Eskom's Employees Perception on Nuclear Power In Accordance with the IRP 2010 Nuclear Energy Plan

A COMPARATIVE STUDY

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ABSTRACT

The future role of nuclear power in global sustainable development, and particularly in the development of industrialising countries is contentious; the debate is often highly emotive. The Republic of South Africa's (RSA) progress towards its largest nuclear procurement program is taking place in the midst of changes within the African National Congress (ANC) ruling party, an increase in global demand for uranium and growing energy needs within South Africa. Major nuclear accidents such as Chernobyl or Fukushima have set nuclear power plant security on top of the public agenda. The internalisation of governance through the creation of responsible eco-citizenship is a primary technique to screen perceived risk, which works through the course of public participation. Participation however, must include those that drive the objectives within the nuclear context.

Eskom's Koeberg Nuclear Power Station (KNPS) has a workforce of more than 2000 employees. In 2016, the Department of Energy (DOE) had decided that Africa's leading power utility will be the owner operator and procurer of the planned 9.6 Gigawatts (GW) (e) nuclear fleet that is set out in the IRP2010 report. The perceptual impact of this workforce that keeps the country's economic lifeblood moving is often understated, which was the focus of this study.

This study had a distinct focus on what Eskom employee's perceptions are with respect to the IRP2010 nuclear new build program. It was limited to the Western Cape Province and included views from divisions that may be involved in the realisation of the nuclear project. It is unique in its context, as very little has been documented on employee perception within RSA's nuclear industry. It is comparative to a public perception survey, which had a distinct focus on nuclear risk. The public's greatest concerns were noted to be corruption, project mismanagement, excessive cost and lack of trust in stakeholders.

The outcome of this study discovered similarities with the public perception survey, however here within nuclear safety and compliance to business best practice were greater significant factors. Most respondents had sufficient knowledge and support for RSA's nuclear plans set out in the IRP reports.

Dimensions of how perception was created were voted as being heavily dependent on the leadership within the organisation. With this in mind, Eskom employees have indicated that they are more likely to influence the public if they have their leadership's support, and have gone as far as selecting nuclear power over renewable energy to drive towards the country's commitment towards low greenhouse gas (GHG) emissions.

So while there may be shades of perceptual similarities between the public and Eskom employees, fundamentally this study revealed that these two bodies do not have the same perception on nuclear power. **The study revealed that if Eskom employee's nuclear perception is disregarded and mismanaged, it may delay the realisation of the nuclear new build program in line with IRP 2010 timelines. This is mainly due to the concern of adherence to good corporate governance by Eskom's leadership.**

DEDICATION

This research is dedicated to future Chutri generations. I hope the work conducted in this dissertation is motivation enough to challenge you in doing better than those who ran before you. You will do great things, not because of what is around you, but rather because of what is within.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Table 1 - List of Abbreviations

ANC	-	African National Congress
ANOVA	-	Analysis of Variance
CEO	-	Chief Executive Office
DOE	-	Department of Energy
e	-	Electrical
EE	-	Employment Equity
EIA	-	Environmental Impact Assessment
ESQ	-	Employee Survey Questionnaire
GHG	-	Greenhouse Gases
GW	-	Gigawatts
IAEA	-	International Atomic Energy Agency
IRP	-	Integrated Resource Planning
KNPS	-	Koeberg Nuclear Power Station
Necsa	-	Nuclear Energy Corporation of South Africa
NGO	-	Non-Governmental Organisation
NPP	-	Nuclear Power Plant
OCB	-	Organisational Citizenship Behaviour
RE	-	Renewable Energy
RSA	-	Republic of South Africa
SAR	-	Safety Analysis Report
Trn	-	Trillion
UNFCCC	-	United Nations Framework Convention on Climate Change
US	-	United States

