to the School of Mechanical, Industrial and Aeronautical Engineering in the Faculty of Engineering and the Built Environment, University of the Witwatersrand, in fulfilment of the requirements for the degree of Masters in Engineering.

January 2020

Declaration

I, **Nkosikhona Kheswa**, declare that this research report is my own work, except as indicated in the references. It is submitted in partial fulfilment of the requirements for the degree of Master of Science in Nuclear Technology Leadership at the University of the Witwatersrand, Johannesburg It has not been submitted before for any degree or examination at this or any other university

Nkosikhona Kheswa ----------

Signed on 30th day of January, 2020

Abstract

The constant evolution and development of nuclear-power projects has necessitated changes to contemporary projects. The Republic of South Africa has included the development of nuclear-power projects in its development goals as detailed in the Integrated Resource Plan. However, these projects have been delayed for years. This research is aimed at investigating the root causes of these delays. The relevant literature was analysed and reviewed while several nuclear projects were studied in order to elicit viable information about the root causes of the delays observed in the country's own nuclear power project. The research method used to address the problem is qualitative. Internet websites, research papers and interviews were used to obtain the information.

The status of different management models in power construction were analysed and reviewed in order to determine the delays in the procurement process in South Africa's nuclear project since 2006.

This research found gaps and issues for the current stakeholders and flaws in the current procurement process. Nuclear-project completion in South Africa is crucial for South African industry and citizens because of its contribution to economic growth and job opportunities, necessitating strict adherence to procedures to avoid delays.

Recommendations were made for the future approach for the procurement of nuclear power stations in South Africa.

Dedication

I dedicate this research to my late parents and grandparents. They did not live to see this accomplishment and the man I have become, but I know they would have been proud. I also dedicate my research to my family – you will always be in my heart and on my mind.

Acknowledgements

I would like to thank the following people for their contribution to my research:

- Bernadette Sunjka, my supervisor, for all her assistance and academic guidance during the research. The in-depth reviews and comments she provided helped me to further understand the topic.
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Glossary

Base-load plant: An energy plant that is able to produce energy at a constant, or near constant, rate, that is, a power station with high-capacity factors.

Gross domestic product (GDP) per capita: Is a measure of a country's economic output that accounts for its number of people. It divides a country's GDP by its totalper head of population.

Intergovernmental Agreement (IGA): Section 231(2) of the constitution provides that IGA binds the Republic only after it has been approved by resolution in National Assembly and National Council of Provinces.

Levelised cost of energy: Refers to the discounted total cost of a technology option or project over its economic life, divided by the total discounted output from the technology option or project over that same period, that is, the levelised cost of energy provides an indication of the discounted average cost relating to a technology option or project.

Overnight cost: Overnight cost is the cost of a construction project if no interest was incurred during construction, as if the project was completed "overnight."

Paris Agreement: An agreement within the United Nations Framework Convention on Climate Change (UNFCCC) dealing with greenhouse-gas emissions mitigation, adaptation and finance as from 2020.

Plan: Any diagram or list of steps with details of timing and resources, used to achieve an objective to do something.

Procurement: The act of obtaining or buying goods and services. The process includes preparation and processing of a demand as well as the end receipt and approval of payment. This is the process which creates, manages and fulfils contracts.

Programme: This is the grouping of a set of related projects in order to deliver outcomes and benefits related to strategic objectives which would not have been achieved if the projects were managed independently.

Strategy: The art and science of planning and marshalling resources for their most efficient and effective use.

Third World Countries/Non-aligned Nations: These are often the developing nations of Africa, Asia, and Latin America. These countries are referred to as such because they did not align with either the United States and or the former Soviet Union.

Abbreviations

ANC	African National Congress
BRICS	Brazil, Russia, India, China, South Africa
CEO	Chief Executive Officer
COP 21	Conference of Parties Number 21
DEAT	Department of Environmental Affairs and Tourism
DoE	Department of Energy
DPE	Department of Public Enterprises
EIA	Environmental Impact Assessment
EIUG	Energy Intensive User Group
ERA	Electricity Regulation Act
IAEA	International Atomic Energy Agency
IDTTE	Inter-Departmental Task Team on Energy
IEC	Electoral Commission
IEP	Integrated Energy Plan
IGA	Intergovernmental Agreement
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producers
IRP	Integrated Resource Plan
LCOE	Levelised Cost of Energy
MW	Megawatts
MYPD	Multi-year Price Determination
NDP	National Development Plan
NECSA	Nuclear Energy Commission of South Africa
NEDLC	National Economic Development and Labour Council
NEP	Nuclear Energy Policy
NERSA	National Energy Regulator of South Africa
NGO	Non-governmental Organisation
NIASA	Nuclear Industry Association of South Africa
NIP	National Infrastructure Plan
NNB	Nuclear New-build
NNEECC	National Nuclear Energy Executive Coordinating Committee
NNR	National Nuclear Regulator
NPP	Nuclear power plant
NRWD	National Radioactive Waste Disposal Institute
OUTA	Organisation Undoing Tax Abuse
PBMR	Pebble Bed Modular Reactor

PICC	Presidential Infrastructure Coordination Commission
PLEXOS	Energy simulation software
PPA	Power Purchase Agreements
PWR	Pressurised water reactor
RCA	Regulatory Clearing Account
REIPPP	Renewable Energy Independent Power Producer Procurement
RFI	Request for Information
RFP	Request for Proposal
SAFCEI	Southern African Faith Communities' Environment Institute
SAHRC	South African Human Rights Commission
SANEDI	South African National Energy Development Institute
SARS	South African Revenue Service
SIPDM	Standard for Infrastructure Procurement and Delivery Management
SOC	State-owned Company
SOE	State-owned Entity
SSA	Statistics South Africa

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CHAPTER 1- INTRODUCTION

Research Background and Context

South Africa intends to build new nuclear power plants (NPPs) in the future. In order to achieve this goal, detailed planning is required so that this project can be completed timeously and within the budgeted finances (Sadika 2017).

In 2007, Eskom was a procuring agent for the nuclear new-build (NNB) programme. The parastatal had previously conducted a study and had decided to add new NPPs to its generator mix (Sacities 2014). In 2013, the government decided to replace Eskom with the Department of Energy (DoE) as the designated procuring agency. Eskom was instead now to be an owner and operator of the NPPs (Earthlife Africa-Johannesburg and Another v Minister of Energy and Others, 2017). Subsequently, in 2015 Cabinet declared the Nuclear Energy Corporation of South Africa (NECSA) and Eskom to be joint procurement agents. This was meant to give Eskom sufficient time and capacity to focus on the Medupi, Kusile and Ingula projects and the energy-supply problems the country was facing at the time. The Nuclear energy plan of South Africa, 2008, made provision for South Africa to pursue the research, development and innovation of nuclear technology locally. NECSA was to be owner–operator and procurer for the entire nuclear-fuel cycle system and multi-purpose reactor for the production of medical radio isotopes, whereas Eskom was to be the procurer for the NPPs (Battersby, 2015).

On 14 December 2016, the then Minister of the Department of Energy, Tina Joemat-Pettersson, published a *gazette* in which the role of the DoE as nuclear procurer was officially handed over to Eskom. This changing of agents wasted time and possibly indicated that the nuclear programme was not well planned from the start. The handing over of the nuclear programme from one organ of state or state-owned company (SOC) to another inevitably takes time; hence, the implementation of the programme was delayed. One of the reasons for changing of procurer was poor planning (Forbes 2015).

Between October 2014 and March 2015, the DoE held vendor parade workshops with all prospective vendor countries for the NNB programme. At the end of March 2015, the DoE released a media statement claiming that all activities necessary for the pre-procurement phase had been concluded and that they were now ready to move onto the procurement phase (Forbes 2015). On 12 October 2015, Earthlife Africa Johannesburg, the Organisation Undoing Tax Abuse (OUTA) and the Southern African Faith Communities' Environment Institute (SAFCEI) launched legal proceedings in the Cape Town High Court against South Africa's planned procurement of 9 600 MW of power via nuclear sources. These organisations won their case on the facts that the legal processes were not followed (Earthlife Africa-Johannesburg and Another v Minister of Energy and Others, 2017).

In 2013 the DoE based section 34 determination on an outdated IRP 2010 and they also did not conduct public participation before gazetting it. They repeated the same mistake in December 2016 for section 34 determination. For 2016 determination, Eskom was a procurer and in 2013 determination DoE was the procurer (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others, 2017).

The Minister of energy was not empowered by law to procure nuclear power for Eskom and Eskom would not give consent. The Intergovernmental Agreement (IGA) with Russia was also found to be unlawful. Based on these facts government lost the court case (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others, 2017). The DoE is responsible for the development of the energy plan for South Africa and the Minister of the DoE is responsible for the delivery of the agreed Cabinet energy plans. Development of these plans must be transparent and such plans must involve public participation when required by law (DoE 2010).The procuring agent is also required to be transparent when procuring an NPP in terms of the legal requirements. Finally, the procurement must be done properly to ensure that all stakeholders are satisfied (DinP 2012).

Problem Statement

To date, however, nothing has been built and it is clear that there have been delays. The strategy for procuring the NPPs was neither approved nor accepted by all the stakeholders. As a result, these factors have caused delays (Touffie 2017). Examples of these major delays are listed below.

Table 1.1: NNB delays (created by author)

	Delay	**Comment**
1	In 2008 Eskom decides not to continue with the nuclear programme because they could not afford it.	2006–August 2008
2	April 2017 court judgment	Procurement process not followed
3	2006–2018; delay >10 years	All stakeholders do not approve or accept the procurement plan.

Some of these delays were caused by not complying with the laws and regulations of the republic of South Africa. As a result, this has cost South Africa time and money. The root cause of these delays must be established, critically analysed and effective solutions suggested; however, if nothing is done about these procurement delays, these delay problems will recur.

The recent process involved in the procurement of nuclear power in South Africa failed to follow the required procedures as mandated by the law. In addition, the process was not formulated properly and therefore led to slow-downs. Finally, the strategy for the procurement of the NPPs was neither approved nor accepted by all the stakeholders (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others, 2017). These factors all contributed to the delays.

This research will investigate the causes of the delays in the process of the procurement of nuclear power in South Africa, and suggest possible solutions to avoid similar delays in the future.

Research Question

Critical question: What are the key causes of delays in the process of the procurement of nuclear power in South Africa and how can these delays be prevented in the future?

Research Objectives

The purpose of this research is to investigate the main causes of delays in the process of the procurement of nuclear power in South Africa and to suggest ways in which they may be prevented in the future. This objective will be achieved by:

- Investigating the current procurement process for nuclear power in South Africa.
- Identifying the sources/causes of delays in this process.
- Proposing solutions so as to prevent similar delays in the future.

Limitations of Scope

A limiting factor in this research was not being able to interview the ministers and presidents of the republic who were directly involved with nuclear procurement in South Africa.

Assumptions

Several assumptions will be made to simplify the current complex South African environment (Legal, Economic, Procurement and Political). Variations of the following assumptions may change how decisions are made:

- South Africa will build NPPs in accordance with the latest authorised Integrated Resource Plan (IRP).
- This research will only use information that is publicly available.
- Eskom will own and operate the NPPs as per the Nuclear Energy Policy of 2008.

Outline of Chapters

Chapter 1: Introduction: This chapter provides background to the delays that leads into the problem statement and the critical research question. The research objectives, assumptions and limitations are discussed.

Chapter 2: Literature Review: This chapter discusses the literature around key concepts that emerged from the problem statement and the critical research question in Chapter 1. The literature review around the concepts lead to the identification, development and discussion and will be used to create a conceptual framework.

Chapter 3: Research Methods: This chapter outlines the investigational method that was used. The chapter also describes the implementation approach that was used to arrange the conceptual framework developed in Chapter 2. The ethical considerations around the research are stated – the ethics clearance number is MIAEC 086/18.

*Chapter 4: Data Analysis and Results***:** This chapter provides a researcher's view on the literature that was obtained from the literature review.

Chapter 5: Discussion: This chapter discusses the results and builds arguments around the theoretical propositions of the phenomenon that was studied.

Chapters 6 and 7: Recommendations and Conclusion: These chapters answer the research question and discuss final conclusions and make recommendations related to the conceptual framework.

CHAPTER 2 - LITERATURE REVIEW

This literature review provides some background on concepts from nuclear-power generation, a nuclear-power plant (NPP) project lifecycle, business case study, the procurement process, the laws and regulations affecting the procurement process, and local and international stakeholders.

2.1 Nuclear Power Plants

NPPs provide a base load that emits no greenhouse gases, use less water for power generation when compared with coal fired stations, but are capital-intensive. The financial benefits of having an NPP are realised only after a period of approximately 20–30 years, depending on the contract that was signed. The NPP can operate for a period of 60–80 years or more. The plant can provide base-load power for the whole year. This means that it represents a reliable technology. The high-capacity factor and reliability also means it is easy to estimate costs (Cameron 2014).

Technology risks such as construction time and design changes are substantial for new designs until a proven record of construction and sound operation builds up. The complexity of the new build projects makes them more sensitive to high risks of construction delays and cost overruns (Kidd 2014).

2.1.1 Example of an NPP

The photograph bellow illustrates an NPP under construction, the plant comprises two reactor units inside a concrete containment.



Figure 2.1: A United Arab Emirates NPP under construction (source: Scmp.com 2017)

The US$20 billion Barakah NPP is situated in Abu Dhabi's far western desert. The first of four reactors, it is expected to come online in 2018 (Qamar Energy 2017).

2.1.2 Nuclear-power generation

Nuclear power is a form of energy that is produced by a fission chain reaction. This reaction produces large amounts of heat energy which is transformed into electrical energy.

In order to harness nuclear energy, an NPP is necessary; however, NPPs are capital-intensive and they require lengthy periods (+/−6 years) to construct (Locatelli 2015). Financial institutions play a vital role in providing finance for the project as substantial investment is required for the construction phase. A country's government needs to be involved in every step of any nuclear-power production process. The aim of any nuclear-power projects must be in line with government goals. This is important as the government develops policies, energy plans and regulations that directly affect such projects (University of the Witwatersrand 2014). In addition, the government may also provide financial guarantees due to the capital-intensive nature of this type of project (Brown 2015).

2.2 An NPP Project Lifecycle

Figure 2.2 below illustrates the lifecycle of an NPP. The project lifecycle starts with planning. This phase is called the 'pre-construction phase' and it may take up to five years. This phase is followed by the construction phase that may take up to six years or more. The construction of an NPP is initiated when concrete is poured into the basement of a reactor (Poyry PLC 2011). Commissioning and testing of the reactor are carried out after construction. The operations phase begins when the NPP starts producing electricity. Waste management is a crucial element of operations and decommissioning. Decommissioning and site rehabilitation represent the final stages in the lifecycle of an NPP, therefore financial provision must be made for this final phase while the plant is still in operation (Poyry PLC 2011).

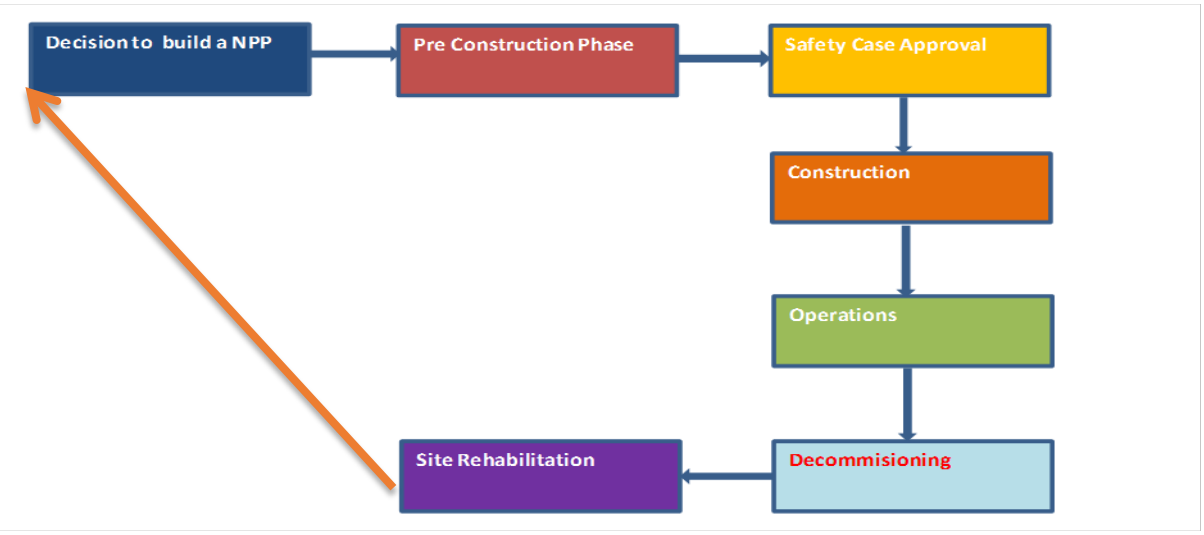


Figure 2.2: An NPP lifecycle (source: the author)

2.3 Business Case

Vendor countries who can demonstrate a high nuclear safety culture, preferably with some specific nuclear site experience tend to be more successful than others. Their capital costs and construction time are reasonable. The capital costs of an NPP include the cost of site preparation, construction, manufacture, commissioning and financing. Building a large-scale NPP takes thousands of workers, huge amounts of steel and concrete, a multitude of components, and different systems in order to be able to provide electrical power, cooling, ventilation, information, control and communication (Lucet 2015).

In order for a nuclear project to run to plan, all the investors need to understand every financial detail throughout all phases of the project, for instance, who is responsible for paying for other parts of the projects which the vendor won't be building and paying for. With such information made available to all parties concerned, smooth execution of the project is far more likely (Poyry PLC 2011).The profits generated from running an NPP are substantial and are dependent on the size of a reactor, chosen technology, single or multiple units on a site. These figures, which are part of a business case study, are calculated by a reputable accounting firm with the help of a group of nuclear professionals and communicated to all investors involved in order to allow for sound decision-making (Cameron 2014; Lucet 2015).

Safety and efficiency of nuclear power generation is an important policy objective in countries that rely, or plan to rely, substantially on this source of energy (Ilchong 2014). Nuclear power cannot be introduced in a country without the full support of government. Government must, of necessity, play a major role in a nuclear project. It needs to develop policies, energy plans and a nuclear regulator, and provide financial guarantees or power-purchase agreements as the project is capital-intensive. A socio-economic impact of nuclear programmes is conducted by the procurement agent and this also forms part of the business case study (Joskow 2009).

2.4 NPP Procurement in South Africa

Numerous literature has been accessed to gain a deeper understanding of NPP procurement in South Africa. This literature review seeks to identify key factors in the current South African nuclear procurement procedures and processes.