Chapter 1
Introduction

1.1 INTRODUCTION

Whilst sitting in an induction lecture at UCT, a final year nuclear engineering student approached the class and began sharing her journey and exposure to Nuclear Power. At the end of her 15 minute talk, she requested that students voluntarily participate in a survey questionnaire, which focused on the Public's Perception of Nuclear Risk in South Africa. As I started to respond to the survey questions as a member of the public, I felt conflicted. As an organisational member that owns Africa's only Nuclear Power Plant (NPP), my response was subject to my inclined exposure with the technology. I was unable to provide feedback solely as a member of the public. As I pondered if my colleagues concurred with my sentiments, it was later confirmed through discussion. It also revealed that there had been little interrogation of NPP employee perception and its influence on local communities in RSA. This was a precursor to this study.

1.2 DEFINITION OF THE RESEARCH PROBLEM

Electricity is not an end in itself, but a means of satisfying needs. People do not need energy but the services that energy provides in helping them meet needs such as lighting, cooking, space heating, cooling, water pumping, information, entertainment, and much more. It is the use of electrical energy that drives economies and businesses to greater heights. Considering that RSA had experienced intermittent load shedding from 2008 to 2016, impacting economic expansion.

Energy planning over long periods (more than 20 years) is conducted within an Integrated Resource Plan (IRP). D'Sa (2005) explains that "an IRP's approach is through the estimated requirements for electricity services during the planning period. This is met with a least-cost combination of supply and end-use efficiency measures, while incorporating concerns such as equity, environmental protection, reliability and other country-specific goals". In line with RSA's IRP2010 report, nuclear power's contribution to the country's energy mix is set to increase from the current 4% to 13%. This is due to a 9.6 GW nuclear fleet that is planned to form part of RSA's energy mix by 2023 (Batyashe, 2011). An updated IRP termed the draft IRP2016 is currently out for comment, which includes nuclear plans to a different order and magnitude to those of the IRP2010.

Change impacts perception and is therefore dynamic, whereas the assessment of perception is considered as a static process (Fayolle, 2014). With research being conducted in 2014 that focused on the public's perception relative to nuclear risk, little or no information is available to determine the perception of staff that operate and maintain Africa's only operational nuclear power plant (NPP), known as Koeberg Nuclear Power Station (KNPS). It is also unknown whether KNPS staff members believe they have the potential to be catalysts for change, by correcting the public's misconceptions of the nuclear industry. This study will examine employee's views of these critical questions.

Eskom, the owner/operator of KNPS and the nominated developer of the new nuclear power stations is currently exiting from a dark period of load shedding, undergone changes to the organisation's senior leadership and a recent Public Protector's report that suggests corruption by its leadership. It is not far-fetched that the affordability and alleged lack of application to business best practices may create widespread concern.

Recently, renewable energy (RE) has also featured as a proposed alternative to nuclear power by anti-nuclear bodies. This is partially due to perceived high capital costs required when establishing a nuclear power plant, relative to renewables. The renewable alternative may influence employee nuclear perception.

Therefore, the abovementioned elements will be examined in this study, with outcomes being compared with a public survey reported two years ago conducted by Hide (2014). It will then be determined if perceptual similarities exist between the public and Eskom's employees, and if differences may impact on the IRP2010 and draft IRP2016 nuclear plans from becoming a reality.

1.3 RATIONALE FOR THE STUDY

The discourse on nuclear power and risk has shifted over the last few decades from security concerns emanating from nuclear weapons, to threats of public safety in the event of an industrial nuclear accident. While the main focus of existing scholars have been on public risk perceptions, comparatively, little is known about organisational risk perception and the factors that influence employee's willingness to accept the risks of a NPP. It is expected that Eskom employees are more familiar with the challenges affecting their organisation than those of the general public; hence they are in a better position to provide meaningful views about developments related to the industry in which they work (Wong, 2014).

KNPS has approximately 2000 employees, of which a number of critical, core and scarce skilled staff members are leaving RSA. As they leave, they take with them valuable experience, competencies and qualifications that the local industry lacks, to adequately implement RSA's future nuclear new build programs (Heyns, 2012). It has been suggested that, but not limited to, employees concern over corruption within the nuclear environment, the way leadership demonstrates their roles to support corporate governance or even fear of a nuclear accident due to commitment levels to nuclear safety. How do the abovementioned factors influence employees' nuclear perception and its effect on future nuclear projects? The aim of this study is to provide answers to these questions through a comparative study for UCT and the Eskom Board, in order to determine Eskom employee's nuclear perception. This report will further determine if this perception is a limiting factor for employees being able to influence society.

This study tests the hypothesis that *employees of the national electricity utility may have different and lesser concerns about the proposed new nuclear build than identified in a public survey two years ago.* The validity of the hypothesis will be determined through the formulation of four (4) research questions that focuses on a narrow yet critical set of issues.

The purpose of the study was (1) to compare the nuclear perceptions of NPP workers to those of the general public and (2) to determine employee's perceptual influence on society when they drive their organizational initiatives. The study embraces descriptive analysis techniques to the understanding of elements most critical in the creation of employee perception. Factors such as, but not limited to leadership, risk, trust and employee roles that inform NPP perceptual judgement will be analysed.

1.4 RESEARCH QUESTIONS

The following research questions need to be answered to test the validity of the hypothesis:

1. Which factors through identification and analysis appear to be most significant in determining the perceptions of employees about the proposed nuclear new build?
2. To what extent are the perceptions about nuclear power affected by the possible alternative or complementary to the renewable energy option?
3. To what extent does the leadership within Eskom influence their employee's nuclear perception?
4. Are Eskom employees confident that nuclear dependencies will be aligned to business best practices?

1.5 THE RESEARCH MODEL

Employees' perception of nuclear power and the IRP have identified several perception elements that are expected to influence public perception. Based on this view, the research model as illustrated in figure 1 was developed. The descriptive variables proposed in this research model uses perceptual-based elements that can be neatly categorized into five propositions to answer the four research questions. It will also inform the comparative study and hypothesis.