2.4.1 Enabling factors

A number of factors must be in place before an NPP is added as a source of power production in South Africa (Sacities 2014). These important factors are:

- The number of coal-fired power stations i.e. Arnot , Camden, Grootvlei, Hendrina and Komati are due for decommissioning in the near future (2021-2024) which will create the need for new base-load power (high-capacity factor) (IRP 2010).
- South Africa has committed to the international community, Paris Agreements and Conference of Parties (COP) Number 21 to reduce greenhouse gases. Nuclear power is one of the best options to achieve this. This has become such an issue that it now is almost impossible to focus solely on any energy technology without linking it in some way to climate change and therefore to a space largely dominated by the United Nation's Intergovernmental Panel on Climate Change (IPCC), various environmental non-governmental organisations (NGOs) and environmental activist organisations such as Earthlife Africa Johannesburg and Greenpeace as well as relevant government policies.
- South Africa must be able to afford an NPP or sign power-purchase agreements.
- Intergovernmental agreements (IGAs) must be signed with vendor countries before the start of construction.
- Human-resource capacity, infrastructure and nuclear-power generation legal and regulatory frameworks must be in place.
- Government policies and government willingness to build new base-load power stations that emit no harmful gases must be demonstrated (Sacities 2014).

2.4.2 Local and international stakeholders in the nuclear programme

Stakeholders in the nuclear programme are parties that are affected by any decision taken during the life cycle of the power plant. The local and international stakeholders in the nuclear programme are:



Figure 2.3: Typical NNB programme stakeholders (source: the author)

The following stakeholders are important to the successful implementation of the NNB programme as they all have a role to play. Their role varies from advisory, financing, sharing information and providing expectations, providing technology amongst other issues.

- The State
- The Energy Intensive-User Group (EIUG)
- Parliament
- Cabinet
- The energy portfolio committee
- The Department of Finance (Treasury)
- The public
- NGOs
- The Energy Security Cabinet Sub-committee
- The National Economic Development and Labour Council (NEDLC)
- The International Atomic Energy Agency (IAEA) - IAEA monitors spent nuclear fuel in all nuclear power stations in the world, this prevents countries from making nuclear bombs from the fuel.
- The vendor country
- Financial institutions (University of the Witwatersrand 2014).

The following two examples of stakeholders are discussed later in the report;

Chapter 9 Institutions of South Africa

Chapter 9 institutions refer to a group of organisations established in terms of Chapter 9 of the Constitution, 1996, in order to guard democracy. The institutions are: the Public Protector, the South African Human Rights Commission (SAHRC), the Auditor-General, the Independent Electoral Commission (IEC) and the Commission on Gender Equality (Constitution 1994). Some of these institutions impact the NNB by protecting democracy and the rule of law, and by ensuring no human rights, tenets of the Constitution or Acts are violated.

Brazil, Russia, India, China and South Africa (BRICS)

This is a group of emerging economies comprising Brazil, Russia, India, China and South Africa (BRICS). The headquarters are situated in Shanghai, China. Its main objectives are cooperation between the member nations for development, the provision of financial assistance, the support of various projects, infrastructure, etc. South Africa joined BRICS in 2010 (Mutalemwa & Mutalemwa 2013).

2.5 Legal Documents

The procurement process for an NPP means adhering to the laws of the country; disregarding any relevant legislation will render the entire procurement process illegal (Earthlife Africa- Johannesburg and Another v

Minister of Energy and Others). Examples of South African legislation that will impact the procurement process are:

- *Section 217(1) of the Constitution of Republic of South Africa, 1996, Procurement: when an organ of state in the national, provincial or local sphere of government, or any other institution identified in national legislation, contracts for goods or services, it must do so in accordance with a system which is fair, equitable, transparent, competitive and cost-effective.*
- *International Law – Section 231. International agreements.*

  (1) The negotiating and signing of all international agreements is the responsibility of the national executive.

  (2) An international agreement binds the Republic only after it has been approved by resolution in both the National Assembly and the National Council of Provinces.
- *Public Finance Management Act No 1 of 1999: to regulate financial management in the national government and provincial governments; to ensure that all revenue, expenditure, assets and liabilities of those governments are managed efficiently and effectively; to provide for the responsibilities of persons entrusted with financial management in those governments; and to provide for matters connected therewith.*
- *Promotion of Access to Information Act 2 of 2000: to give effect to the constitutional right of access to any information held by the state and any information that is held by another person and that is required for the exercise or protection of any rights; and to provide for matters connected therewith.*
- *Electricity Regulation Act (ERA), Section 34 of the ERA deals with the subject of new generation capacity and provides in part as follows;*

  The minister may in consultation with the regulator-

  a. *Determine that new generation capacity is needed to ensure the continued uninterrupted supply of electricity;*
  b. *Determine the type of energy sources from which electricity must be generated and the percentages of electricity that must be generated from such sources;*
  c. *Determine that electricity thus produced may only be sold to the persons or in the manner set out in such notice;*
  d. *Determine that electricity thus produced must be purchased by the persons set out in such notice;*
  e. *Require that new generation capacity must:*
     - *Be established through a tendering procedure which is fair, equitable, transparent, competitive and cost effective;*
     - *Provide for private sector participation*
- *National Energy Regulator of South Africa (NERSA) is a statutory body set up in terms of the National Energy Regulator Act (NERA), 40 of 2004*

- *Section 9 of NERA sets out the duties of members of the energy regulator who must inter alia:*
    a. *Act in justifiable and transparent manner whenever the exercise of their discretion is required*
    b. *Act independently of any undue influence or instruction*
    c. *Act in the public interest*

- *Section 10 of NERA, sets out the requirements for the validity of NERSA's decisions and provides as follows:*
    a. *Every decision of the energy Regulator must be in writing and be-*
    b. *Consistent with the constitution*
    c. *In the public interest*
    d. *Taken with a procedurally fair process*
    e. *Based on reasons, facts and evidence that must be summarised and recorded*
    f. *Explained clearly as to its factual and legal basis and the reasons thereof.*

2.6 Ideal Procurement Process for Nuclear Power Plants

The diagram below shows a high level view of the ideal flow of the nuclear procurement process in South Africa as determined by the laws of South Africa as outlined above.

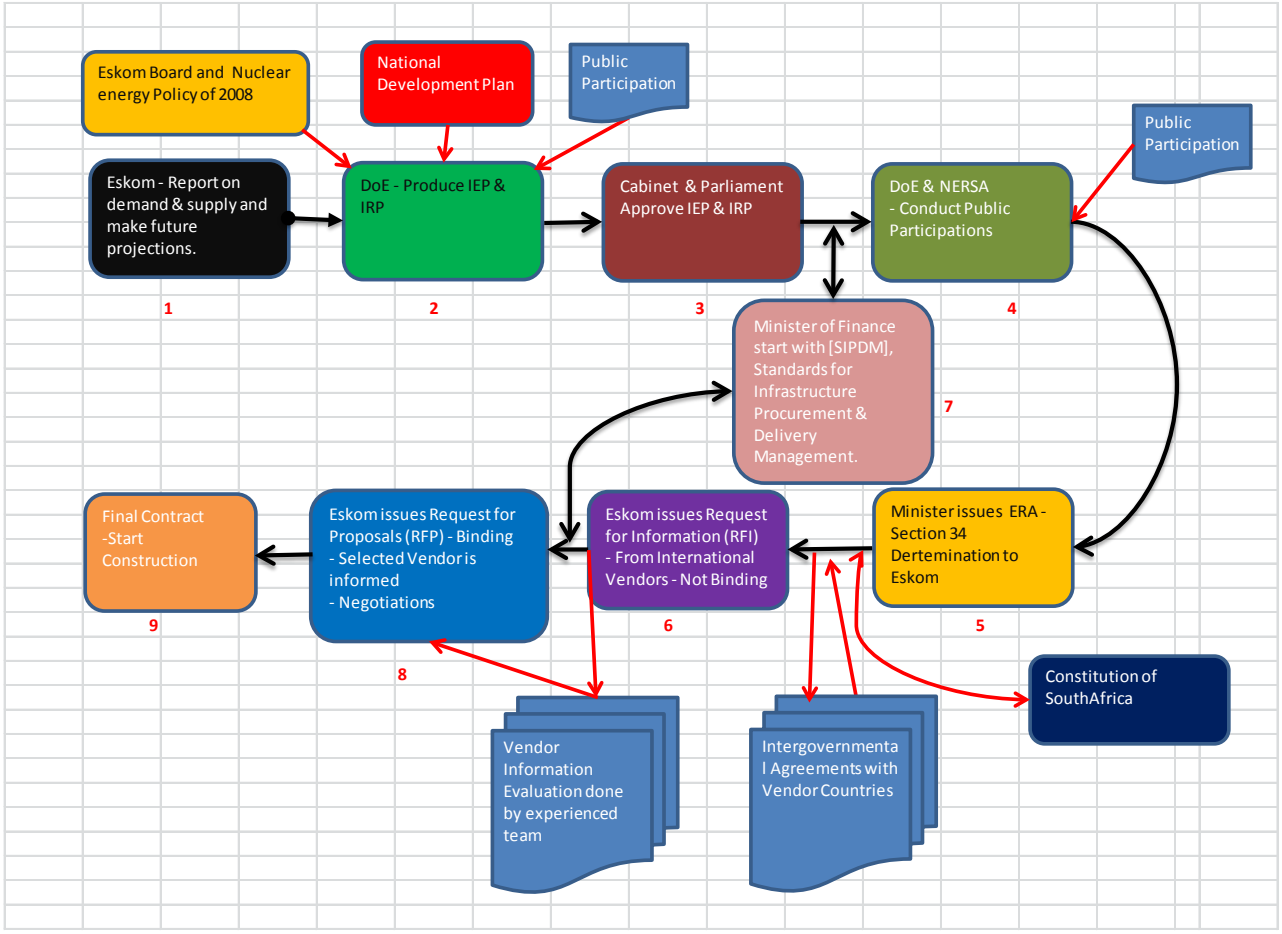


Fig 2.6: The procurement process flow diagram (source: the author)

Each element of the process is described in the next sections.

2.6.1 Eskom reports on electricity capacity outlook (Step 1 in Fig 2.6)

Eskom regularly checks its fleet and they know how many units or power station will be decommissioned in which year. This information is approved by the board before publishing. This report forms part of the basis for development of IEP and IRP.

2.6.2 DoE – Produce IEP and IRP (Step 2 in Fig 2.6)

Integrated Energy Plan (IEP)

The IEP seeks to address the question: Given current policies and legislation, what is the most optimal energy mix that will ensure South Africa achieves energy supply security? Some demands must be fulfilled in order to achieve this, for instance, minimising cost, increasing access, diversifying energy sources, minimising carbon dioxide emissions (other pollutants are not included), improving energy efficiency, economic localisation, technology transfer, job creation and water conservation (DoE 2013).

The IEP outlines the interactions between all energy sectors and aims to determine the best way to meet current and future energy needs in an efficient, sustainable, environmentally friendly and socially beneficial way (University of the Witwatersrand 2014). It seeks to address the three key objectives of the NDP while considering the key challenges facing South Africa including poverty, inequality and unemployment. The IEP is intended to guide the investment in the development of energy technology and infrastructure in South Africa through high-level modelling. It also projects the energy outlook for a period spanning to 2050. It presents the electricity-generation mix and the capacity for different technologies in different scenarios with the aim of choosing the best. Before IEP is sent to cabinet, public participation must be done (University of the Witwatersrand 2014).

The current IEP has listed nuclear energy as one of the sources of energy. This means that IRP must specify the amount of nuclear power that must be added to the national grid within a specific timeframe. On the latest IRP this amount of nuclear power is 2500MW. International agreements and commitments such as the Paris Agreements and Conference of Parties (COP) Number 21 contribute to the development and efficient application of this plan (DoE 2013, IEP).

Integrated Resource Plan (IRP)

The main objective of the Integrated Resource Plan (IRP 2010) is to determine the long-term electricity demand and describe how it would be met in terms of generating capacity, technologies, timing and cost. However, the IRP 2010 is not the only objective of the energy sector as it adds input to other government planning functions, among other things economic development, financing, environmental and social policy developments. One of the prime drivers of nuclear energy is a desire for lower carbon emissions while at the same time providing a base load (DoE 2013, IRP 2010).

South Africa is currently constructing coal-fired power stations which may end up polluting the environment by emitting harmful gases. The installation of flue gas desulphurization (FGD) will reduce emissions and not eliminate them e.g. SO2 will be about 400 milligrams per cubic meter (Eskom, 2014,Medupi FGD Retrofit Technology Selection Study Report).

The adoption of the IRP occurred at the same time as the creation of the Presidential Infrastructure Coordination Commission (PICC) in July 2011 (Presidential Infrastructure Coordinating Commission, 2012). The PICC is mandated by Cabinet to plan and coordinate a National Infrastructure Plan (NIP). In February 2012, the PICC accepted the NIP which highlighted 300 projects, consolidated into 18 Strategic Integrated Projects (SIPs) (Infrastructure Development Act 2014). Three of the 18 SIPs are energy-related and these include the development of a green economy (SIP 8), electricity generation (SIP 9), and electricity transmission and distribution (SIP 10).

The Infrastructure Development Act 23 of 2014 creates the PICC and the NIP as important legal entities for driving and coordinating infrastructure development in South Africa (Infrastructure Development Act, 2014). The Act is aimed at speeding up and improving the delivery and implementation of social and economic infrastructure and maximising the developmental impact. The accuracy of the IRP 2010 is improved by regular reviews and updates as and when things change or new information unfolds. For this reason, all long-term plans should be considered indicative rather than 'cast in stone'. The IRP should be a plan implemented over an agreed timeframe while determining the rate and capacity of coming up with the technology mix (DoE, IRP). The input parameters which drive the IRP 2010 modelling are updated with the Medupi, Kusile and other southern African large-power infrastructure such as the Independent Power Producers (IPPs) (DoE, IRP 2010).

The cost of renewables has significantly declined since 2010. However, because of their capacity factors, levelized costs are still generally higher than nuclear power capacity. IPPs have caused arguments regarding the reliability of supply, with some people claiming that nuclear projects are not necessary because renewable sources of energy can supply the same amount of electrical power more cheaply (Eberhard 2014) (National Planning Commission 2011). In addition, renewable sources of energy are easier to build when compared with nuclear power. However, renewable sources of energy do not have a base-load capacity as solar installations do not generate at night and wind farms are highly weather-dependant. Public participation is done before the document is sent to cabinet for approval (DoE, IRP 2010).

Nuclear Energy Policy of 2008

The policy focuses on the technological aspect of nuclear energy as per the White Paper Energy policy which was approved by government in 1998. (DME 1998)

The National Development Plan (NDP)

President Jacob Zuma of South Africa appointed the National Planning Commission in May 2010 to draft a vision and national development plan which was to be reviewed by public and other government institutions. The commission consisted of 26 people, drawn largely from industry and chosen for their skills and knowledge in key areas (National Planning Commission 2011). The commission released a Diagnostic

Report in June 2011 which set out South Africa's achievements and shortcomings since 1994. It identified a failure to implement policies and an absence of broad partnerships as the main reasons for slow progress, and set out nine primary challenges (National Planning Commission 2011):

1. Too few people work.
2. The quality of school education for black people is poor.
3. Infrastructure is poorly located, inadequate and under-maintained.
4. Spatial divides hobble inclusive development.
5. The economy is unsustainably resource-intensive.
6. The public health system cannot meet demand or sustain quality.
7. Public services are uneven and often of poor quality.
8. Corruption levels are high.
9. South Africa remains a divided society.

The National Development Plan (NDP) offers a long-term view of South Africa. It defines the desired goal and identifies the role of the different sectors in society in achieving that goal. This document was developed by the National Planning Commission (2011). The essence of the commission's NDP vision for 2030 for South Africa is to eliminate poverty and reduce inequality while at the same time increasing economic growth in order to benefit all citizens. The NDP intends to achieve this by investing in infrastructure, encouraging private investment, promoting entrepreneurship and innovation (National Planning Commission 2011). The National Planning Commission's focus is on creating the conditions, capability and opportunities that will enable South Africans to lead the lives they desire, with a particular focus on the disadvantaged citizens. The commission consulted widely on the draft plan:

Our public forums drew in thousands of people; we met with parliament, the judiciary, national departments, provincial governments, development finance institutions, state-owned entities and local government formations; and we held talks with unions, business, religious leaders and non-profit organisations (National Planning Commission 2011).

The NDP collectively describes the future objectives for the country, for instance, increasing the electricity supply. The NDP suggests that South Africa investigates possible sources of electrical power and select the most reliable, efficient and beneficial option for the country as a whole. These investigations are done at IEP and IRP space.

2.6.3 Cabinet approves IEP and IRP (Step 3 in Fig 2.6)

The Minister of the DoE

The main responsibility of the minister is to formulate energy policies, regulatory frameworks and legislation, and oversee their implementation to ensure energy security, promotion of environmentally friendly energy carriers and access to affordable and reliable energy for all South Africans (Department of Energy, 2010). The minister submits the IEP and IRP to the cabinet.

Cabinet

Cabinet is the most senior level of the executive branch of the government of South Africa. It is made up of the President, the Deputy President and the ministers. Cabinet ministers form the main decision-making group within executive government. Cabinet is responsible for approving plans, policies and other laws relating to nuclear power (Hajer & Fischer 1999).

The Cabinets has powers of rejecting or approving these documents. When they are approved, the minister starts the consultation with the NERSA, the reason for this is to plan public participation which is a legal requirement. (ERA)

2.6.4 DoE and NERSA doing public participation (Step 4 in Fig 2.6)

Section 34(1)(*a*) to (*d*) of the Electricity Regulation Act 4 of 2006 (ERA) allows the Minister of Energy, in consultation with the National Energy Regulator of South Africa (NERSA), to conduct public participation using the cabinet approved IRP.

2.6.5 ERA Section 34 Determination to Eskom (Step 5 in Fig 2.6)

DoE in conjunction with NERSA makes a Ministerial Determinations for new generation capacity if they believe that it is necessary to secure an uninterrupted supply of electricity (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others, 2017).

The Minister of Energy of South Africa commences the procurement process by issuing a 2016 Section 34 Determination just after authorisation of the Integrated Resource Plan (IRP) and public participation. The Ministerial Determinations also outline the types of energy source from which electricity must be generated, for instance, coal, wind, solar or nuclear. This information comes from IRP. NERSA and the DoE and must ensure that such decisions are in the public interest, require public participation and must be publicly available (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others). The ERA section 34 determinations also prescribe the procuring agent.

Once these Ministerial Determinations are issued and gazetted, section 34(1) (*e*) of the ERA requires that for new generating capacity to be established, a fair, equitable, transparent, competitive and cost-effective

tendering system be undertaken. The tendering system must comply with the Constitution and provide for private-sector participation.

2.6.6 Eskom issue RFI (non-binding) (Step 6 in Fig 2.6)

A Request for Information (RFI) is issued in order to collect all relevant information concerning the capabilities of the various NPP suppliers. The RFI is legally non-binding therefore it does not require the approval of the National Treasury (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others, 2017). By way of contrast, inviting a binding Request for Proposal (RFP) is an early part of the procurement process which does require National Treasury approval.