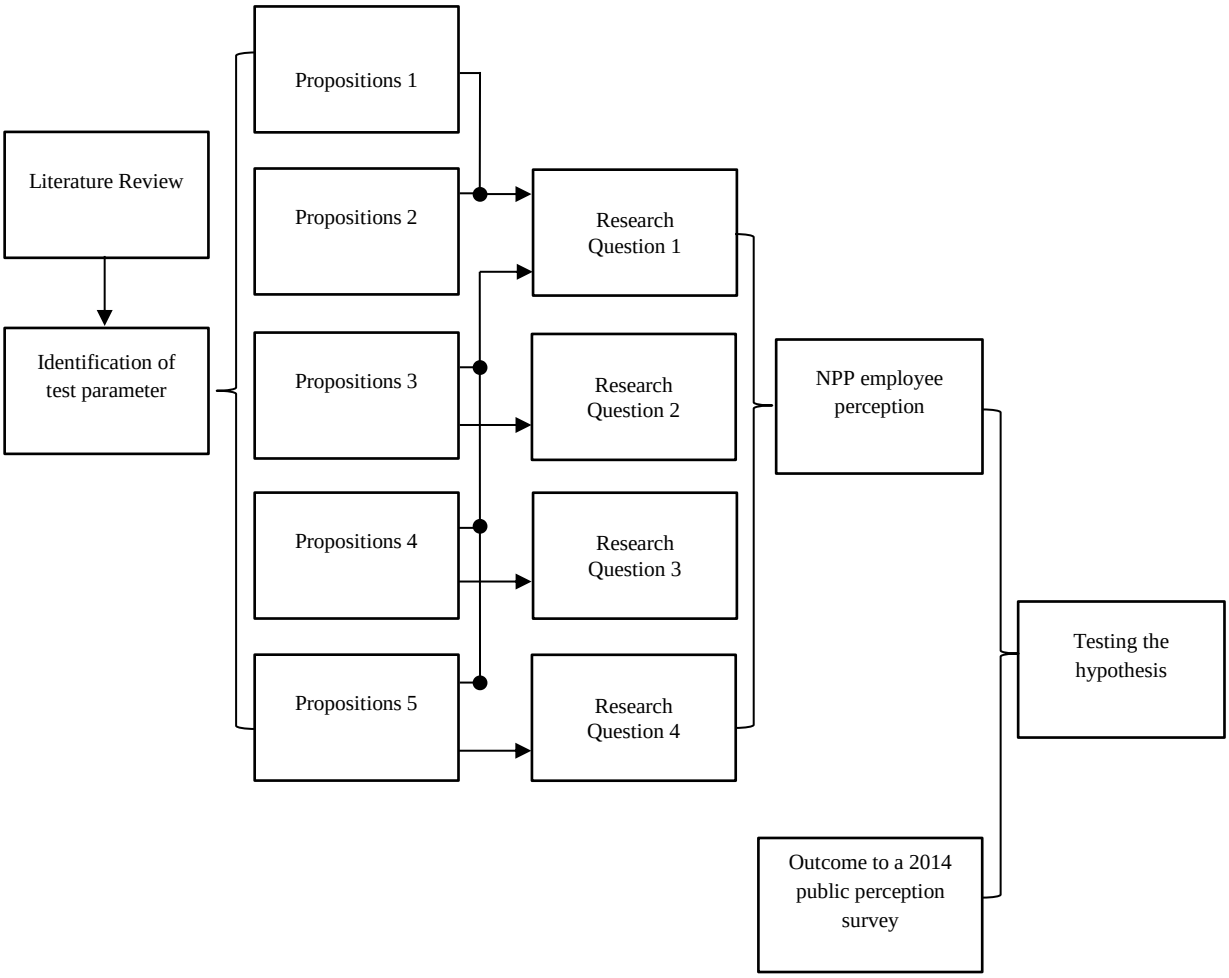


Figure 1 – The Research Model

1.6 SIGNIFICANCE OF THE RESEARCH

Apart from gaining an improved understanding of the diversity of perceptions of nuclear power in South Africa, this research could assist Eskom's management in understanding their employee's views and concerns. As Eskom will be responsible in owner operator and procurer of the new nuclear build program, it is of critical importance that positivity is created within this industry. The outcome of this study could inform decisions about communication and the scale of change management required within the utility.

1.7 STRUCTURE OF THE STUDY

The following section provides a brief outline of the chapters.

Chapter 2 reviews the existing knowledge on the subject of perception and its formational constructs. It discusses risk perception, perceptual influence, RSA's environmental commitments, nuclear safety and Business best practice with specific focus on procurement tenders.

Chapter 3 defines the theory development in reference to the hypothesis. The outcome of a second public perception survey that was conducted by the Nuclear Energy Corporation of South Africa is briefly unpacked. The propositions are established to answer the research questions, through a narrow set of dimensions.

Chapter 4 will discuss the research methods and test protocol. The experimental parameters will be established in order to test the propositions through research design. It will include computer based modelling, three-way ANOVA, test criteria and assurance to the reliability of the results.

Chapter 5 will reveal the survey test results, interpret the findings and discussed critical observations made. This chapter is categorised into two sections that determine (1) employee nuclear perception and (2) their ability to become change agents.

Chapter 6 provides further discussion to the propositions. It includes a comparative overview that ties the outcomes of this study to a public perception report. Similarities and differences are highlighted,

Chapter 7 summarizes the conclusions from this study.

Chapter 2
Literature Review

2.1 INTRODUCTION

In order to survive, organisations must convince the public of their legitimacy by conforming, at least in appearance, to the prevailing institutions that define how business is conducted within their environments (Voegtle, 2014). The emphasis on legitimacy may limit change, as it exerts pressure on organisational members to adopt particular managerial practices (Walter, 2012). Therefore, organisations embedded in the same environment, and thus subjected to the same institutional pressures, tend to adopt similar practices. Scholars have long recognised the political nature of the change process in organisations (Dauvergne, 2012). To implement planned organisational change, that is, premeditated intervention intended to modify the functioning of an organisation (Thayer, 2001), change agents need to overcome potential resistance from members internal and external to an organisation (Robert, 2012). Change implementation can thus be conceptualized as an exercise of social influence, defined as the alteration of an attitude or behaviour by one actor, in response to another actor's action (Pamela, 2013).

The new nuclear build program will introduce significant changes to Eskom. Research on organisational change has improved our understanding of the challenges inherent in change implementation, but it has not accounted systematically for how characteristics of a change initiative affect's its adoption in organisations (Burt, 2005). To this end, organisational changes are not equivalent. One important dimension of the variance is the extent to which they break away from existing institutional norms in a field of activity, defined as patterns which are taken-for-granted that they are perceived by actors as the only possible ways of acting and organizing (Butner, 2009).

There are many studies aimed at understanding the dynamics of actor's behaviour, which have significantly contributed to organisations performance theory. This has increased both in professional and academic management oriented literature of recent years. Organisational citizenship behaviours (OCB) have a crucial role in organisational effectiveness (Brumby, 2005). The concept of OCB has been used by Organ and others in 1988. Organ (1988) defines OCB as "a voluntary action which is not defined clearly in the formal reward and punishment systems of the organisation, but still supports the effectiveness and efficiency of the organisation as a whole".

OCB inherently improves an organisation's effectiveness by providing higher performance levels in qualitative and quantitative senses (Cohen, 1998). Examples of organisational citizenship behaviour are supporting senior leadership by executing operational outputs, proudly representing the organisation to the public, solving destructive conflict among people (Abu Elanain, 2010), working overtime whenever necessary, and not complaining about the small problems which should be considered normal to daily work life of current times (Cole, 2008). İnce (2010) suggest that "OCB improves organisational performance, by increasing effectiveness through greasing the engine and reducing the friction between parties". There are two dimensions of OCB that are pointed out by Munnik (2010), they are:

a) The behaviours which are not necessary, but are displayed that improve the organisations image and performance, that is fruitful for an organisation.
b) The behaviours that are seen as sacrificial and are beneficial for the individuals in the organisation who have important responsibilities, such as managing projects that are of significant importance

These dimensions contribute to positive notions of perceptual creation in the minds of those who evaluate the organisation's contribution to society.

2.2 PERCEPTION

A great deal of research has been undertaken into the public perception of nuclear power, in part because of the controversy it has presented since the inception of the technology (Rosenbaum, 2016). Very few studies have been released on employee perception within organisations that operate a NPP, determinations on how employee perception is created, managed and further used to aid society (Butner, 2009).

Perception, as defined by Marangu in 2012, is about "receiving, selecting, acquiring, transforming and organizing the information supplied by our senses". Macrae (1991) reminds us that research on perception can be traced back to Bartlett's influential work in 1932, focusing on the constructive nature of cognition. He argued that schematic thinking dominates a human's perception in ways that general beliefs about the world influences and shapes the information process. Several researchers have extended Bartlett's work and have advanced our understanding of perceptions, attitudes, judgments, and several other concepts. One of these extended views is that of Suter (2009), which states that "perception is a process through which humans attend to select, organize, interpret, and remember stimulating phenomena". Although the human species is constantly involved in perception and the processes may be similar across individuals, each person perceives the world in unique ways that is open to a number of factors (Suter, 2009).