Once proposals have been received and evaluated, the DoE is required to report back to Cabinet on the proposed plant design (vendor) and the funding model. For a project of this magnitude, public consultation at various stages forms an integral part of the procurement process (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others, 2017). Apart from the public, political parties, as well as the government in power, must be actively involved in a successful process.

The Republic of South Africa is a constitutional democracy and the key functions of the National Assembly are to represent the public, to ensure government's and Cabinet's compliance with all tenets of the Constitution. The executive authority is the Cabinet which comprises the state president, deputy-president and ministers of departments (Constitution of the Republic of South Africa, 1996).

2.6.7 Minister of Finance (Step 7 in Fig 2.6)

The South African National Treasury

South Africa's National Treasury manages the national economic policy and is responsible for managing the country's national government finances and preparing the annual national budget (National Treasury). National Treasury falls under the portfolio of the Minister of Finance, as does the South African Revenue Service (SARS) and Statistics South Africa (SSA). Its role is defined by the Constitution (section 216) and in the Public Finance Management Act 1 of 1999 (PFMA).

The National Treasury plays a fundamental role in the management of government spending, setting financial-management norms and standards for state departments, monitoring their performance and reporting any deviations to the Auditor-General. It also acts as a banker for national government departments, sets and maintains treasury norms and standards to assure transparency and expenditure control in each arena of government as it oversees logistical control of funds and assets. It supports the government's macro-economic policy by determining macro-limits on spending by departments, in line with the affordability and sustainability of services. These limits are guided and matched with departments' budget proposals for the following financial year (National Treasury).

The DoE in conjunction with Eskom are responsible for the long-term planning of energy production in South Africa. The department is responsible for providing a cost-effective and uninterrupted power supply to the country. The main characteristics of the planning approach include:

- explicit consideration and fair treatment of a range of demand-and-supply options;
- consideration of the environmental and other social costs of providing energy services;
- fair public participation in the development of the resource plan, and
- analysis of the uncertainties associated with different external factors and resource options.

The National Treasury's Standard for Infrastructure Procurement and Delivery Management (SIPDM) requires that all major capital projects that have an estimated capital expenditure greater than or equal to the prescribed value and be subject to a gateway review of the Stage 4 deliverable (concept report or feasibility report) prior to acceptance of this deliverable. Such a review, in the first instance, focuses on the quality of the documentation and, thereafter, on deliverability, affordability and value for money (2016-01 SIPDM, Page 11).

2.6.8 Eskom issues RFP (binding) (Step 8 in Fig 2.6)

The Intergovernmental Agreement (IGA) according to Section 231(2) of the constitution provides that IGA binds the Republic only after it has been approved by resolution in National Assembly and National Council of Provinces.

2.7 The Experience from South Africa and Other Countries

2.7.1 Koeberg Nuclear Power Station

In the 1960s, electricity planners identified the need to locate a nuclear power station in the Western Cape. The first and only nuclear power plant in Africa. In 1966, Eskom purchased a farm, Duynefontein, near Cape Town, which would become the present day Koeberg. Construction of Koeberg project began shortly after the contract with a French consortium was signed in 1976. With the first of its two units starting commercial operation in April 1984. (Crawford 1999, Pg. 85 - 98).

The South African political landscape has evolved immensely since the construction of the Koeberg project and now. There was no major resistance from within parliament to build the nuclear plants. South Africa's apartheid government pursued nuclear power without any major opposition from any organization or the public. The only major resistance was from the ANC. The ANC bombed the KNPS during construction and this caused 18 months of delays. However, the ANC was not against nuclear power but against the apartheid system (Crawford 1999). There was no person or organizations that went to courts to oppose the project. This was made possible by the apartheid regime laws. On 15th October 1976, the apartheid governments of South Africa and France formalized the Koeberg negotiations by signing a bilateral agreement.

The South African government was involved in the whole cycle of the uranium business from uranium mining, fuel fabrication, operating a nuclear plant and management of nuclear waste. At the time there were no organizations that were against nuclear power in South Africa. This is because public participation was not allowed before construction. During the apartheid period, the state had no accountability to its citizens in this regard. This simplified the process of implementing the nuclear power plant project.
In 1977 in the wake of the Soweto massacres of the previous year, South Africa was removed from IAEA and the board of Egypt. This greatly affected the South African nuclear industry. The main reason this happened was because of the ruling style of the apartheid government (Crawford 1999). These are the main differences between the apartheid government when Koeberg was built and the current government in the politically and constitutionally.

2.7.1.1 Financing Koeberg Nuclear Power Station

In the early 1970's, the escalation of energy prices made nuclear power relatively more competitive. Tenders were invited for two identical pressurized water reactors to be located on the Duynefontein site, renamed Koeberg after a nearby landmark. The Koeberg power station was financed by South African government. Eskom approved the loan application for construction of the plant.
South Africa was sanctioned by other countries because of the apartheid system. At this time it was in the procuring process of the nuclear plants. However, these sanctions did not discourage or rehabilitate the apartheid government evils. (Crawford 1999, Pg. 85 - 98).
France ignored the United Nations (UN) boycotts, it offered South Africa all sorts of arms to aid their fight against the ANC within the country and to protect itself from external attacks.
The South African government turned to the countries in Western Europe and China for nuclear materials when the USA sanctioned them in between the 1970s and 1980s. Despite growing sanctions, South Africa was able to play off prospective tenders and in the end, opted for the technology from France. Eskom took advantage of the fact that anti-apartheid movements were not popular in France as compared with the US and Netherlands and therefore there was a chance that the Nuclear contract would move on as planned.

The Koeberg contract was signed in Johannesburg and Paris in August 1976, this was followed by bilateral agreements between France and South Africa in October 1976. South Africa was comfortable with the French deal because it offered good credit for its projects with 82% of the finance for Koeberg provided by a group of French Banks led by state-owned Credit Lyonnais and Banque de I'Indochine et de Suez, later on, absorbed into the French Bank of Southern Africa (Crawford 1999, Pg 85 - 98).
The consortium consisted of Framatome (40%) which was to supply the reactors, Spie-Batignolles (40%) which was to do civil engineering and Alsthom (20%) which would supply turbo-generators. Currently, Koeberg has cleared its debts and is now a cash cow for Eskom. All the electricity that is produced by Koeberg is put on the grid. This electricity helps in the stabilization of the grid which directly translates to economic growth (Crawford 1999).

2.7.2 United Kingdom

Governance in the United Kingdom (parliament democracy) is similar to that in South Africa (constitutional democracy) (Hattingh 1998). In both instances peaceful protest within the boundaries of the law is permitted. Opposition parties are allowed to oppose any government plans and even take these issues to court (Pidgeon, Lorenzoni & Poortinga 2008).

On 15 September 2016, the UK government announced that they would proceed with the first new NPP for electricity generation at Hinkley Point C. However, ministers imposed a new legal framework for future foreign investment in Britain's critical infrastructure such as NPPs (Department for Business, Energy and Industrial Strategy 2016). In October 2011, more than 200 protesters blockaded the Hinkley Point C NPP site. Members of several anti-nuclear groups who are part of the Stop New Nuclear Alliance barred access to the site in protest at EDF Energy's plans to renew the site with two new reactors (https://www.gov.uk/government/organisations/department-for-business-energy-and-industrial-strategy/about/media-enquiries). In February 2012, protesters set up camp in an abandoned farm on the site of the proposed Hinkley Point C NPP. They were angry because the West Somerset Council gave EDF Energy the go-ahead for preparatory work before planning permission had been granted. The group of about seven protesters also claimed that a nature reserve was at risk from the proposals (Gagnon 2012). Protesting is also a feature in South Africa. Some UK laws can, therefore, be used in a comparative case study with South Africa.

The protests that occurred in the United Kingdom were mainly as a result of the poor public consultation. The main issue concerning UK citizens was the fact that China was financing their strategic infrastructure. They feared that China would install systems that might allow them to shut down the plant or cause accidents. However, this is not the case in South Africa. South Africans are mainly worried about corruption and the price tag of the NNB. Some South Africans want the programme to go ahead so that they can obtain work and other benefits that come with the project.

2.7.3 Egypt

In 1978 Egypt drew up nuclear plans for ten reactors to be online by 1999. These reactors were designed to have a capacity of 7 200 MW. Egypt negotiated with French, German and Austrian companies as well as Westinghouse. However, these negotiations yielded no results (World Nuclear Association 2018).

New nuclear cooperation agreements were eventually signed with Russia in 2004 and 2008. These revived Egypt's plans for nuclear power. This was supported by Rosatom and, in October 2006, the Minister for Energy announced that a 1 000 MW reactor would be built at El Dabaa (World Nuclear Association 2018). The Egyptians, who recently launched a NPP build programme, financed the programme in the following

manner: 70% of capital expenditure was a loan from the vendor country (Russia) at 3% interest (the loan to be repaid over 20 years), whereas the remaining 30% is provided by private-sector investors (Shay 2016).

According to the contracts signed between the two countries (IGAs), Rosatom will build four VVER-1200 units of the El Dabaa NPP in the Matrouh region on the Mediterranean coast, as well as supplying nuclear fuel throughout the plant's operational lifetime. This will help ensure competitive electricity pricing in Egypt over a period of 60 years. Rosatom will also be conducting personnel training and will assist its Egyptian partners in the operation and maintenance of the El Dabaa NPP for the first ten years of its operations. Construction on the plant is expected to start in 2020, with commissioning expected to begin in 2026 (Shay 2016).

While many governments are reconsidering the role of nuclear energy in their national energy mix, nuclear power is still a contentious issue with respect to public opinion. Nuclear energy does not feature amongst most people's highest concerns. The factors that reduce public support for nuclear energy are concerns with respect to terrorism, radioactive waste disposal and the misuse of nuclear materials.The highest energy related concerns are those of price and security of energy supply. There are large sections of the public with no firm views for or against nuclear energy in many countries (University of the Witwatersrand 2014).

2.7.4 The experiences of other countries, particularly, Third World economies in building nuclear facilities

Some third World and/or developing countries have encountered serious challenges when expanding or introducing nuclear-energy infrastructure in their countries. Major barriers include the high capital cost of constructing NPPs, the time required to develop robust legal and regulatory frameworks and the long-term commitment required (Banks & Massy 2012). Other hurdles include establishing a sustainable safety and non-proliferation culture, the corruption of officials, limited electrical grids and the lack of interconnections, industrial knowledge and of human-resource capacity (Shay 2016).

Countries in West, Central, and southern Africa, for instance, Ghana, Kenya, Namibia, Nigeria, Senegal, Tanzania, Uganda and Zambia are all in the process of planning their own NPPS (World Nuclear Association 2018). Some of these countries have committed plans, legal and regulatory infrastructure development, whereas others are currently not officially employing nuclear-energy policy options.

2.8 Comparison with other South African Large Infrastructure Projects

Medupi and Kusile Coal Power Stations are other projects with the magnitude close to that of a new nuclear programme. These projects were/are over budget and years late on delivery. The experience gained from these projects is valuable and essential for the development of the nuclear programme. Medupi (4 764 MW) and Kusile (4 800 MW) have been plagued with delays and cost over-runs. This has forced Eskom to implement the high tariff increases. This experience should provide enough assurance to investors about the

timely construction of the project while operating within the planned budget (Steyn, Burton & Steenkamp 2017).

These cost overruns and delays were mainly caused by lack of knowledge, experience and skills. The experience gained from these two projects will help South Africa in future.

CHAPTER 3 - RESEARCH METHODS

3.1 Introduction

This chapter describes and justifies the procedures and instruments utilised to conduct the research. It also discusses the approach adopted to analyse the research data.

3.2 Research Design

Qualitative methods are used to gain insight into people's motivations, beliefs, behaviours, concerns, culture or lifestyles. A qualitative approach assists a researcher in eliciting in-depth information or insight about a phenomenon of interest. Apart from its use in conducting research, this approach is used to inform business and policy decisions (Leedy & Ormrod 2016). It is subjective in nature and it provides research participants with an opportunity to explain phenomenon from their own point of view. This involves the perceptions of the participants. Perception is the way a person or group of persons view a phenomenon and is influenced by the bias, inclinations and experiences of these respondents in a study (Leedy &Ormrod 2016). This research uses two types of qualitative methods to achieve the objectives i.e. document analysis and semi-structured interviews.

3.2.1 Work flow chart for the research

The flow chart below represents the thinking behind the methodology that was used to write this research.

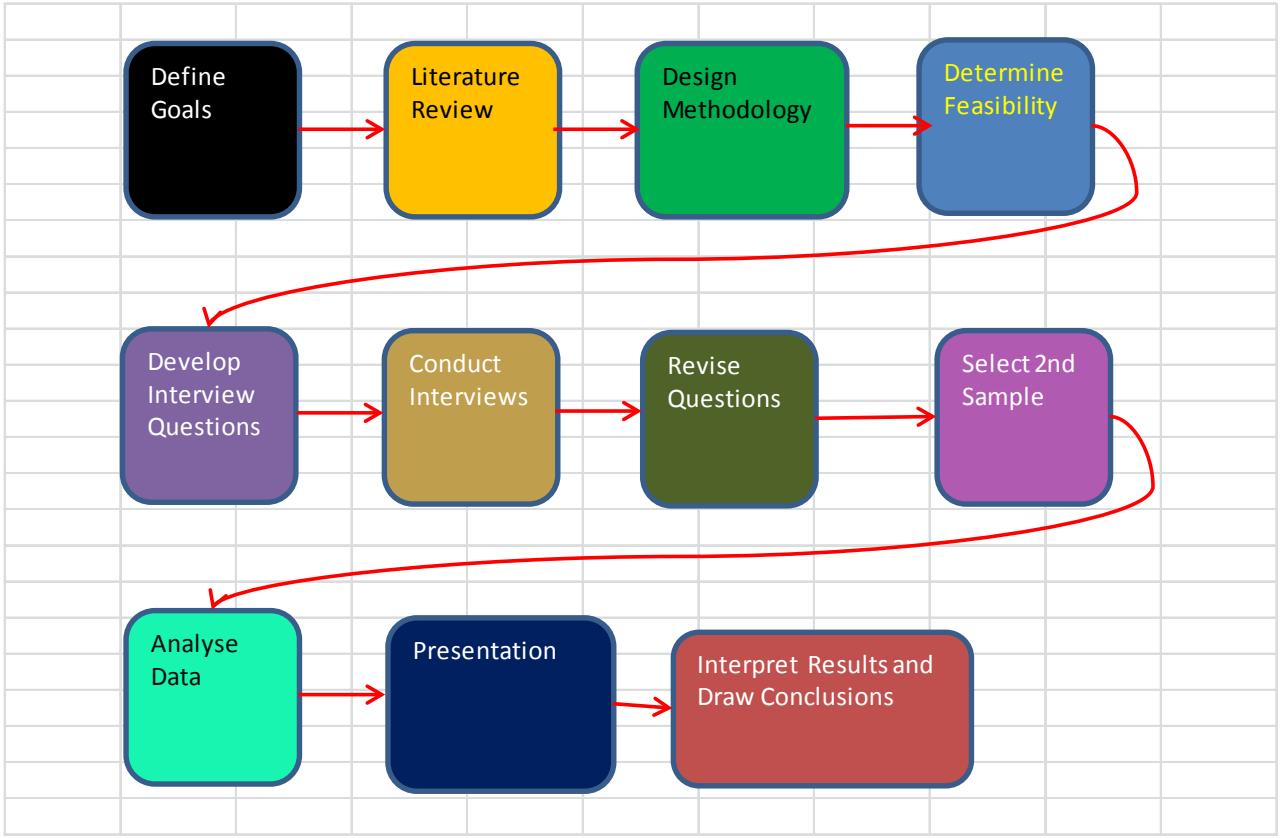


Figure 3.1: Work-flow chart for the research (source: the author)

3.3 Instrumentation

The research instruments used to collect data were documents and media (internet websites, research papers, minutes of meetings) and interviews.

3.3.1 Document and media Analysis

Table 3.1 lists some of the main governing documents and Acts which are related to the nuclear programme including treasury documents. It also covers the stakeholders and main players involved in the nuclear new-build (NNB) and the main players in the nuclear programme. The main reasons for selecting these documents are that they are all sensitive to the nuclear-power procurement process, for example, you cannot build power plants using technology that is not on the IRP, it is against the law (DoE, IRP). A procuring agent can be indicted for not obeying these documents which may lead to a delay of the procurement process (Constitution 1994). The Government of the Republic of South Africa must ensure the energy policy documents are complied with at all times or risk litigation which may delay the NNB programme (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others). These documents were analysed to identify gaps between the government documents and procurement process that was followed to procure the 9 600 MW. The constitution and actions of the stakeholders and main players are also analysed.

Table 3.1: Related documents, main players and stakeholders (source: the author)

The table below shows government documents that affect nuclear new build. It also shows the stakeholders that can influence the nuclear new build. Lastly the table shows the main players in the nuclear procurement.

Government documents	Stakeholders	Main players
Constitution	State	Eskom
National Development Plan (NDP)	Energy Intensive User Group (EIUG)	National Energy Corporation of South Africa (NECSA)
Integrated Energy Plan (IEP)	Parliament	Department of Energy (DoE)
Integrated Resource Plan (IRP)	Cabinet	National Energy Regulator of South Africa (NERSA)
Nuclear Energy Policy of 2008	Energy portfolio committee	
Nuclear Energy Act	Department of Finance (Treasurer)	
Electricity Regulation Act	Public	
Public Finance Management Act	NGOs	
Promotion of Access to Information Act 2 of 2000	Energy Security Cabinet Sub-committee	
	The National Economic Development and Labour Council (NEDLC)	

3.3.1 Interviews

The interviews were semi-structured and exploratory by design, having two phases. In the first phase, qualitative methods were used to establish a general sense of characteristics, phenomena and/or issues related to the nuclear-procurement delays. In the second phase, qualitative data from the first interviews were used. This provided a basis for a more systematic, detailed study in second interviews (Leedy & Ormrod 2016).
Interview results, summaries and analysis are in appendix F.

3.3.2 Data collection

Individuals who are/were involved in the nuclear new-build (NNB) programme in South Africa were interviewed. Respondents from the financial sector and renewable-energy industry were also included in the interviewee pool. The reason for interviewing people from renewable energy was to establish the difference in procurement process between renewables energy and nuclear energy. Information on the South African nuclear programme that started in 2006 is publicly available in the form of articles, interviews and internet websites, this is used in this work. There is also some information that was not publicly available, to collect this information, semi-structured interviews were conducted. Interviews were carried out both telephonically and face to face. However, as building rapport with participants is required in the interview method, there was a co-participation by the researcher. Co-participation, other than asking questions, was limited to acknowledging responses and demonstrating understanding of these (Eriksson 2008).

The interviews took approximately 60 minutes at participants' offices. All interviews were recorded using a cell phone voice recorder and were later uploaded to the researcher's computer. All participants granted the researcher written permission to conduct interviews. The researcher also established and maintained rapport with participants.