The perception discipline sits in the physiological realm of academics (Kursell, 2015). The importance of perception varies with the significance of an interaction. It involves signals in the nervous system, which in turn results from physical or chemical stimulation of the sense organs (Guerrero, 2014). Humans respond differently to an object or person that we perceive more favourable than we do to something we find unfavourable. Humans filter through large amounts of incoming information, organize it and make meaning from what makes it through the perceptual filters and into social realities. Naime (2006) confirms that the selection of data informs our perception and decision making on whether we are for or against a concept, product or idea. Within the process, many sub-processes are at play, which includes risk screening that will be discussed in later sections.

Discrete perception of ideas is much easier to manage when compared to reputation after they merge. However, perception thrives on regurgitating old material. The psychological perception process as in figure 2 includes a selection of events that pass through our perceptual filters, organized into existing structures and patterns and are then interpreted based on previous experiences.

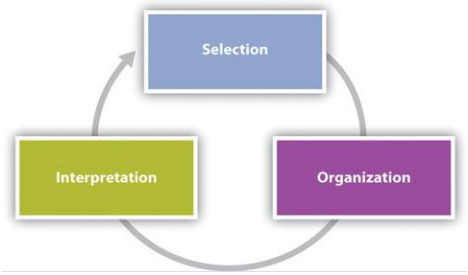


Figure 2 - Perceptual cycle (Mahler, 1997)

2.3 RISK PERCEPTION

When managing risk, one must confront the question, what is considered a risk? The dominant conception views risk as the chance of injury, damage, or loss (Sjöberg, 1999). The probabilities and consequences of adverse events are assumed to be produced by physical and natural processes in ways that can be objectively quantified by risk assessments. Much social science analysis rejects this notion, arguing instead that risk is inherently a subjective judgment that people make about the characteristics and severity of a risk, dependent on ones consciousness of risk in performing risk assessments (Lewis, 2003). With this view, risk does not exist "out there," independent of our minds and cultures, waiting to be measured. Instead, human beings have invented the concept of risk to help us understand and cope with the dangers and uncertainties of life (Manuel, 2011). There are different kinds of risks as well as different reactions to risks. Researchers such as Sjoberg (1999) have tried to trace some of the sources of risk attitudes and have concluded that people react more strongly to risks they consider unjust, less known, forced upon them against their will and beyond their control.

The nuclear industries risk assessments for the likelihood of a nuclear accident, or the toxicologist's quantitative estimate of a chemical's carcinogenic risk are both based on theoretical models. These models are subjective, assumption-laden and the inputs are dependent on judgment (Slovic, 2006). Non-scientists have their own models, assumptions, and subjective assessment techniques (intuitive risk assessments), which are sometimes very different from the scientists' models. In spite of considerable efforts, risk perceptions are still incompletely understood. Experts tend to differ greatly in how risk is viewed when compared with the public (Kasperson, 1988). Attitudes are frequently found to be largely dependent on how risks are conceived (Drottz, 1991). Risk perception has a lot to do with the way figureheads (politians, business leaders, community heads, etc.) communicate to recipients of information, directly or indirectly. The communication of facts about risks is indeed difficult, among other things because credibility is hard to establish in situations where experts openly disagree.

Many experts argue that people exaggerate nuclear power risks, and it is often said that the public are misguided to focus on matters that are not regarded as real risks, such as radon in their homes (Luken, 1993). For this reason, the US Environmental Protection Agency conducted a study in which expert judgments of environmental risks were compared to typical judgments of those outsit the set environment to the same risk. The results were found to be virtually unrelated (Sovacool, 2011).

2.4 NUCLEAR RESURGENCE

The nuclear power industry has experienced devastating disasters that have prevented it from becoming the ubiquitous energy source many nuclear industry supporters had hoped it would be by now. In 1979, Three Mile Island marked the worst nuclear accident to hit the United States (US), where a partial nuclear meltdown occurred on reactor 2 (Denton, 1987). The public's concern over the nuclear safety then delved deeper into the topic of spent fuel, indicating that nuclear power may likely become a smaller and smaller slice of the U.S. energy mix, not forgetting the financial cost of the nuclear industry, that has been cited with contention from anti-nuclear bodies (Hunt, 2012). Seven years later Chernobyl suffer by far the worst disaster in the world, where a flawed reactor design was operated by inadequately trained personnel. It was this disaster in particular that led to the reassessment of the nuclear industry as a whole (WNA, 2016).