3.3.3 Participants

All participants were selected for a particular purpose, however, mainly for their knowledge derived from their involvement in the NNB programme and renewable energy programme. People with knowledge of nuclear procurement, renewable energy and financing of large projects were specifically chosen. One participant, from the renewable-energy industry, was also interviewed. This was done in order to obtain another perspective from somebody outside the finance and nuclear industries. This group of people represent diverse perspectives on an issue of nuclear-power procurement process.

The interview-sampling method used in this work is called 'purposive sampling'. This method was employed in order to obtain quality data.

The following people were interviewed (their titles and workplaces during this research are shown):

- *Participant A:* Operations Readiness Manager at Eskom, he was involved in the procurement process of Nuclear-1 during 2008.
- *Participant B:* Energy Specialist at the Development Bank of South Africa, she is an economist with a particular focus on energy.
- *Participant C:* CEO of PBMR, he has experience of nuclear new-build (NNB) in South Africa.
- *Participant D:* He has vast experience in nuclear industry and he was a 'vendor' representative in the 2010 Nuclear-1 procurement process.
- *Participant E:* He has more than ten years' experience in a nuclear industry and currently works for a NNB.
- *Participant F:* He is a managing director of a renewable energy company based in Johannesburg.

3.4 The Type of Interview Questions Used

The research questions that were used during interviews were seeking facts rather than private or confidential information. The questions were clear and precise. The literature review helped the researcher to develop appropriate questions. The gaps between literature and research objectives were identified, these gaps were used to develop some of the questions. Leading or ambiguous questions were avoided. Interview questions were related to the research questions and overall research problem (Eriksson 2008).

McCrea et al (2008) guidance suggests that questions' intention should answer these two questions: 'What do I intend to do with the information I'm requesting?' and 'Is it absolutely essential to have this information to solve part of the research problem? Therefore questions should be made simple, easy to read and to respond to.

A pilot study (test run) involving some volunteers was carried out in order to identify weak spots in the questions. Controversial questions were pushed towards the end.

Eriksson and Kovalainen (2008) present three types of qualitative interview:

- *Structured and standardised:* same standardised questions for all participants, mostly 'What' questions.
- *Guided and semi-structured:* outline of topics, issues or themes, but variation in wording and sequence; both 'What' and 'How' questions.
- *Unstructured, informal, open and narrative interviews:* some guiding questions or core concepts to start with, but freedom to move the conversation in any direction of interest that may come up; both 'What' and 'How' questions.

Semi-structured interview questions were used to direct the respondents in a specific direction the researcher wanted. This was done to avoid collecting unnecessary data. The researcher was interested in information that could answer the research problem, and questions were structured to achieve this.

Most of the interviews were done face to face and some were done over telephone. Most interviews were recorded. One interview was done inside the Koeberg NPP, where cell phones are not permitted; this interview was not recorded.

3.4.1 The questions

1 What do you understand about intergovernmental agreements (IGAs) and why are they important?
2 During the Nuclear-1 negotiations, after six negotiation meetings, a technical evaluation was done by the Nuclear-1 project team in May 2008. The final round of negotiations was concluded early August 2008. The team recommended a vendor based on the latest evaluations. The global financial crisis of 2008 created an international liquidity crisis and, consequently, the Eskom board decided that Eskom could not fund the project and consequently requested the stakeholder (government) to intervene and proceed with the procurement of the nuclear fleet. (a)What do you think caused this delay? (b) Why didn't Eskom buy what they could afford?
3 What do you think would be an easy route to signing binding contracts? Starting from an authorised IRP.
4 What can be done in future to avoid similar nuclear-procurement delays? For example, the April 2017 court case.
5 To what extent do you think cronyism and corruption (wanting a Russian deal) contributed to the delays? For example, South Africa wanting to make a deal with Russia. If yes, how?
6 The court judgment in the Cape High Court on 17 April 2018, nullified the nuclear-procurement process. In addition, the judgment indirectly nullified the way renewables were procured. Why were renewables not challenged in court?
7 Why were different energy committees formed?

3.4.2 Purpose of each question

Question 1: The purpose of this question was to find out how participants understood the importance of IGAs. Many people interpret IGAs differently. The researcher wanted to test the probability of having IGAs signed towards the end of the procurement process.

Question 2: The purpose of this question was to find out why Eskom went out on tender if it could not afford NPPs and why didn't Eskom buy what they could afford? Did they evaluate their finances before going to market?

Question 3: This question was asked to gauge the understanding of the nuclear-procurement process from each participant and participants were alluding to what took place in the recent procurement process.

Question 4: This question was seeking participant's litigation-free procurement process according to their understanding.

Question 5: This question wanted to establish if participants agreed with the corruption and cronyism that other people were seeing, as during the Zondo Commission it was speculated that former president Zuma wanted the nuclear deal to be done with Russia, and cronyism may have encouraged president Zuma not to follow the correct procurement process.

Question 6: The researcher wanted to establish NGOs' bias towards the renewable-power industry during nuclear-power procurement process, because these NGOs caused delays.

Question 7: Many different committees were responsible for nuclear planning. The question sought an understanding from other participants as to why were they established. The researcher suspected this was a form of poor planning from the start of the nuclear programme.

3.5 Data Analysis

The qualitative research method used in this work provides data obtained from natural settings that needed to be analysed. The researcher moved back and forth between data collection and analysis. This is called the 'constant comparative method'. The collected data was analysed to find the meanings that lies within them. The qualitative data analysis is an iterative process (Leedy & Ormrod 2016).

During analysis phase, data continued to be collected until it was clear that no new information was forthcoming. This is referred to as 'data saturation' which is reached when there is enough information to replicate the study and when the ability to obtain additional new information has been attained (Creswell 2009; Bernard 2012).

The analysis of raw data involved recorded human communication; that is, interviews and opinions. Interviews were not transcribed but listened to. Data was analysed through listening to the recordings.

Since the primary objective of the research was to understand the current procurement process as well as understanding what additional insights could be extracted from the research, the researcher decided to apply content-analysis techniques for analysing the data. A content analysis is a detailed and systematic examination of the contents of a particular body of material for the purpose of identifying patterns, themes or bias. This form of analysis is typically performed on forms of human communication, including books, newspapers, personal journals, legal documents, films, television, art, music, videotapes of human interactions, transcripts of conversations, and internet blogs and bulletin board entries (Leedy & Ormrod 2016). All documents that were analysed in this work were analysed using this method.

In conducting the analysis, both vertical and horizontal analyses were performed. Vertical analysis is the summarisation of content and horizontal analysis as the comparison of content. During the vertical analysis

of content, the volume of content is reduced by summarising text, paraphrasing or transforming data from text to tables. As the reduction in volume involves the researcher's discretion in elimination and retention of data, this results in a form of thematic analysis being performed (Leedy & Ormrod 2016). This form of analysis was necessary, given the volume of information collected during the reading and interview processes.

Once all the interviews are summarised within themselves, the cross-comparison of interviews (horizontal analysis) is performed. The main purpose of this comparison is to identify themes across units of analysis worthy of further discussion relative to the research topic (Leedy & Ormrod 2016).

In the context of this study, the vertical analysis was performed when summarising individual interviews and horizontal analysis was used when comparing interviews against one another and extracting data in relation to the hypotheses. Content analysis of the summarised interview texts was performed to identify recurring themes that were noteworthy. For some hypotheses, a comparison of the findings against available literature was also done.

3.6 Interview Recordings

It is assumed that the participants provided the researcher with open, honest responses. The themes and codes that were used by participants when giving answers are listed below. The ones that appeared once were filtered and the ones that appeared more than once were grouped together. An inductive approach was used to develop codes (Creswell 2009).

Thematic analysis was used because it is flexible, the aim was to allow the researcher to use his thinking in developing codes. The researcher developed the themes and coding was done systematically. Semantic codes capture the surface meaning of data, some of the statements from participants produced these codes. Latent codes capture the assumptions underpinning the surface meaning, since some participants were involved in the nuclear procurement process, they gave these latent codes (Creswell 2009).

3.7 Reliability and Validity

The responses from interviews were treated as perceptions and opinions rather than as facts. The reliability and validity of the information was tested for truthfulness and credibility (Kvale & Brinkmann 2009). The data collected were analysed to find the meaning, make sense of and recognise patterns among written and spoken words in order to build up a meaningful picture without compromising its richness and dimensionality. The collected data were good in terms of the characteristics and dynamics of the entities or situation studied and consistent in the patterns and dynamics they reflected.

The essence of reliability for this research is the consistency in the information.

3.7.1 Reliability

Reliability indicates the extent to which an instrument could be used repeatedly in a similar research without causing errors in the results. It is a measure of the consistency of a research instrument. Reliability of the interval is a function of the representativity of a sample, regarding the entire population and the various subgroups expected to be investigated. More generally, reliability is the consistency with which a measurement instrument yields a certain, consistent result when the entity being measured has not changed (Leedy & Ormrod 2016). In this report, the way in which the research method has been explained and outlined ensures reliability.

3.7.2 Validity

Reliability is a prerequisite for validity. There are three different types of validity: face, content and criterion-related. With face validity, a researcher employs their judgement to scrutinise and modify questions to be answered to ascertain their suitability for the research objectives. With content validity, the researcher relies on the judgement of experts and literature searches to ascertain if an instrument provides acceptable coverage of a study. Criterion-related validity involves the use of a mathematical model to predict the dependent variable or groups of variables in a dependent–independent variable relationship (Leedy & Ormrod 2016) – this type was not used in the study.

The researcher received answers that were expected from the interviews, this validated the instrument. The validity of the research instrument was done to yield meaningful, credible results.

3.8 Ethical Issues/Clearance

Ethics clearance for the research interviews was necessary. This was obtained from the School of Mechanical, Industrial and Aeronautical Engineering Ethics committee (ethics clearance number MIAEC 086/18).

The University of the Witwatersrand has a clear policy on all research conducted by members of its community. A committee receives applications from investigators and reviews their submissions prior to issuing an ethics clearance certificate. The policy stipulates that clearance be sought prior to conducting any research. This is to ensure that relevant ethical issues are adequately considered in the research methodology adopted.

This research has human beings as subjects, therefore all research ethics protocols of the university were observed. The university's research policy stipulates that all human survey research must be reviewed and approved by the relevant research committee before its commencement.

CHAPTER 4 - DATA ANALYSIS AND RESULTS

This chapter presents the analysis and results derived from the document analysis and the interviews.

The objective of this research is to investigate the key causes of delays in the nuclear-power procurement process in South Africa and to suggest ways in which these delays may be prevented in the future. This objective will be achieved by:

- Investigating the current procurement process for nuclear power in South Africa – this is achieved in the document analysis presented in section 4.1.
- Identifying the sources/causes of delays in this process – this is achieved through analysing delays that consumed the most time (see section 4.2).
- Proposing solutions so as to prevent similar delays in the future – this is achieved through identifying gaps, analysing them and making assertions (see Tables 4.2 & 4.3 and Chapter 5).

4.1 Objective 1: Investigating the Current Procurement Process for Nuclear Power in South Africa

The analysis of this objective draws on the key factors identified in section 2.4 of the literature review.

4.1.1 Document analysis

The following documents were analysed to identify gaps between the government documents and procurement process that was followed to procure the 9 600 MW

Table 4.2: Constitution, policies and Acts

Documents	Analysis
Constitution, 1996 Section 217 of the Constitution of the Republic of South Africa, 1996, reads as follows; **Procurement** 217(1) When an organ of state in the national, provincial or local sphere of government, or any other institution identified in national legislation, contracts for goods or services, it must do so in accordance with a system which is fair, equitable, transparent, competitive and cost-effective. (2) Subsection (1) does not prevent the organs of state or institutions referred to in that subsection from implementing a procurement policy providing for - (a) Categories of preference in the allocation of contracts; and	Section 217(2) of the Constitution allows for multi-governmental deals to be made between the concerned states. This is an open and straightforward process. This sometimes affects the section 217(1) objective. South Africa is one of the member states of BRICS which it joined officially in 2010. BRICS is an association of five major economies: Brazil, Russia, India, China and South Africa. This has placed South Africa in an advantageous position in its efforts for procuring a nuclear-energy project. This section 217(2) can be used in South Africa when BRICS relationship and commitments are prioritised. Multi-governmental deals do not always satisfy everyone as some vital information is not always released to the general public. This is in violation of the Promotion of Access to Information Act 2 of 2000. The implementation of section 217 requires the procuring agent to offer information to the public only when it is necessary and to ensure the public is convinced the course of action taken was the best.

(b) The protection or advancement of persons, or categories of persons, disadvantaged by unfair discrimination. (3) National legislation must prescribe a framework within which the policy referred to in subsection (2) may be implemented.	
Therefore the gap 1 is: As it stands both section 217(1) and (2) can be used. There must be a determination that specifies the part of the Constitution that must be used when procuring NPPs in South Africa. This did not happen.	
National Development Plan (NDP) NDP is a vision for the country.	Energy forms a crucial part of this vision. Therefore energy documents (IEP & IRP) must be aligned to the NDP. The NDP has no direct hierarchical links and integration to the IEP and the IRP. The existing information in the IEP and IRP are not entirely congruent with the vision of the NDP. It is clear the sequence of events of the publication of the documents is out of expected sequence. The NDP is supposed to be followed by IEP, once IEP is authorised IRP must follow.
The gap 2: The NDP suggests that a study on nuclear energy be done, this study was not done. NDP did not prescribe who should do the study. This poses a threat to the procurement process. Any entity can do the study and publish it, people may believe biased study.	
Integrated Energy Plan (IEP) The IEP seeks to address the question: Given current policies and legislation, what is the most optimal energy mix that will ensure South Africa achieves energy supply security?	The Department of Energy (DoE) issued the Integrated Energy Plan & Integrated Resource Plan (IEP & IRP) at the same time (in 2016), which was not the correct way of releasing these documents for public consultation. This is because the IRP is only relevant after the analysis and authorisation of the IEP. This misalignment of the National Development Plan (NDP), EIP, and IRP frameworks shows the lack of coherence within the DoE and the National Planning Commission. This was fundamental to the failure of the nuclear programme. Cabinet is ultimately responsible for ensuring the correct progression and timing of these series-related documents. The Cabinet failed in this regard, when the DoE announced IRP and IEP drafts in 2016 (DoE 2010).
The gap 3: Eskom and NECSA were not satisfied with the content of the 2016 drafts. This dissatisfaction is proof there is a lack of cohesion among the major stakeholders who are directly affected by these documents. They are all working independently while they are all aiming for one goal which is to provide a safe, reliable, and cheap and environment-friendly source of energy for all South Africans. IEP must be authorised first and IRP authorisation should follow. They must not be published at the same time as drafts.	

Integrated Resource Plan (IRP) The main objective of the Integrated Resource Plan (IRP 2010) is to determine the long-term electricity demand and describe how it would be met in terms of generating capacity, technologies, timing and cost.	The revision of IRP 2010 must be done only when it is necessary for instance when any of the original assumptions have fluctuated. An example of these assumptions includes energy demand or the economic growth of a country. New environmental regulations may also necessitate the revision of the IRP. This revision takes time as it involves public participation. All the involved departments should be consulted and their contribution considered (DoE 2010). When developing IRP, a computer model is used for selecting a technology at least cost that will provide a reliable supply of electricity to the country. Energy Simulation Software (PLEXOS) is a computer model which is fed figures. On the IRP 2018, the draft nuclear programme was portrayed as expensive, yet no calculations were shown or referenced on the IRP. The calculations for all technologies should be provided to the public including assumptions, as transparency is very important. An IRP and IEP provide a legal and statutory framework against which nuclear procurement can be evaluated. It seems that on pure costs PLEXOS has discounted the nuclear option. The decision-making seems to be more complex with factors such as air and land pollution, base-load requirements, etc. needing to be considered (DoE 2010).
The gap 4: The calculations for selecting the best technologies for the IRP must be made public so that people can scrutinise them.	
Nuclear Energy Policy of 2008	The policy focuses on the technological aspect of nuclear energy as per the White Paper Energy policy which was approved by government in 1998. (DME 1998)
Gap 5: Cabinet approved the nuclear-energy policy but did not have an implementation plan in place with the agreed timelines. The implementation plan is accepted at Cabinet level and it must be executed by the DoE, Eskom and the energy portfolio committee in conjunction with the Treasury, or a newly formed committee.	
Nuclear Energy Act 46 of 1999	The Act provides for the establishment of the South African Nuclear Energy Corporation (NECSA), fully owned by the state.
Gap 6: NECSA does not have enough capacity to procure a NPP. They are most experienced in nuclear-research reactors which are different from the NPP reactor.	
Electricity Regulation Act 4 of 2006 (ERA)	This Act gave birth to NERSA, which exists to protect the public in terms of electricity tariffs, NERSA conducts public-participation meetings before the increase in price is implemented. Eskom forecast how much power will be needed in ten years' time. They use this information to produce a Multi-Year Price Determination (MYPD) which is presented to NERSA for approval. From these demand projections, they know how many power stations should be built and also have accurate capital-cost estimates for each technology, based on the IRP (Poyry 2011). This and other information helps NERSA to approve Eskom-calculated tariffs. A minimum tariff must be charged in order for investors to build a NPP in a country and this tariff is used in financial modelling. In most cases, loan repayment of an NPP must be achieved in approximately 20 years. In terms of section 34(1)(*a*) and (*b*) of the Electricity Regulation Act 4 of 2006, it is a requirement that NERSA makes decisions in concurrence with the Minister of Energy. Those decisions must be in the

	interest of the public, require public participation and must be publicly available (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others). NERSA has to also ensure that the tariffs can sustain Eskom. Finding a balance between the two is a difficult task.
Gap 7: The South African government wants every industry and household to have electricity. There must also be enough electrical power available for economic growth. Therefore, Eskom should build its capacity to meet the overall needs of South Africa. The best way of increasing energy capacity is to build more power plants, while avoiding situations where electricity becomes a luxury commodity accessible only to a few people. However, these power plants are expensive to construct and Eskom cannot pay the building expenses from the low tariffs collected. These tariffs are meant to cater for capacity expansion among other expenses.	
Public Finance Management Act 1 of 1999 (PFMA) This regulates financial management in national and provincial governments; ensuring that all revenue, expenditure, assets and liabilities are managed efficiently and effectively; to provide for the responsibilities of persons entrusted with financial management, and to provide for matters connected therewith.	For South African government to purchase a new NPP in order to meet its NDP objectives, it must do the procurement within the prescripts of the law. Naturally, the spending of public funds must be undertaken within a defined legislative framework with appropriate checks and balances. In South Africa public procurement is extensively regulated. However, the country's Constitution sets out clear procurement principles, which all procurement models and decisions must adhere to in order for such model or decision to be valid. This Act is aimed at eliminating wasteful expenditure.
Gap 8: Since the start of the nuclear programme there have been delays and wasteful expenditure and this Act has been contravened.	
Promotion of Access to Information Act 2 of 2000 This Act gives effect to the constitutional right of access to any information held by the State and any information that is held by another person and that is required for the exercise or protection of any rights; and to provide for matters connected therewith.	Section 12(*a*) of this Act specifically excludes 'Cabinet and its Committees, members of parliament or of the provincial legislature and courts' from being subject to the Act. This means the South African public has no means of knowing what's happening inside Cabinet and its committees. This exclusion impacts on transparency which is outlined in Constitution. Section 32(1)(*a*) of the Constitution, 1996, provides that everyone has a right of access to any information held by the state and any information held by another person that is required for the exercise or protection of any rights. Section 32 enshrines the right of access to certain information and the (PAIA) gives effect to that right.
Gap 9: If there is information that Cabinet or its committees thinks that should not be publicly available, reasons for protecting this information must be given. If reasons are not given, people will have questions. Why should the details of a nuclear procurement for this country be made confidential when South Africa is portrayed as a democratic, transparent and accountable country? Transparency leads to accountability which is a hallmark of a democratic country. The people of this country should study the conditions of the nuclear-plant loan and accept or reject it before the government accepts it – not the other way around.	

4.2 Summary of Key Gaps

Some of the gaps identified in the nuclear-procurement process can be significant and more time is required to resolve them. They must be resolved if nuclear procurement is to go ahead:

1. There must be a determination that specifies the part of Constitution that must be used when procuring NPPs in South Africa – as it stands, both section 217(1) and (2) can be used. This must be agreed by parliamentarians.
2. The NDP suggests that a study on nuclear energy be done – this was not done. The NDP did not prescribe who should do the study, which poses a threat to the procurement process.
3. Eskom and NECSA were not satisfied with the content of the 2016 drafts. This dissatisfaction is proof that there is a lack of cohesion among the major stakeholders directly affected by these documents. All are working independently while aiming for the one goal which is to provide a safe, reliable, and cheap and environment-friendly source of energy for all South Africans. The IEP should first be authorised and then IRP authorisation should follow. They must not be published at the same time as drafts. Significant changes on the IEP directly impact the IRP.
4. The calculations for selecting the best technologies for the IRP should be made public in order that they may be scrutinised. This will help prevent politics interfering with a technical document (see Chapter 5).
5. Cabinet approved the nuclear-energy policy but did not have an implementation plan in place with agreed timelines. The implementation plan is accepted at Cabinet level and it must be executed by the DoE, Eskom and the energy portfolio committee in conjunction with National Treasury or a newly formed committee.
6. NECSA does not have the capacity to procure a NPP. They are most experienced in nuclear-research reactors which differ from NPP reactors. It is unfair to compare a NECSA facility with a NPP. Cabinet in 2015 designated the NECSA as the implementing agent for the nuclear new-build (NNB) programme. This was meant to give Eskom time to focus on the Medupi, Kusile and Ingula projects and the energy problems the country was facing at the time. This was proof that the nuclear programme was not well planned from the beginning. The handing over of the nuclear programme from one organ of state or state-owned company (SOC) to another takes time, hence the delays to the programme. The procuring agent has to conduct technical evaluations on tender documents submitted by vendors.
7. The South African government wants every industry and household to have electricity, and enough electrical power must be available for future economic growth. Therefore, Eskom should build its capacity to meet the present and future needs of the country. The best way of increasing energy capacity is to build more power plants while avoiding situations where electricity becomes a luxury commodity accessible to only a few. However, these power plants are expensive to construct and Eskom cannot finance these projects from the low tariffs currently collected. These tariffs are meant for capacity expansion among other expenses.

8. Since the start of the nuclear programme there have been delays and wasteful expenditure. The PFMA has been contravened.
9. If there is information that Cabinet or committees thinks that should not be publicly available, reasons for protecting this information must be given. Why should the details of a nuclear procurement to this country be made confidential when South Africa is portrayed as a democratic, transparent and accountable country? Transparency leads to accountability which is a hallmark of democracy. The public should be able to study the conditions of the nuclear plant loan and accept or reject it before the government accepts it – not the other way round.

4.3 Stakeholders

Table 4.3 below represents an analysis of the key issues surrounding the stakeholders of the nuclear programme in South Africa.

Table 4.3: Stakeholders of the nuclear programme (source: the author)

Stakeholders	Analysis
State In this research, 'state' means government. A State President is the president of the republic.	All SOCs are a responsibility of the state, however, the public are also a major shareholder. A legal requirement is that decisions affecting shareholders are taken through shareholder participation. . Organs of state ensure this participation. The decisions must be in the public interest, require public participation and must be publicly available (Jó 2008).
Issue 1: This state participation was not sufficient in the nuclear-procurement process.	
Energy-intensive User Group (EIUG) This is a highly influential lobbying organisation, whose members, such as AngloGold Ashanti, Lonmin Platinum, SABMiller and Transnet, use approximately 44% of South Africa's electricity.	If tariffs are unaffordable, the EIUG may seek alternate sources of power. Between 2012 and 2014, the EIUG, representing the 32 largest industrial consumers, showed a dramatic decline in electricity demand (University of the Witwatersrand 2014).
Issue 2: These users are continuously investigating alternatives of reliable and cheap energy. Eskom will lose revenue if the EIUG leave the grid.	
Parliament The parliament is where the elected representatives of the people meet to discuss matters and decide on laws. The parliament elects the president, who serves a fixed term of five years.	Parliament is responsible for laws of the country; therefore it is responsible for ensuring that nuclear procurement is done according to the Constitution. The key functions of the National Assembly are to represent the people, to ensure the Constitution is adhered to and that Cabinet takes decisions in accordance with the Constitution (Stoker 2014).
Issue 3: The April 2017 court case was instigated by NGOs; the irregularities identified by the court were supposed to be revealed by parliament or the energy portfolio committee.	
Cabinet This is the most senior level of government made up of the president, ministers and deputy ministers. The president holds the executive authority as he heads the government and Cabinet.	On 9 December 2015, President Zuma's Cabinet approved the 9 600 MW nuclear-procurement programme (Battersby 2014).

Issue 4: The Cabinet failed to provide necessary oversight and give direction to a legitimate NNB procurement process.

Energy portfolio committee The committee comprises members from different political parties. It is responsible for the oversight of the DoE as well as the following statutory entities; • CEF (Pty) Ltd • NECSA • EDI Holdings (Pty) Ltd • NERSA • NNR • South African National Energy Development Institute, • The National Radioactive Waste Disposal Institute (NRWD)	The committee on energy matters provides oversight for the DoE on behalf of the National Assembly to ensure the minister of the DoE is held accountable to agreed plans (DoE 2010).

Issue 5: The roles and responsibilities of this committee and committees such as NNEECC or similar must be made clear and documented. This is to avoid overlap in the functioning of these committees to avoid confusion. The committee had no strategy for the NNB programme. Its mandate was to ensure development of said strategy.

Department of Finance (Treasury)	**Cost–benefit analysis: Theoretical aspects (nuclear)** A cost–benefit analysis is a systematic process with the goal of calculating and comparing net benefits and costs of nuclear projects. This analysis is an effective tool for calculating a project's opportunity costs. A major concern is the affordability of a nuclear build in the South African context where the country is experiencing a slow growing economy, fiscal and debt-constrained environment. The National Treasury's SIPDM requires that all major capital projects having an estimated capital expenditure greater than or equal to the prescribed value be subjected to a gateway review of the Stage 4 deliverable (concept report or feasibility report) prior to acceptance of this deliverable (2016-01 SIPDM). The SIPDM came into force on 1 July 2016 and precedes the work done by Eskom on the feasibility of NPPs as well as the gazetted IRP of 2010 (PICC 2011).

Issue 6: This was not done in the nuclear programme and this posed a major delay to the programme. Eskom had already done a considerable amount of groundwork and, therefore, wanted assurance the preparations it had done prior to the promulgation of the SIPDM would meet the criteria it sets. This must be tested.

Issue 7: On 9 December 2015, President Zuma's Cabinet approved the 9 600 MW nuclear-procurement programme. It was alleged that Minister Nene, as Minister of Finance, was fired because he did not want to sign nuclear programme approval documents. He insisted on the full observance of the lawful procurement process in the nuclear programme (Battersby 2014).

Public Participation	Public participation must be done during EIA. This is done to ensure the public is aware of the nuclear project that will be constructed in their area. This participation is one of the elements that are considered during the final decision-making process. Community objections may be dispositioned in the final decision. Public is also involved during NERSA public participation before power-generation technology is approved (Jó 2008).

Issue 8: The Constitution is open to interpretation. The then Minister of Energy, Tina Joemart-Peterson, used the incorrect section of the Constitution (subsection 2 instead of subsection1) to implement the nuclear-procurement process. This was seen as a quick route by the minister since it required no public participation and no parliamentary involvement. The court found otherwise. This rush to decision was incorrect and it eventually caused delays.

Non-governmental Organisations (NGOs) These are special interest groups such as Greenpeace Africa and Earth life Africa.	On 12 October 2015, Earthlife Africa Jhb, OUTA and SAFCEI originally launched legal proceedings in the Cape Town High Court regarding South Africa's planned nuclear procurement of 9 600 MW (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others). Legal counsel for SAFCEI and Earthlife Africa Jhb have taken the government to court demanding information contained in the following documents (McDaid & Doyle 2016): • The proposal to Cabinet that the minister signed off for the roll-out of the new NPPs. • The Integrated Nuclear Infrastructure Review by the IAEA. • The Terms of Reference of the NNEECC. • The Communication and Stakeholder Engagement Strategy. • The Phased Decision-making Approach for implementing the nuclear programme. • The designation of Eskom as the owner and operator of NPPs in South Africa. • The 2004 Bilateral International Agreement with the Russian Federation. • The May 2013 agreement between Russia and South Africa signed during the BRICS summit meeting in Durban. • The invitation to attend vendor parade workshops sent to the Republic of Korea, the United States, the Russian Federation, the French Republic, the People's Republic of China, Canada and the Kingdom of Japan. • The list of topics each vendor country was requested to address (Eberhard 2014).

Issue 9: Since South Africa is a democratic country, anyone can take government to court if they feel the government is breaking the law. These NGOs took government to court because they felt that due process was not followed. Strangely enough, they did not take renewable energy companies to court for not following the same processes. This confirms the long term agenda of these organisations.

Energy Security Cabinet Sub-committee (July 2014) – South African President Jacob Zuma, on 23 July 2014 announced the composition of the 'Energy Security Cabinet sub-committee', which he said would oversee the development of South Africa's future energy mix. This sub-committee replaced the NNEECC. The sub-committee comprised ministers and director-generals from different ministries.	In South African a nuclear-energy programme cut across a number of different government departments and committees resulting in a need for coordination. The sub-committee responsibilities are to lead, monitor and provide oversight to the planned nuclear expansion programme. It reports to Cabinet and it, in turn, has a Nuclear Energy Technical Committee reporting to it. Both the sub-committee and Cabinet were chaired by the president. This was done so that no information could be lost between the two (DoE 2015).

Issue 10: No regular meetings were held and these .meetings that involved relevant and affected government organs and departments would have prevented delays. The concentration of power in the president for coordinating the NDP, Cabinet and the sub-committee seemed to obfuscate.

The National Economic Development and Labour Council (NEDLC) This is the vehicle whereby government, labour, business and community organisations seek to cooperate, through problem-solving and negotiation, on economic, labour and development issues and related challenges facing the country.	NEDLC caters for the wider involvement of stakeholders. This will go in line with what Innes (an academic) insinuated when he said that no matter how good an agreement (outcome) may be if the process to reach it was not regarded as fair, open, inclusive, accountable or otherwise legitimate, it may not be accepted by all. Consensus-building must produce good answers through good processes (Innes 2009). Involving NEDLC may eliminate the risk of leaving other stakeholders outside negotiations. This involvement must start as early as possible. The process should include representatives of different interests and must be driven by purpose and task that is realistic. The organisation shall be self-organising, allow participants to decide on ground rules, objectives and discussion topics. Everyone must be encouraged to participate in discussions and informal interactions. The organisation shall seek consensus only after discussions have been fully explored. This shall ensure that consensus-building is achieved.
Issue 11: There is a lack of commitment to bring together government, labour, business and community structures for the common purpose of providing clean, reliable power, economic growth and job-creation. It is not clear when NEDLC should start participating in the process.	

4.4 Main Players in the Procurement Process

Table 4.4 below is an analysis of the key issues surrounding the main players in the procurement process:

Table 4.4: Main players in the procurement process

Main players in the procurement process	Analysis
Department of Energy (DoE) Eskom reports to DoE and Public Enterprises. The DoE is responsible for the development of the energy plan for South Africa. The Minister of the DoE is responsible for the delivery of agreed plans.	In 2015, the DoE announced that it has done studies as per the NDP, the studies included among other things, costs, financing, funding model, skills development and the economic impact of localisation. These studies confirmed that this programme is fundable and will contribute positively to the economy of the country. In 2018, President Ramaphosa announced that NNB is expensive and South Africa cannot afford it. The DoE shall educate the public by means of social media, television advertisements, billboards, school debates as a minimum so they can make informed decisions during public participation.
Issue 12: This sudden change by president Ramaphosa without publicly available studies suggests the programme is based on politics not on facts and figures. The role of DoE in the nuclear-procurement process shall be formalised.	
Department of Public Enterprises (DPE)	DPE is a shareholder of Eskom and during the 2006 nuclear-procurement process, it failed to provide guidance and oversight to the process.
Issue 13: This created delays which continue to hurt the country today.	

Eskom The power utility of South Africa	In 2008 Eskom failed to finance the NNB project. The final negotiations with two potential vendors were concluded in August 2008. In late 2008, following the global financial crisis, the Eskom board decided not to fund the nuclear programme because it could not afford it. In 2007, Eskom was a procuring agent for the NNB programme. The parastatal had previously conducted a study and had decided to add new NPPs to its generational mix (Sacities 2014). In 2013, the government decided to replace Eskom with the DoE as the designated procuring agency. Eskom was instead now to be an owner and operator of the NPPs (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others). Subsequently, in 2015, Cabinet declared NECSA and Eskom to be joint procuring agents.
Issue 14: Eskom shall be made a procurer, owner and operator of NPPs. This shall be formalised and publicly known.	
South African Nuclear Energy Corporation (NECSA) The Nuclear Energy Act provides for the establishment of NECSA, fully owned by the state. The main functions of NECSA are to undertake and promote research and development in the field of nuclear energy and radiation sciences and technology; to process source material, special nuclear material and restricted material and to cooperate with persons in matters falling within these functions (Nuclear Energy Policy 2008).	In terms of section 13 of the Nuclear Energy Act 46 of 1999, NECSA is mandated to: undertake and promote research and development in the field of nuclear energy and radiation sciences and technology and subject to the IAEA Safeguards Agreement to make these generally available: • Process source material, special nuclear material and restricted material and to reprocess and enrich source material and nuclear material. • Cooperate with any person or institution in matters concerning these functions, subject to the approval of the minister. In 2015 Cabinet declared NECSA) and Eskom to be joint procuring agents (Sacities 2014).
Issue 15: Procuring NPPs is not a speciality of NECSA, and therefore its involvement in the procurement of NPPs isill-informed.	
National Energy Regulator of South Africa (NERSA)	The responsibility of the NERSA is to regulate the price of electricity. Building new, expensive, power plants will have an impact on electricity prices when tariff adjustments are not made. The investments made to build a power plant are recovered through tariffs over time. The repayment period can be negotiated with the investor or vendor. This period is normally around 20–30 years. This period will be determined by the agreements made during negotiations with the investor. **Regulatory Clearing Account (RCA)** The NERSA multi-year price determination (MYPD) methodology requires Eskom, after financial year-end, to submit its RCA application based on efficient and practical costs reflected in financial statements audited by an independent company. RCA is an account in which all potential adjustment to Eskom's allowed revenue, which has been approved by NERSA, is accumulated and managed. This RCA enables Eskom to adjust for the over- or under-recovery of preceding years' regulated costs and revenues through the electricity tariffs in subsequent years (NERSA 2018).

Issue 16: NERSA is responsible for carrying out a rational and fair decision-making pricing process, and must make provision for the public to submit its views before concurring with the minister's proposed nuclear decision or any technology. In this case, NERSA did not do so, and its decision was therefore irrational, procedurally unfair and breached the Promotion of Administrative Justice Act. In addition, NERSA was under a statutory duty to act in the public interest, and in a transparent manner. For these reasons, NERSA's decisions failed the test for rational decision-making and the decision for new nuclear power was therefore set aside by the court.	
Investors	South Africa invited investors to contribute on the power production through REIPPP, Eskom did not see fit to sign power purchase agreements with these IPPs but government forced Eskom to sign these agreements. This was done to protect the image of the country and 86% of debt to finance these IPP was raised from South Africa, pension and insurance funds. If these were not signed the rest of the investment community was not going to trust the government going forward. These investors had already invested some money in the country, built some renewable energy plants in 2009 and not signing PPA was going to be seen as wasteful expenditure.
Issue 17: If Eskom did not sign the agreements the reputational damage was going to be substantial. Investor confidence is a crucial issue in a large-scale project such as a NNB. Policy certainty and political stability are also crucial. Foreign investments are good for any country when done cautiously, they stimulate economic growth and create employment. South Africa does not have budget to build NPPs as these plants are expensive. An investor who is willing to invest in the country should be welcomed to come and negotiate with government representatives. These representatives may include a team of experts which includes some government officials. **Issue 18:** South Africa has no strategy that is accepted by all stakeholders including investors in the nuclear-procurement process. Investors shall be convinced that fair processes will be used when they tender for the project (Kidd 2014).	

4.5 Summary of Key Issues

Most of the issues listed in Table 4.4 were caused by government departments and SOCs working in silos; most issues could have been avoided if they had worked together. Stakeholders should be involved in all the steps where possible and not only when required by South African law. Changing procuring agents merely wastes time. From the beginning, Eskom should have been the procuring agent as they have the skill and capacity to operate NPPs and managing national grid. Sources of finance and legal advice may come from other institutions outside Eskom like legal firms and banks.

4.6 Objective 2: Identifying Sources/Causes of Delays in the Current Process

4.6.1 Analysis results

The following delays were identified by analysis of the sequence of events as identified in the Eskom internal documents, media reports and internet since 2006 in relation to nuclear new build:

4.6.2 Delays

- **Delay 1: Eskom decides not to continue with the nuclear programme because they could not afford it.**

  In 2006, Eskom initiated a study to include nuclear power (PWR Technology) in its generation mix. The new Pebble Bed Modular Reactor (PBMR) technology development started in the 1990's. This followed calculated projections, which indicated that a base-load capacity needs in excess of 30 000 MW was required over the 2011 to 2026 period. Of this, and in line with the modelling results, a maximum of 20 000 MW could potentially be met using nuclear energy as a primary energy source.

  The Nuclear-1 Project Team evaluated different technologies against the plant maturity, design certification status, plant size, overnight costs, services, alternative fuel supply, schedule to deploy the plant and plant availability. Each measurable was weighted and scored to determine a weighted average per plant type. The results were presented to the Executive Committee and the Board of Directors of Eskom on 26 October 2006.