Despite the few nuclear accidents, the nuclear power industry may be about to enjoy resurgence thanks to a number of technological breakthroughs in Generation 3 and 4 reactors. These innovations, scientists claim will dramatically reduce both the cost and nuclear waste, while embracing enhanced nuclear safety designs in a NPP (TNE, 2015). Sovacool (2011) states that while the capital costs of nuclear power stations are especially high, they require less in the way of long-term fuel and external expenses.

Figure 3 depicts the percentage of people (the public) who have been in favour of, uncertain or unsure about continuing the construction of nuclear reactors from 1975 to 1983. It can be noticed that immediately after the nuclear accident of TMI, there was a decrease from those in favour of NPP construction to continue (William, 1981). This mentioned, Goodfellow (2011) highlights that around the world, a number of countries have started to reinvest in or at least starting to reconsider building new NPP. The gravitation to nuclear new-build development is in stark contrast to the muted nuclear activities over the last 20 years.

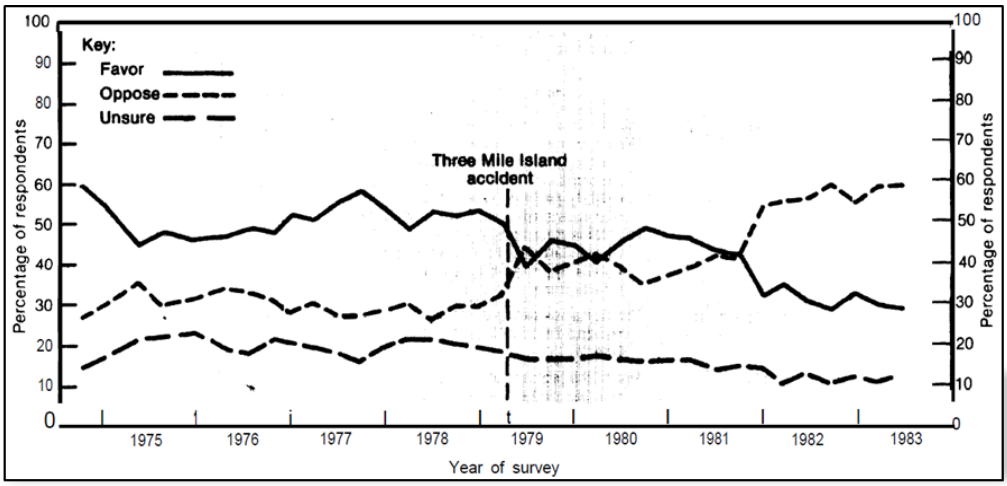


Figure 3 - Public opinion on nuclear power after TMI (Goodfellow, 2011)

The IAEA provides an indication of global interest and reliance on nuclear energy to drive their economic requirements. In 1999, there were 434 nuclear reactors totalling around 349 GWe operating in 32 countries (IAEA, 2012). Comparatively, Nkomo (2015) states that in 2015 "the number of reactors in the world had increased to 450" as depicted in Annexure 1. China has 17 nuclear plants in operation and another 29 being built. India has 20 plants running and 7 more being established, while Russia operates 33 and has another 11 in construction (WNA, 2016). The IAEA has also reported that the number of countries that have shown interest in the building of their first NPP had reached 60 by 2016.

Within the African continent, South Africa, Ghana, Algeria and Egypt are also actively pursuing small new nuclear power build programs (Martin, 2015). So while it might be premature to call it a nuclear resurgence, much of the world doesn't seem too worried about what happened at Fukushima, where a "major earthquake resulted in a 15m tsunami that disabled the power supply and cooling of its three reactors" (Goodfellow, 2011). Indeed, nuclear power looks like it could be around for a long time to come, given the global developments in this industry.