  Eskom has gained tremendous amount of experience and knowledge with Pressurised Water Reactor (PWR) technology while assisting in the project management and commissioning of the Koeberg Nuclear Plant in the 1980s. Eskom has been operating and maintaining this NPP for more than 30 years (Sadika 2017).

  Vendor countries were invited to make presentations on their technology and finance options to the Eskom evaluating team covering a diverse technical and commercial spectrum of their respective technologies (Sadika 2017).

  Subsequent to the approval of the Eskom Board of Directors, on 29 March 2007, an external legal firm, namely, Wim Trengove, was appointed by Eskom to conduct a legal audit. The firm concluded the commercial process that was followed by the Nuclear-1 project team in identifying the vendors shortlisted was fair. The conclusion of the legal opinion stated that '… the commercial process that Eskom adopted in its Nuclear-1 project has been deemed to be fair, transparent and equitable thus far', in accordance with the principles of the Constitution. This legal opinion initiated the EIA, Site safety reports and geological studies (Sadika 2017).

The Nuclear-1 project team engaged in negotiations with vendors after bids submission in December 2007. The vendor scope of supply included the manufacturing, construction and commissioning of the NPP as well as all the other associated activities to establish a fully functional power plant. After six negotiation meetings, a technical evaluation was done by the Nuclear-1 project team in May 2008. The final round of negotiations was concluded early August 2008. The Nuclear-1 project team recommended a vendor based on the latest evaluations.

The global financial crisis of 2008 created an international liquidity crisis and the Eskom board consequently decided that it could not fund the project and, consequently, requested the stakeholder (government) to intervene and proceed with the procurement of the nuclear fleet. In the interim, Eskom committed to continue with the development work of the project with the intention of ring-fencing parcels of work (Environmental Impact Assessment, Site Safety Report and other NNB documents) for handover to the governments procurement agent.

- **Delay 2: The April 2017 court judgment**

Chronology of events

Minister of Energy, Ben Martins and the chairperson of the National Energy Regulator of South Africa NERSA), Cecilia Khuzwayo, signed the determination notice on December 2013, but this public information was not publicly available – it surfaced only in December 2015. This notice gave the go-ahead for procuring 9 600 MW of NPPs under the guidance of the DoE. The 2013 DoE determination was made by the minister on 11 November 2013; however, it was gazetted only in December 2015 (*Government Gazette* 39541 of 21 December 2015). Between 2013 and November 2015, government kept on saying Cabinet had not approved the nuclear procurement process.

In early 2014 Russian atomic energy company Rosatom published that South Africa had already concluded a deal with it. This announcement caught political parties, nuclear lobbyists, industry insiders as well as the ANC's National Executive Committee (NEC) off guard.

On 22 September 2014, a joint media release by Rosatom from Russia and the South African government announced the two countries had signed an intergovernmental framework agreement which laid foundations for large-scale nuclear power plants procurement and development programmes in South Africa, based on the construction of new NPPs with Russian VVER reactor technology with a total installed capacity of up to 9 600 MW.

Between the months of October 2014 and March 2015 the DoE held vendor parade workshops with all prospective vendor countries for the nuclear new-build programme. Canada, France, Japan, Russia, South Korea, the People's Republic of China and the United States proposed various offering to South

Africa. These workshops were followed by the signing of IGAs with the respective countries except the United States. IGAs are required for any nuclear deal. The reason the United States was not included is because South Africa and the United States had signed on IGA in the past and it was still valid.

On 31 March 2015, the DoE released a press statement saying that all activities necessary for the pre-procurement phase have now been concluded and they are now ready to move into the procurement phase. On 8 December 2016 the minister issued a further determination under section 34(1) of ERA in relation to the requirement for and procurement of 9 600 MW of electricity from nuclear energy with NERSA's concurrence, and published it in the *Government Gazette* on 14 December 2016. The 2016 determination failed to withdraw or amend 2013 section 34 determinations.

Court judgment

All IGAs that were signed by South Africa with other countries were found to be invalid by a court of law (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others). DoE submitted plans to NERSA for expanding nuclear energy in South Africa, these plans were found to be invalid since they did not follow proper processes. The court also found the government and Eskom proposed procurement was unlawful and unconstitutional. This ruling set aside all proposals from nuclear-energy vendors. Eskom was ordered to stop the procurement process. Eskom as a procuring agent was set aside. The court declared the government decision (section 34 determination) should have had public participation as part of its procurement process.

- **Delay 3: Forming committees responsible for a nuclear-procurement process**

  The committees below were all somehow involved in the nuclear-procurement process. The formation of these committees wasted time, causing delays and showed there was no procurement strategy that was thoroughly planned at government level:

  - *2009:* The Inter-Departmental Task Team on Energy (IDTTE) established under the Inter-Ministerial Committee on Energy, the responsibility of the committee was to decide on the nuclear programme going forward.
  - *September 2011*: Presidential Infrastructure Coordination Commission (PICC), PICC was responsible for grouping similar projects. The PICC comprises ministers, premiers and executive mayors of metropolitan councils. They came together quarterly to assess progress with regard to the implementation of the NIP and reflect on ways of removing bottlenecks where these exist in order to fast-track the delivery of infrastructure for social and economic development.
  - *November 2011:* National Nuclear Energy Executive Coordination Committee (NNEECC) leads, monitors and ensures oversight of the implementation of the country's nuclear-energy policy. It was set up in line with the Cabinet approved Nuclear Energy Policy of 2008. NNEECC comprises the following ministries; Energy, Public Enterprises, Finance, State Security, Defence and International Relations. The size of the committee was reduced to strengthen its efficiency in decision-making.

4.6.3 Formation of working groups and committees

The Nuclear Energy Policy of 2008 requires that institutions such as the NNEECC be formed for implementation of the policy. The NNEECC was established in November 2011. Its responsibilities are to lead, monitor and provide oversight to the planned nuclear expansion programme. NNEECC and Cabinet are chaired by the president, this is done so that no information is lost between the two bodies.

This NNEECC has a sub-committee or working group appointed to study and report on particular questions and make recommendations based on its findings. Nuclear Energy Working Group has six sub-working groups reporting back to it. These sub-working groups are as follows;

- Sub-Working Group on Finance and Procurement
- Sub-Working Group on Safety, Regulation, and Legislation
- Sub-Working Group on Skills, Localization, and Industrialisation
- Sub-Working Group on Siting, Environment, and Communication
- Sub-Working Group on Safeguards, Security, and Physical Protection
- Sub-Working Group on Fuel Cycle: Front and Back End.

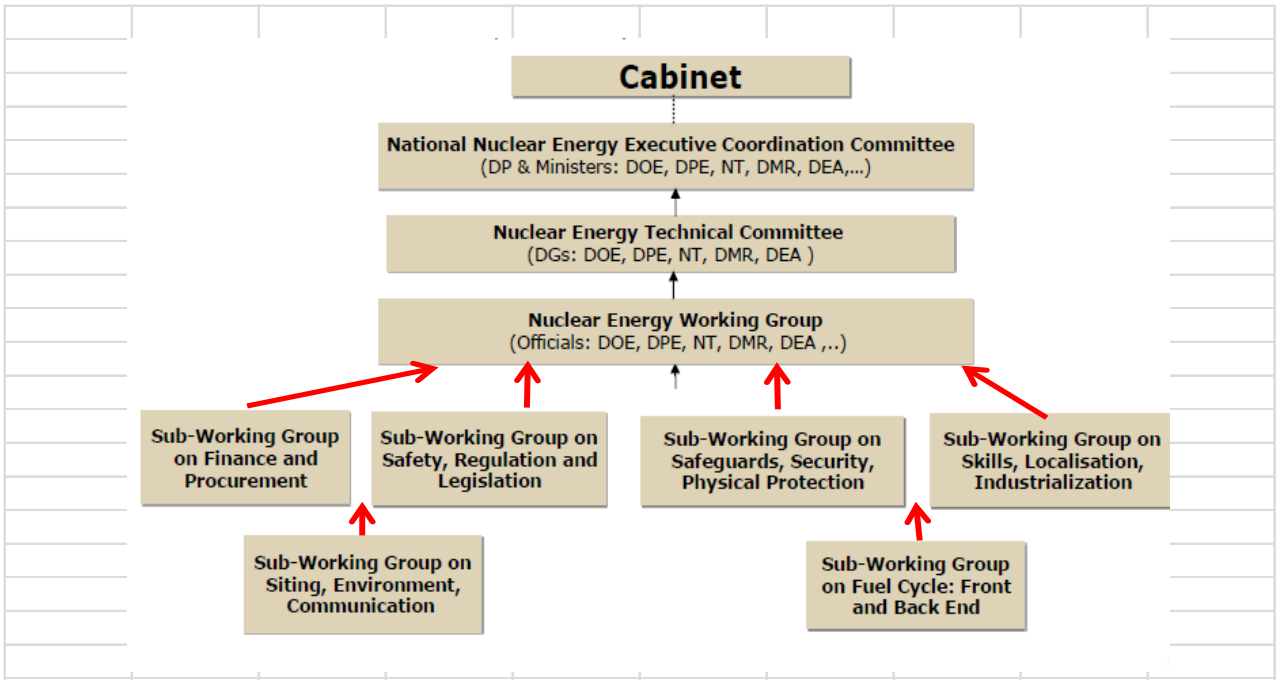


Figure 4.2: Cabinet committees (DoE)

The NNEECC failed in its duties causing delays in the nuclear programme in South Africa. Regular meetings that involved relevant and affected government organs would have prevented these delays. The NNEECC and Cabinet were chaired by the president. This was done so that no information could be lost between the two. The concentration of power in the president for coordinating the NDP and NNEECC

seemed to obfuscate. Some of this work shall be delegated to a minister or a specially formed committee to ease the load of work that all these plans (NDP), Cabinet and NNEECC entail.

The NNEECC failed to ensure synergy among all the affected departments, for instance, the DoE, NECSA, Eskom and other main stakeholders. This led to court a battle (Earthlife Africa- Johannesburg and Another v Minister of Energy and Others) that delayed the process of building nuclear facilities.

On 22 September 2014, a joint media release by Rosatom from Russia and the South African government announced the two countries had signed an intergovernmental agreement which laid a foundation for large-scale NPPs' procurement and development programmes in South Africa, based on the construction of new NPPs with Russian VVER reactor technology with a total installed capacity of up to 9 600 MW.

This announcement caught political parties, nuclear lobbyists, industry insiders as well as the ANC's NEC off guard. There was such an outcry over Russia's unfair advantage that the DoE tried to downplay the agreement and instituted damage control by asking other vendor countries for similar agreements, including the United States, South Korea, France, Japan and China. This yet more proof that there was no accepted plan that was widely accepted by stakeholders from the early phases of the nuclear-build programme. NNEECC was supposed to provide a plan.

- *July 2014* : South African President Jacob Zuma, on 23 July 2014 announced the composition of the 'Energy Security Cabinet sub-committee', which he said would oversee the development of South Africa's future energy mix. This subcommittee replaced the NNEECC.

  Energy Security Cabinet Sub-Committee. The sub-committee (2014) comprises cabinet members – Minister of Energy, Tina Joemat-Pettersson; International Relations and Cooperation Minister Maite Nkoana-Mashabane; Public Enterprises Minister Lynne Brown; Finance Minister Nhlanhla Nene; State Security Minister David Mahlobo; Trade and Industry Minister Dr Rob Davies; Economic Development Minister Ebrahim Patel; Mineral Resources Minister Adv Ngoako Ramatlhodi; Environmental Affairs Minister Edna Molewa and Defence Minister Nosiviwe Mapisa-Nqakula – would oversee the development of South Africa's future energy mix.

Energy portfolio Committee

Portfolio committee comprises members from different political parties. This committee is responsible for the oversight of the DoE as well as the following statutory entities;

- The Central Energy Fund ((CEF) (Pty) Ltd)
- NECSA
- EDI Holdings (Pty) Ltd
- National Energy Regulator of South Africa (NERSA)

- National Nuclear Regulator (NNR)
- The South African National Energy Development Institute (SANEDI)
- The National Radioactive Waste Disposal Institute (NRWD).

The roles and responsibilities of this committee, as far as a NNB programme, are unclear to everyone and they need to be clarified and documented.

4.7 Summary of Delays

Eskom in 2006 stopped the nuclear procurement of new plants because it could not afford them, government took over the process. The court in April 2017 found the South African government had not followed the correct processes when procuring the NPPs. This stopped the procurement process, causing delays. Since the South African government has taken over the process, it formed a number of committees responsible for this process, and these different committees contributed to delays.

CHAPTER 5 - DISCUSSIONS

5.1 Introduction

The overall objective of this research was twofold. First, the aim was to investigate the main causes of delays in the process of the procurement of nuclear power in South Africa. This was achieved by investigating the current procurement process in South Africa and then identifying the sources/causes of delays in this process. The second part of the objective was to propose solutions in order to prevent similar delays in the future.

South Africa is a developing country with an increasing population and a growing industrial base. The effects of high population and industrial expansion include pressure on the available resources, for instance, energy. Eskom is a South African company mandated with the procurement, generation, transmission and distribution of electricity. It was given the work of procuring a nuclear power plant (NPP) to sustain the base load. This project, however, has experienced delays due to incompetency and miscommunication within the government departments and all stakeholders involved.

5.2 Current Procurement Process (Gaps and Delays)

These rather impressive lists of national plans (NDP, IEP and IRP) create a strong perception that South Africa's energy future is safe; provided, of course, these plans will be timeously implemented. Delving deeper and analysing the current energy situation, however, leads one to suspect the positive picture painted by such policies and plans does not quite match current energy realities in South Africa. In the literature, key factors in the current South African nuclear-procurement procedures were identified. An analysis of key documents referring to government, stakeholders and the main players was done to further investigate gaps and issues in the current procurement process. A number of gaps between what was required in the government documents and what actually has happened in the procurement process came to light. These are discussed further below.

The relationship between South Africa and BRIC countries when prioritised may affect section 217 of the Constitution. In order for South Africa to prevent this possible conflict, parliament should ensure it selecst subsection 217 of the Constitution that is best for the country. However, government-to-government deals breach section 217(1) of the Constitution and South Africa cannot use this arrangement when procuring NPPs.

When the National Development Plan (NDP) was drafted by the planning commission it suggested a study be done for NPPs to determine the feasibility of the nuclear technology in South Africa including its costs, financing options, institutional arrangements. The NDP did not prescribe who should conduct the study, this allowed any person to do their own studies and publish their results. These studies by different people (organisations, academics, accountants etc.) resulted in different results which created confusion among people who did not understand NPP price calculations.

When the Department of Energy (DoE) issued the IRP and the Integrated Energy Plan (IEP) drafts in 2016, Eskom and the Nuclear Energy Commission of South Africa (NECSA) were dissatisfied with the drafts. All three players have one goal and that is to provide a safe, reliable, cheap and environment-friendly source of energy for all South Africans. Having one goal and not working together shows a lack of cohesion. The IEP was issued at the same time as the Integrated Resource Plan (IRP) which was not supposed to be the case and has caused confusion. The IEP should be authorised first and then IRP must follow.

The IRP prescribes energy technologies to be used in order to meet the energy requirements of the country. This document is revised by the DoE when there is a need for a revision. The changes in energy demand, the economic growth of a country and new environmental regulations may, therefore, necessitate revision. Revision of the IRP takes time as it involves public participation. All the involved departments must be consulted and their contributions considered. The DoE does not seem to do this even when convincing evidence is provided. They have in the past allowed politics to influence this technical document. The IRP must be a technical document, and politics should not influence the IRP. In the IRP 2018 draft nuclear was portrayed as an expensive technology yet no calculations were shown or referenced in the IRP. This, therefore, lacked transparency – an important part of the process.

The Nuclear Energy Policy (NEP) of 2008 focuses on the technological aspect of nuclear energy. This policy was approved by the South African Cabinet. When the government approved this policy they did not have an implementation plan with agreed timelines. Since nuclear technology cuts across many government departments and involves other stakeholders, the National Nuclear Energy Executive Coordinating Committee (NNEECC), or similar committee, should develop a comprehensive plan that should ensure realisation of nuclear technology in South Africa. The NNEECC failed to accomplish this task which involves coordination, planning and implementation.

NECSA is the most experienced entity in nuclear-research reactors which are different from the NPPs reactors. It is inappropriate to compare a NECSA facility with a NPP. Cabinet in 2015 designated the NECSA as the implementing agent for the nuclear new-build (NNB) programme. This was meant to give Eskom time to focus on the Medupi, Kusile and Ingula projects and the energy problems the country was facing at the time. This was proof the nuclear programme was not well planned from the beginning. The handing over of the nuclear programme from one organ of state or state-owned company (SOC) to another takes time hence delaying the NNB programme. In addition, the procuring agent has to conduct technical evaluations on tender documents submitted by vendors and NECSA cannot evaluate an NPP in the same way as Eskom because they don't know and understand a nuclear power plant like Eskom does.

There is a minimum tariff that must be charged in order for investors to build an NPP in a country and this tariff is used in financial modelling. In most cases, loan repayment of an NPP must be achieved in

approximately 20-30 years. In terms of section 34(1)(*a*) and (*b*) of the Electricity Regulation Act 4 of 2006 (ERA), it is a requirement that NERSA makes decisions in concurrence with the Minister of Energy. Those decisions must be in the interest of the public, require public participation and must be publicly available. NERSA has to also ensure that the tariffs can sustain Eskom. Finding a balance between the two is a difficult task.

Naturally, the spending of public funds must be undertaken within a defined legislative framework with appropriate checks and balances. In South Africa public procurement is extensively regulated. However, the country's Constitution sets out clear procurement principles, with which all procurement models and decisions must adhere in order for such model or decision to be valid.

The Public Finance Management Act 1 of 1999 (PFMA) is aimed at eliminating wasteful expenditure. South Africa has experienced a great deal of wasteful expenditure with regard to the NNB programme. South African entities have spent the money inefficiently and ineffectively and no-one has shouldered the blame for this.

The Promotion of Access to Information Act 2 of 2000 (PAIA) means the South African public has no means of knowing what's happening inside Cabinet and its committees in relation to sensitive information, this is covered on Section 12(a) of the PAIA. This exclusion impacts on transparency which is outlined in Constitution. Section 32(1)(*a*) of the Constitution, 1996 provides that everyone has a right of access to any information held by the state and any information held by another person that is required for the exercise or protection of any rights. Section 32 of the Constitution enshrines the right of access to certain information and the PAIA gives effect to that right. This Act requires information that affects the public to be publicly available. Previously, the South African government did very little to communicate nuclear plans to the public. This is risky because it can cause public resentment of the nuclear programme, due mainly to a lack of adequate information. In future, any plans that are agreed at parliamentary level must be disseminated via the proper channels so that information filters down through all levels.

The Integrated Nuclear Infrastructure Review (INIR) is a peer-reviewed assessment conducted by international experts on nuclear energy – coordinated by the International Atomic Energy Agency (IAEA) – to support countries in developing their nuclear capacity by determining their infrastructure status and needs. The IAEA (INIR) report was never made available to the South African public. The other countries that did a similar review allowed the public to have access to the report. The South African report was classified, this led the people to believe that government was hiding something from them.

The promotion of transparency in the procurement process and the business opportunities that a NNB programme provides must be highlighted and this can be achieved by making use of good corporate

governance as stipulated in the King Report. The procurement process must be presented for approval by Cabinet. Once endorsed by Cabinet, the procurement process will be presented for deliberation by parliament, and then government will launch a procurement process well in time to ensure that South Africa commissions the first unit in time as per the IRP

5.3 Issues from Main Players and Stakeholders

Power failures (load-shedding) in South Africa caused by insufficient capacity started in 2006, (ESKOM 2000 – 2008, 2013) and now in 2019 still represent a major problem. The entire country is radically affected by these power cuts which are caused by insufficient generating capacity and major plant-operating issues. Delays in building new NPPs, as per the authorised IRP2010, add to the problem. Delays and uncertainty in the NNB procurement process have and will continue to have a negative effect on the economy of the country unless changes are made to the process for new NPPs.

To identify sources and/or causes of delays in the procurement process, documents were analysed and interviews conducted. From the analysis it is clear there were problems from the start of the NNB programme in 2006. All these problems somehow contributed to the delays experienced in the programme.

It is important to note that contravening any laws of South Africa will cause delays. The following issues are from Table 4 and Table 4.4. and categorised into financial, regulatory and constitutional issues. All these issues will cause delays if they are not considered and planned for in the nuclear power plant procurement process.

5.3.1 Financial issues

- The High Energy-intensive Users Group (EIUG) is a highly influential lobbying organisation, whose members, such as AngloGold Ashanti, Lonmin Platinum, SABMiller and Transnet, use approximately 44% of South Africa's electricity. These users are continuously investigating alternatives of reliable and cheap energy due to Eskom's increasingly high tariffs. If these users leave the grid, Eskom loses substantial revenue. South Africa might as well forget about building NPPs without these intensive users. NERSA and Eskom have the responsibility of ensuring they don't lose these bulk-user customers and then be left with the problem of non-paying municipalities.
- The South African government faces many cases involving corruption and mismanagement of state funds. This issue goes back to the scandal around the arms deal, the appointment of many ministers, improper use of service-delivery funds or no service delivery even though funds are allocated, the state capture report and many more. In addition, the inability of Eskom to deliver the Medupi and Kusile projects on time and within budget also adds to the list of scandals. This calls into question the ability of the government and state-owned entities (SOEs) to handle funds and brings doubt to its ability to manage a mega-project such as a nuclear programme which is estimated to cost R1.2 trillion in order to

produce 9 600 MW of power. If corruption and mismanagement is not rooted out, financing of NNBs may be negatively impacted.

- The question are: Can South Africa afford new NNPs? What are GDP projections? What is the current Ratings agencies grading? How do you establish if the economy of the country is sound or if it can afford an NNB?

On 9 December 2015, President Zuma's Cabinet approved the 9 600 MW nuclear-procurement programme. It was alleged that Minister Nene was fired because he did not want to sign nuclear-programme approval documents when he was Minister of Finance, as he insisted on the full observance of the lawful procurement process in the nuclear programme.

Financing an NPP is not easy as many analysis and negotiations are involved. Many financing options are available as they differ from one country to another. In 2008 Eskom failed to finance an NNB project. The negotiations with two potential vendors were concluded in August 2008. In late 2008, following the global financial crisis, the Eskom board decided not to fund the nuclear programme because it could not afford it. When finance negotiations are taking place, gross domestic product (GDP), tariffs, loan-repayment periods, etc, are taken into account and the conclusion is made based on affordability. The South African National Treasury is the only government department that can answer these questions.

5.3.2 Regulatory issues

- The National Treasury's Standard for Infrastructure Procurement and Delivery Management (SIPDM) analysis was not carried out for a nuclear programme. This severely delayed the nuclear programme. The Eskom board had already done a considerable amount of groundwork. It therefore wanted assurance that the preparations it had done prior to the promulgation of the SIPDM would meet the criteria.
- Since South Africa is a democratic country, anyone can take government to court if they feel the government is breaking the law. Non-governmental organisations (NGOs) took government to court because they felt that due procurement process was not followed. Strangely enough, they did not take renewable energy companies to court for not following the same processes. This confirms the bias of these organisations.
- NERSA is responsible for carrying out a rational and fair tariff decision-making process. NERSA must make provision for the public to submit its views before concurring with the minister's proposed nuclear decision or any technology, NERSA did not do this when South Africa wanted to procure 9 600 MW of nuclear power. People and organisations protesting against nuclear energy have used this inadequate public information on nuclear to feed these citizens with inaccurate information and speculations.
- NERSA's decision was therefore irrational, procedurally unfair and breached the Promotion of Administrative Justice Act 3 of 2000. In addition, NERSA was under a statutory duty to act in the

public interest, and in a transparent manner. For these reasons, Nersa's decisions failed the test for rational decision-making and the decision for new nuclear power was therefore set aside by the court.

- Eskom was hesitant about signing power-purchase agreements with IPPs. However, it ended up signing them, and if Eskom had not signed the agreements the reputational damage was going to be huge. It was going to damage investor confidence which is a crucial issue in a large-scale project such as a NNB. Policy certainty and political stability are also crucial. Foreign investments are good for any country when done cautiously. They stimulate economic growth and create employment. South Africa does not have the financial resources to buy NPPS as these plants are expensive. An investor that's willing to invest in the country should be welcomed to come and negotiate with government representatives. The representatives may be a team of experts which includes some government officials.

In December 2009, president of South Africa declared at the United Nations Climate Change Conference in Copenhagen that South Africa was going to reduce its carbon emissions by 34% by 2020. Delaying these NPPs means that South Africa will continue to produce its base load from coal-fired power stations, breaking promises made in December 2009 and damaging the reputation of the country. These stations emit tons of carbon dioxide and other harmful gases (Eskom, 2014,Medupi FGD Retrofit Technology Selection Study Report).

All of these delays to NNB will nullify the commitments made to the international community. The solutions to the environmental problems lie not in perpetuating the status quo, which continues to produce greenhouse gases, but in an honest and holistic evaluation of the challenges and the adoption of multi-criteria decision-making that recognises the opportunities for clean and reliable energy. The same reputational damage South Africa tried to avoid in the IPP case is going to recur if it fails to reduce carbon footprint as promised in December 2009. Notably, most financial institutions are no longer financing coal-fired power stations.

5.3.3 Constitutional issues

- State participation was not sufficient in the nuclear-procurement process. Compliance with the Constitution, as far as energy is concerned, is the responsibility of all South Africans. When laws were being contravened, the portfolio committee and parliament were already in existence.
- The April 2017 court case was initiated by NGOs. The irregularities the court identified were supposed to be picked up by parliament, via the NNEECC or the energy portfolio committee. The NNEECC reported to Cabinet. A number of organisations are against nuclear power in South Africa, these organisations pose a threat to the nuclear programme. They have delayed nuclear programmes before and they can do so again as they have lawyers who are always on the lookout for legal loopholes that can take the government or Eskom to court. This ends up delaying the nuclear programme. A project such as this can easily be delayed by litigation, especially in a democratic state such as South Africa

which embodies freedom of speech. A state attorney must be involved in the process so they can review all the processes and ensure that all concerned adhere to all rules/regulations/laws concerned.

- The roles and responsibilities of the portfolio committee and committees such as NNEECC, or similar, must be made clear and documented. This is to avoid overlap in the functioning of these committees to avoid confusion. Confusion caused by the broad scope of challenges which have to be addressed in order to achieve successful nuclear power plant procurement.
- South Africa officially became a member nation of BRICS on 24 December 2010. During the apartheid era, the African National Congress (ANC) and other political reactionary forces were supported by China and Russia, whereas the government of the day was supported by the anti-communist West (Crawford 1999). Politics and cronyism and may harm transparency in a nuclear-procurement process. All necessary measures must be put in place to prevent these. In 2008, when a NNB was to be built, the procurement process was run as an Eskom internal programme. Questions were raised by concerned people about whether decisions about the nuclear programme would be based on good technical evaluation and evidence-based policymaking or on geopolitical considerations. This history has a potential of influencing decisions about the nuclear programme and poses a threat to transparency. The portfolio committee and the NNEECC must ensure that this does not happen and the Constitution must be respected at all times.
- The South African State President announced during his state of the nation address (SONA) speech in 2016 that the government was expecting to conclude the procurement of 9 600 MW of nuclear energy (Zuma 2016). However, the Minister of Finance was silent on the allocation of budget and guarantees for the NNB in his budget speech which followed SONA. It can be concluded there might have been different views regarding the affordability of nuclear energy in South Africa amongst cabinet and as long as this chaos is not resolved very little progress will be made. This lack of coherence within the government may make it difficult for decisions to be made causing delays to NNB.
- It is clear from the above information there is no consensus within the political system of South Africa on the issue of nuclear electricity. This is another contributor to the delays in the decision on nuclear new build power.
- Countries such as China and Russia have said publicly t they wish to invest in South Africa's nuclear-energy sector in order to support economic development, localisation, skills development and job creation. China and Russia have built NPP on time and within budget (Conca 2015). Statements and commitments such as this by interested parties, encourage the South African government to entertain government-to-government deals. Owing to the fact that foreign funding is available, what is needed is a viable plan and good negotiators who will negotiate repayment periods and other clauses. All this must be done openly and within the prescripts of the Constitution.
- The Constitution may be interpreted differently by different people. The then Minister of Energy, Tina Joemart Peterson, used the wrong section of the Constitution to implement the nuclear-procurement process. She saw this was seen as a quick route, as it required neither public participation nor parliamentary involvement. In her attempt to do this, she referred to subsection 2 instead of subsection

1 of section 217 of the Constitution. However, the court of law found otherwise, as the procurement process lacked transparency. The minister's rush to action was therefore wrong and it eventually caused delays.

- On 23 July 2014, South African President Jacob Zuma, announced the composition of the 'Energy Security Cabinet sub-committee', which he said would oversee the development of South Africa's future energy mix. The president failed to ensure that all main ministers had regular meetings, and that all problems were resolved timeously. No regular meetings involving the relevant and affected government organs and departments were held which would have prevented delays. The concentration of power in hands of the president for coordinating the NDP, Cabinet and Energy Security Cabinet sub-committee seems to obfuscate.
- There is a lack of commitment to bring together government, labour, business and community structures for the common purpose of providing clean, reliable power, economic growth and job-creation. It is not clear at what point the National Economic Development and Labour Council (NEDLAC) should start participating in the nuclear-procurement process.
- In 2018, President Ramaposa announced that South Africa could not build NPPs due to cost. It was not his responsibility to announce this but rather that of Minister of Energy. The sudden change of tune by president – without publicly available studies – suggests that the programme is based on politics not on facts and figures. The role of DoE in the nuclear-procurement process should be formalised.
- During the early phases of the Eskom nuclear programme, the DPE, DoE, and Treasury were not working together and this created misunderstanding between the departments which caused delays. The nuclear negotiations and agreements between DPE and other government departments must be transparent and compliant with the law.

In 2008, Eskom realised that it could not afford an NPP after the procurement process had already begun. As the main shareholder, DPE was supposed to provide oversight and guide Eskom on how to procure an NPP. DPE, as the only shareholder, was unable to realise that Eskom could not afford NPPs, even though the main shareholder was required to be aware of this. DPE's oversight of Eskom therefore needs to be strengthened.

- Eskom has been made a procurer, owner and operator of a NPP, and this was formalised and made public.
- The time wasted during the signing of inter-governmental agreements (IGAs) could have been better used for other issues necessary for the programme to proceed while at the same time saving money. These signings did not achieve anything concrete; instead, they caused delays in the nuclear project.
- Section 34(1)(a) to (d) of ERA allows the Minister of Energy, in consultation with NERSA to make Ministerial Determinations for new generation capacity, if he or she believes it is necessary to secure an uninterrupted supply of electricity. This determination also prescribes the procuring agent. Section 217(1), (2) and (3) of the Constitution may be applied. However, section 217(1) is the more transparent option. The agent requests an RFI from interested vendors. From the information supplied, the agent

requests an RFP. The agent then uses its selection criteria to select the suitable vendor. The experts within departments make a thorough technical analysis and present their findings to the minister, who considers all reports and options and then presents them to Cabinet. Cabinet then approves a vendor. The vendor then signs the contract and starts building.

CHAPTER 6 - RECOMMENDATIONS

It is acknowledged that South Africa has sufficient laws for procuring the nuclear power plants (NPPs). But there is no tried-and-tested method or strategy that South Africa can use to procure NPPs and be accepted by everyone. Many enablers must be understood before an NPP is procured in South Africa, and these (see section 2.4.1) need to be in place in order for South Africa to expand its power generation through nuclear energy.

South Africa shall have no intention of having new technology (First of A Kind) and even the new smaller modular reactors (SMRs) must have an established reference somewhere in the world, this must be implemented in the procurement strategy,

6.1 Involvement of Chapter 9 Institutions

These chapter 9 organisations have failed to help South Africa in big projects, like Medupi and Kusile. Both projects lacked proper oversight from government.
South African government needs to get appropriately skilled people from the private sector . These people shall have extensive experience, knowledge in NNB projects and a good track record.

6.2 Coordination

Coordination and regular meetings between committees, regulator and every government department that is involved in the programme is a crucial issue that must be driven at higher government levels. These meetings should take place when necessary. However, at present, no arrangements exists that prescribe regular meetings between the Department of Energy (DoE), Department of Public Enterprises (DPE), Eskom, Nuclear Energy Commission of South Africa (NECSA), NERSA, the Department of Environmental Affairs and Tourism (DEAT) and National Treasury that can ensure no misalignment of functions occur. The NNEECC failed to ensure this synergy between these government organs and departments. Relationships between governmental departments are crucial especially in projects such as this that require the contribution of different branches of government. The Minister of Finance who is responsible for the National Treasury is supposed to ensure that there are no wasteful expenditures in the nuclear new-build (NNB). The lack of cooperation between the DoE, DPE, Eskom and National Treasury has created delays and other problems in the nuclear project.

In South Africa, the nuclear-energy programme cuts across a number of government departments and committees and there is a need for coordination. The obvious main players are National Treasury, the energy portfolio committee, the DPE, the DoE, NECSA, the DEAT and Eskom. The energy portfolio committee comprises members from different political parties and they give oversight to DoE. The roles and responsibilities of this committee and the NNEECC must be clearly defined and documented to avoid an overlap which may cause confusion.

6.3 Political Environment

Some leading politicians of the ruling African National Congress (ANC) sit on the boards and/or hold shares in mining companies and IPPs. This fact can steer the energy policy in a certain direction which is not based on technical information.

In South Africa, the NPP project is plagued with political baggage. Political parties have issues with the government of ANC which is the ruling party. However, they cannot openly admit that an ANC government will fail in delivering the project. They instead opt to look for an irrational argument about corruption. Some people argue that the nuclear programme is, in fact, a political decision and is not based on any government policy. According to Bent Flyvbjerg, 2014, the specific characteristics of a mega-project are rather irrelevant and the over budget/delay is explained by the stakeholder's attitude toward the project.

It is possible to get all political parties to agree on a nuclear programme though it would be a difficult process. There are many ideas that can be implemented with one of them being to educate parliamentarians about nuclear power instead of assuming they have the necessary knowledge regarding nuclear technology. This shall be technical education and not politics. Understanding the technical part (facts and figures) of it may affect political decisions. Political parties form the link between people and government. It is assumed political parties have some common goals including a better life for all, creating jobs and improving the economy. This can be used as a common ground for starting a journey towards building new NPPs.

6.4 Political Coherence

The lack of political coherence amongst political parties can create doubt and uncertainty for the potential investors. The political instability in South Africa may also make the investor doubt the success of NNB. The investors will need the confidence they will make a profit if they invest in the South African NPP project. This investor confidence can be assured only through political cohesion, good governance, transparency, good ratings agencies projections, good GDP per capita and open communication about the NNB developments.

The critical issue when designing a political alignment framework is transparency. It is a fundamental building block for such a framework. Parliamentarians need to have one voice when it comes to NNB since it will benefit the whole country. This unity is very important when it comes to decision-making and transparency. Nuclear lobbyists and NNEECC or similar committee members must be invited to address members of parliament and also nuclear development around the globe must be discussed as part of education. Job opportunities, energy provision and community elevation (National Development Plan objectives) must be used as the drivers of NNB when building consensus with parliamentarians.

If the South African government wants cohesion in nuclear energy policy documents, it must involve all the government organs and departments directly affected by a decision of the other parties. This will eliminate questions, doubts and speed the process. The goal for everyone is common and that is to provide South Africa with a safe, reliable, clean, sustainable nuclear power that shall help grow the economy, create jobs and reduce the emission of harmful gases to the environment. Meet the needs of electorate and industry cost effectively.

6.5 Intergovernmental Agreements (IGAs)

Proposed vendors are mostly owned by governments, it is therefore important to have the intergovernmental Agreements (IGAs) in place before any binding negotiations are entered into.

CHAPTER 7 - CONCLUSIONS

This research investigated the key causes of delays in the process of the procurement of nuclear power in South Africa and it suggested a new procurement strategy that can prevent similar delays in the future.

South Africa has no strategy for nuclear-procurement accepted by all stakeholders including investors. Investors must be convinced that fair processes will be used when they tender for the project.

South Africa appears to have sufficient laws and regulations for procuring nuclear power. However, no specific procurement law covers nuclear power only.

In summary, on the one hand, Eskom has its own procedures in place for buying nuclear-power plants (NPPs), on the other, National Treasury has its own guidelines. Although these and Eskom's are similar, Eskom cannot proceed without complying with guidelines of the treasury. Treasury was not involved in the early process of procuring NPPs. Government departments and state-owned companies (SOCs) were working in silos which created problems and delays. The roles of Eskom and the government in the nuclear new-build (NNB) projects are unclear and must therefore be clarified and documented. The April 2017 court judgment proved this point – accountability was not clear enough.

All committees involved in a NNB programme must have clear roles and responsibilities. These committees and main departments are the National Nuclear Energy Executive Coordinating Committee (NNEECC), the government energy portfolio committee, the Department of Energy (DoE), the Nuclear Energy Commission of South Africa (NECSA), the Department of Environmental Affairs and Tourism (DEAT), the Department of Public Enterprises (DPE) and Eskom. It would be difficult for any person or persons and/or groups to challenge a procuring agent for violations in a fair-and-open public procurement process.

The importance of fully recognising the benefits that nuclear technology brings to the environment, people's lives and the economy must be emphasised through education. This form of power-generating technology must enable South Africa to meet its international carbon-emission reduction commitments to mitigate climate change while at the same time providing an increased base load.

The Zuma presidency expressed the political will to build NNPs. However, during this period the concomitant will to procure the plants using correct processes was not evident. This was confirmed by Minister Nene during the Zondo Commission on State Capture who confirmed that South Africa had no credible procurement plan in place that was supported by government and National Treasury.

Disagreement among the various political parties in parliament concerning factors such as the NNB programme may lead to long and time-consuming debates in parliament that inevitably impact NNB lead

times. In the event that these parties fail to reach consensus on policy in parliament, their supporters express their frustration in the form of street protests In any event, this may not only cause delays in the NNB process but may also shake investors' confidence in a proposed nuclear programme. The end result may complicate the funding of the project and cause further delays.

South Africa shall be an "Intelligent Customer" such that they can clearly specify for contractual purposes the plant or services they need, or any changes to it recognising the impact this may have on the overall procurement strategy and costs.

In conclusion, wider political consensus, compliance with rules and regulations and alignment between government departments are therefore crucial in avoiding delays in a nuclear-power programme. Also the need for sound IGA's and informed investor agreements and payback periods and percentage comparable with other projects of similar plant and outputs.

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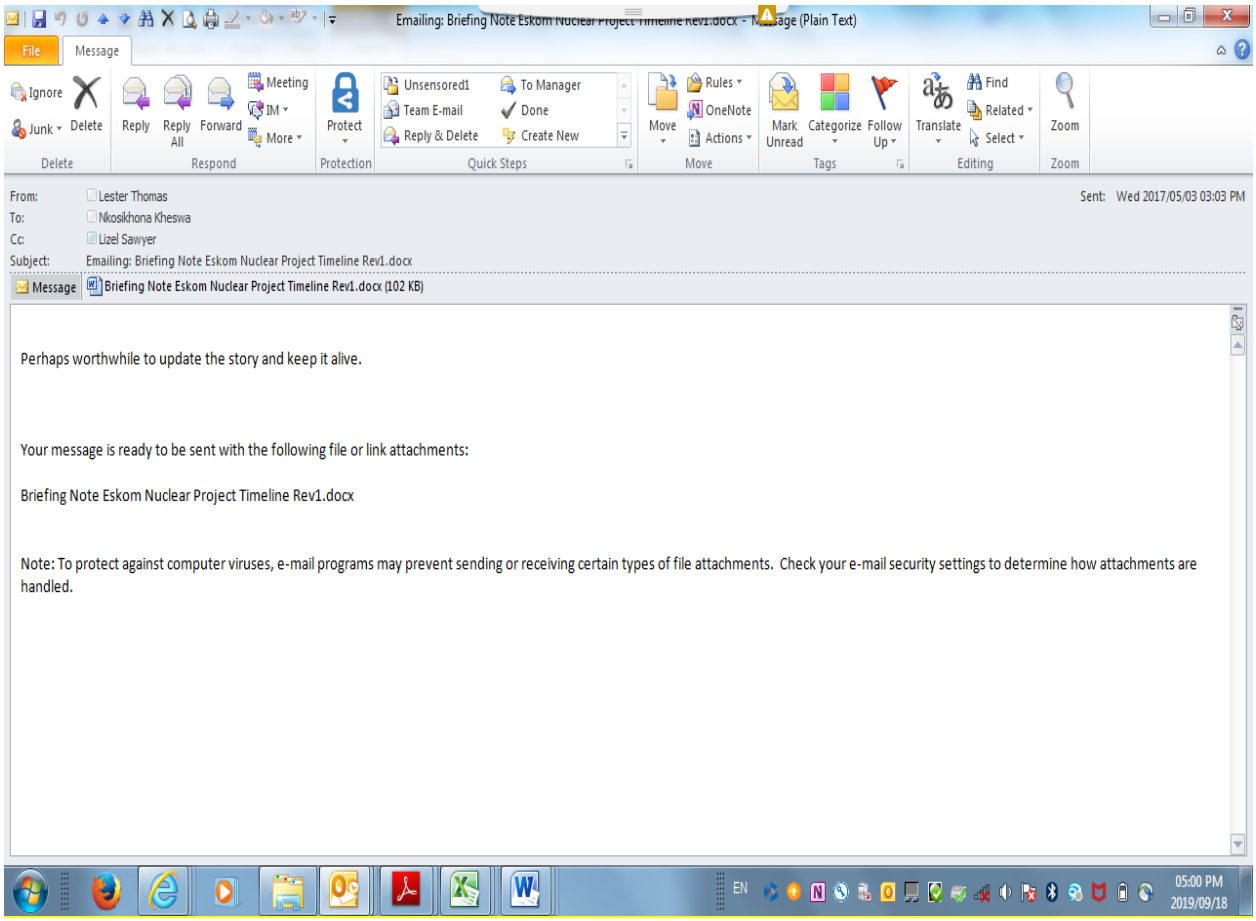
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APPENDICES

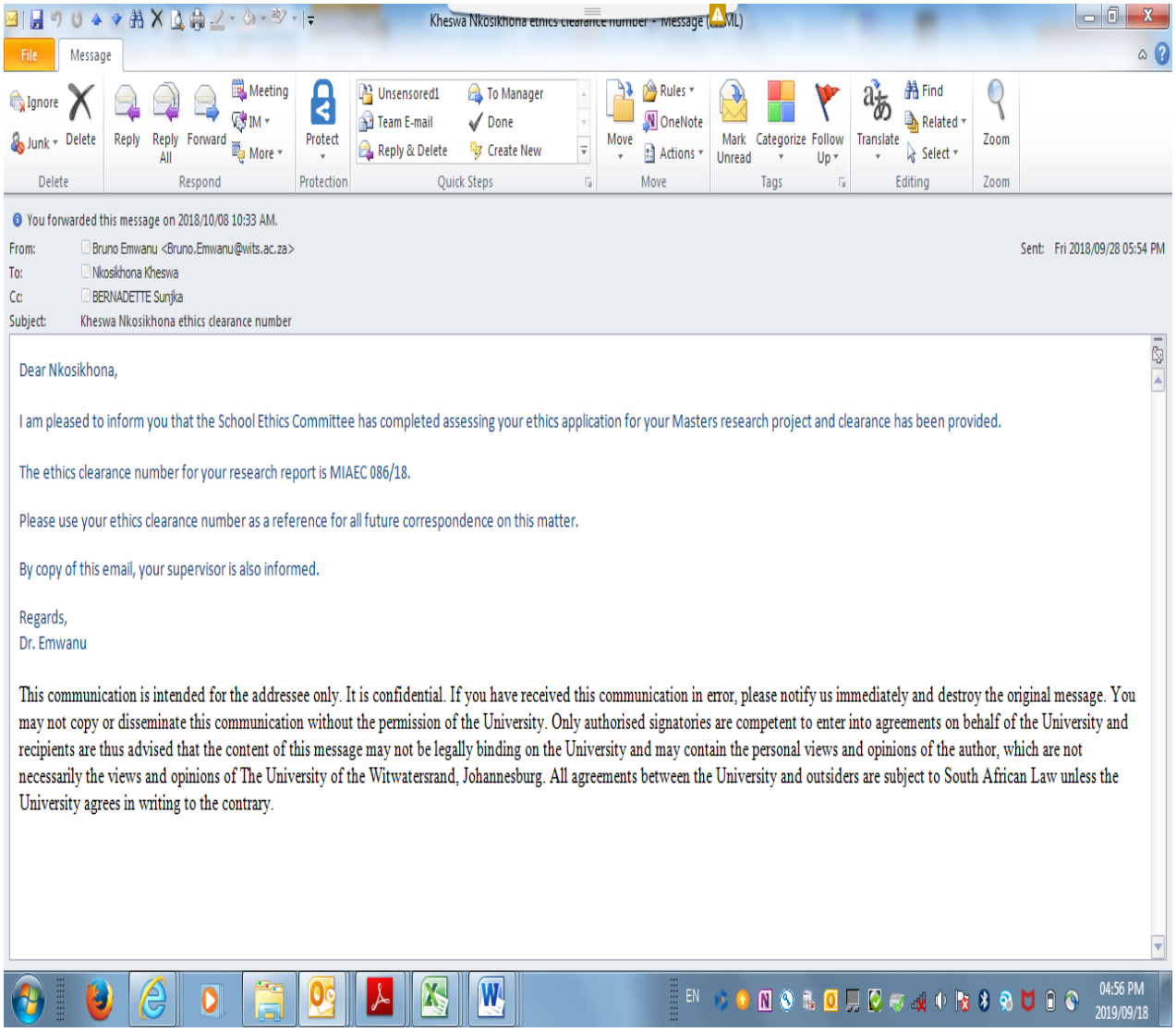
Appendix A

A.1 Email sent with Briefing Note



Appendix B

B.1 Ethics Clearances



You forwarded this message on 2018/10/08 10:33 AM.

From: Bruno Emwanu <Bruno.Emwanu@wits.ac.za>
Sent: Fri 2018/09/28 05:54 PM
To: Nkosikhona Kheswa
Cc: BERNADETTE Sunjka
Subject: Kheswa Nkosikhona ethics clearance number

Dear Nkosikhona,

I am pleased to inform you that the School Ethics Committee has completed assessing your ethics application for your Masters research project and clearance has been provided.

The ethics clearance number for your research report is MIAEC 086/18.

Please use your ethics clearance number as a reference for all future correspondence on this matter.

By copy of this email, your supervisor is also informed.

Regards,
Dr. Emwanu

This communication is intended for the addressee only. It is confidential. If you have received this communication in error, please notify us immediately and destroy the original message. You may not copy or disseminate this communication without the permission of the University. Only authorised signatories are competent to enter into agreements on behalf of the University and recipients are thus advised that the content of this message may not be legally binding on the University and may contain the personal views and opinions of the author, which are not necessarily the views and opinions of The University of the Witwatersrand, Johannesburg. All agreements between the University and outsiders are subject to South African Law unless the University agrees in writing to the contrary.

Appendix C

C.1 Confirmation of permission granted

Eskom

CONTROLLED DISCLOSURE

Date:
13 August 2018

Enquiries:
Vernon Paul
Tel +27 21 522 1159

Dear Nkosikhona Kheswa

CONFIRMATION OF PERMISSION GRANTED

Your request for permission to interview Eskom personnel for your Wits university MSc research entitled "A New Strategy for the Procurement of Nuclear Power Plants in South Africa", under the supervision of Bernadette Sunjka is granted.

The participants shall only be interviewed in the MSc research topic.

Should you have any queries, please do not hesitate to contact the above mentioned person.

Yours sincerely

Vernon Paul
MANAGER (ACTING): OPERATIONS READINESS

Koeberg Operating Unit
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Eskom Holdings SOC Ltd Reg No 2002/015527/30

Appendix D

D.1 Participation Information Sheet

Date: 2018-08-13

Dear **……..,**

Re: Participation in Research on **"A New Strategy for the Procurement of Nuclear Power Plants in South Africa"**

Thank you for offering to participate in interviews.

I am a part-time MSc student in the School of Mechanical, Industrial and Aeronautical Engineering at the University of the Witwatersrand, under the supervision of **Bernadette Sunjka**. My MSc research report title is: **"A New Strategy for the Procurement of Nuclear Power Plants in South Africa".**

My belief is that there have been delays in procuring new nuclear power plants in South Africa and I would specifically like to understand the causes of these delays.

The critical question that this work is trying to answer is "What are the key causes of delays in the process of the procurement of nuclear power in South Africa and how can these delays be prevented in the future?"

I would like to formally invite you to participate in this study. As a Manager in the ……. at ……., your knowledge and experience would contribute significantly.

The study will be conducted between August 2018 and October 2018. Involvement in the study would entail one (1) or two (2) face-to-face interviews with you as the Manager, at your convenience. The interviews would be conducted in your office.

Participation in the study is voluntary, and you may withdraw at any time. Anonymity (regarding company name and any owner/manager/employee names) and confidentiality of information provided will be assured and respected. I would like to record the interviews, so I can later transcribe them. Your consent at the time of the interview will be requested. If you do not wish the interviews to be recorded this will be respected.

The results of the study will form part of my MSc research report, and may also be reported in academic papers and at conferences. A summary of the results of the research will be made available to you on request.

Please contact me if you have any questions regarding the research and participation in the study.

I look forward to hearing from you.

Yours faithfully

……

Nkosikhona Kheswa
University of the Witwatersrand
Faculty of Engineering and the Built Environment
Johannesburg, South Africa
Private Bag 3, WITS 2050, South Africa

Tel: 021 522 1123 (w) or 082 834 0500 (mobile); Email: kheswan@eskom.co.za

Bernadette Sunjka
Supervisor: Tel: 011 717 7367; Email: Bernadette.Sunjka@wits.ac.za

Appendix E

E.1 Letter of Consent

Letter of Consent

I, ……, agree to participate in the MSc research entitled **"A New Strategy for the Procurement of Nuclear Power Plants in South Africa"** , to be undertaken by **Nkosikhona Kheswa** under the supervision of **Bernadette Sunjka** , and certify that I have received a copy of this letter of consent.

I acknowledge that the research has been explained to me and I understand what it entails, as follows:

1. There will be two interviews, which are expected to take no more than 1.5 hours each.
2. The interviews may or may not be audio taped, and transcribed for analysis by the researcher.
3. I have the right to withdraw my assistance from this project at any time without penalty, even after signing the letter of consent.
4. I have the right to refuse to answer one or more of the questions without penalty and may continue to be a part of the study.
5. I may request a report summary, which will come as a result of this study.
6. I am entirely free to discuss issues and will not be in any way coerced into providing information that is confidential or of a sensitive nature.
7. Pseudonyms will be used to conceal my identity, and that of Eskom employees. The information disclosed in the interviews will be confidential.
8. Audio-tapes and transcripts will be kept securely stored during the research and after the research has been completed.
9. This project was approved by the Faculty of Engineering and the Built Environment of the University of the Witwatersrand and the School of Mechanical, Industrial and Aeronautical Research Ethics Committee (non-medical) of the University.
10. If I have any questions or concerns about my rights or treatment as a participant, I may contact the Chair of the School of Mechanical, Industrial and Aeronautical Research Ethics Committee (Dr. Bruno Emwanu) at (011 717 7343) or by (Bruno.Emwanu@wits.ac.za).

Signed: _____

Date: _____

Questions concerning the study can be directed to:

Nkosikhona Kheswa
Tel: 0828340500 or 021 522 1123 and Email: kheswan@eskom.co.za

Bernadette Sunjka
Supervisor: Tel: 011 717 7367 and Email: Bernadette.Sunjka@wits.ac.za

Appendix F
F 1 Interviews Analysis

Interview results, summaries and analysis

The following people were interviewed with the purpose of understanding their views to the main contributors to the delays in the current nuclear-procurement process. A summary of their answers is provided below:

- Participant A: Operations Readiness Manager at Eskom, he was involved in the procurement process of Nuclear-1 during 2008. He believes the nuclear delays mentioned above were caused by a lack of proper planning from both Eskom and government. The nuclear delays have caused reputational damage to South Africa. South Africa had IGAs (France and the United States) but not with Russia. He believes that correct processes were not followed. He believes there was political will from the Zuma administration. The different committees were established to form shortcuts.

- Participant B: Energy Specialist at the Development Bank of South Africa. She is an economist with a particular focus on energy. (She believes that the IGAs are important since they are contracts between the countries.) IRP 2018 reduced the horizon to a shorter period of time. Nuclear overnight cost is expensive. Levelised cost of nuclear is cheapest. She thinks patriotism contributed to the delays because of what she has learned from the Media and Zondo Commissions. She believes in an open tender process for the benefit of the country.

- Participant C: CEO of PBMR, he has experience of a nuclear new build in South Africa. He believes there should be an independent office responsible for nuclear new build procurement. He believes the nuclear policy of 2008 came in too late. Environmental laws are sound in South Africa. The country should have an office that governs government projects including new nuclear plants staffed with good lawyers, engineers and finance people. During the Nuclear-1 procurement process vendors gave different financing options. South Africa had government guarantees during the Nuclear-1 procurement process. IGAs are important, especially for nuclear projects. The IGAs form part of the agreement framework. Corruption can happen between South African companies and officials and not from the vendor. Russia is financing 85% of the plant in Egypt, whereas the Egyptians are financing 15%. The loan will be repaid when the plant is in operation. An interest rate of 8% is the maximum limit for a South African new nuclear plant financial model. Transparency is the key to a widely accepted procurement process. Small Modular Reactors are cheap. South Africa needs an Act to regulate LCOE publication. Environmentalists did challenge coal new-build plants. There is no need for many committees, strategically handling nuclear issues in South Africa.

- Participant D: He has vast experience in nuclear industry and he was a ‘vendor’ representative in the 2010 Nuclear-1 procurement process. He was involved in nuclear builds in China and the United States.

He believes that politics played a huge role in the delays of the programme. Participant D believes IGAs smooth out the procurement process. During construction plant obeys the laws of the vendor country. Russia cannot build a nuclear plant without an IGA. Nuclear-1 was unaffordable because a lot of things were loaded to the financial model (eg training, finance, construction risk, etc). He believes the nuclear-procurement process is not a technical process but a socio-economic and political one.

- Participant E: This senior engineer believes IGAs specify what will be covered between countries. He also believes that buying a fleet is cheaper when compared with a single unit. An open-tender process takes time but it is fair. South Africa cannot afford new nuclear plants at the moment because of the current South African financial situation.

- Participant F: Managing Director in a renewable energy company. His understanding is that, IGA's are agreements between the various spheres of the government on specific areas or fields for cooperation. They are important because they facilitate and enhance working relations between the involved spheres of government whether national, provincial or local.

He says delays were caused by indecisive leadership, poor or lack of policy on nuclear energy but particularly technology rivalry amongst those pursuing and promoting their specific energy technologies. This participant says there was no interest by Eskom to diversify or expand to other power technologies since it also had the PBMR at its disposal.

He believes there is no easy route to signing binding contracts – contracts on power supply are unavoidably complex and cumbersome given the risk they carry. IRP, once promulgated by government is an authorized directive by government for a further addition of power supply.

He recommends there must be a comprehensive and appropriate development of policy on nuclear energy. Adherence to approved procurement practices. Resolute leadership with little indecision coupled with thorough consultation with government.

Coding

Coding is an analytical process in which data in qualitative form such as interview transcripts are categorised to facilitate analysis (Glaser & Strauss 1967). Open coding was used in this work. With open coding the data was divided into segments and then analysed for commonalities that reflect general categories or themes. After meaningful categories were identified, the data were further examined for properties which characterise each category. Properties are typically reflected in adjectives, adverbs, and adjectival and adverbial phrases in verbal material. For example, properties might be related to desirability, intensity or duration. During this phase of analysis, data continue to be collected until it is clear that no new information or categories are forthcoming. At this point the categories are considered to be conceptually saturated (Leedy & Ormrod 2016).

Table F1: Themes and codes (source: the author)

The audio recordings from interviews were analysed and the themes and codes were filtered to get final codes. The table below shows the themes and codes;

Themes →	Filtered codes →	Final codes
• Legal process • Corruption • Patriotism • Rush • Government • Transparency • Easy route • Politics • Reputational damage • Committees • Public • Russia	• Legal process • Patriotism • Government • Transparency • Politics • Reputational damage • Committees • Public • Corruption	• Legal process • Transparency • Politics • Corruption • Public