2.5 THE PUBLIC AND EMPLOYEE CONUNDRUM

There are different views expressed in literature between the general public and experts concerning nuclear power, where experts and the public seldom agree (Gough, 2013). Experts see the public as misinformed, badly educated and highly emotional (Cohen, 1998), while the public suspects that experts know less than they claim and that they are corrupt due to them being hired by the industry or government to further its objectives (Sjöberg, 2004). Dougall (2008) notes that differences in perception is due to a lack of transparency when communicating objectives of essential value, and experience resistance when attempting to align the public's perception to that of an organisations. Lippmann (2012) adds that there is a conscious understanding that society may have disparities between the actual and virtual truths of organisational employee's involvement in national hazards.

This influence is based on imposing opinions stemming from third party role-players. Employees from network research have demonstrated this through the degree of structural closeness in a network. Structural closeness is defined as the extent to which an actor's network members are connected to one another, which have important implications for generating novel ideas and exercising social influence about truths. A high degree of structural closure creates a cohesive network of tightly linked social actors, while a low degree of structural closeness creates a network with holes and brokerage potential (Lewis, 2003).

Further contributors to perception differences between the public and employees are due to the vocabulary that is industry specific. The vocabulary that is more suited to chemistry, engineering and safety make society feel lost in the weave of complexities (Yankelovich, 1999). For this reason, employees within the nuclear field are regarded as "experts", due to the uniqueness the field brings along with it. Due to the past perception of misrepresentation of issues on this topic, the public seems to trust independent experts much more than employees hired by the industry (Siegelbaum, 2016). This theory was tested by Sjöberg (2004) who found that "the public had greater confidence in dissident experts than in experts associated with state authorities or the nuclear industry".

2.6 THE ROLE OF EMPLOYEE PERCEPTION

Employee's perception is largely influenced by interpersonal relationships, reporting lines, group boundaries, employee's work unit grading and the social identities associated with group memberships (Jones, 2010). It is often expected that employees who form part of the same organisation have similar views that are in support of their discipline, thereby driving the industry forwards.

Fischhoff (2012) advocates that employees who have a positive perception of their roles in society show greater levels of emotional commitment to an organisation, higher levels of performance, reduced absenteeism, and are less likely to quit their jobs. However, not all employees that work in NPP's speak with zest and support of organisational decisions. This emphasises an employee's ability to independently review business decisions. Additionally, employees require a reciprocation of an organisation's commitment to them. The result of being valued by the organisation is in the form of approval, respect, pay, promotion, access to information and other forms of aid needed according to Maslow's hierarchy of needs (Price, 2011).

Employees may respond negatively toward change and resist change efforts, due to their perception (Kunanbayeva, 2013). This is because change brings with it increased pressure, stress, and uncertainty for employees (Teresa, 2011). One needs to consider that all perception is bias, however the perceptual observation will be skewed if an employee's decision making is derived from or based on incomplete information and limited observations (Smith, 1988).

2.7 EMPLOYEE PERCEPTION CREATION

In order to unpack how employee perception is created Shani (2016) states that several elements act in unison to the development of perception. If there is a lack of information about an initiative, then evidence of employees' own perspectives and interpretation of change is more likely to be observed (Taylor, 2012). Under or over-estimating perceptual risk may lead to undesirable effects, hence knowledge about the relationship between risk assessments and attitudes are important (Jones, 2016).

During an organisational initiative in response to market needs, employees create their own understanding and interpretations of what is going to happen, what others are thinking, and how they themselves are perceived (Moran, 2011). There are four "leaves" that create employee perception, as depicted in figure 4. Each phase builds on the next until employees use their judgment and make neurological decisions that drive their actions (Noel, 2007).

The steps are:

1. Influence external to the organisation
2. Influence internal to the organisation
3. Perceiver judgment
4. Employee perception

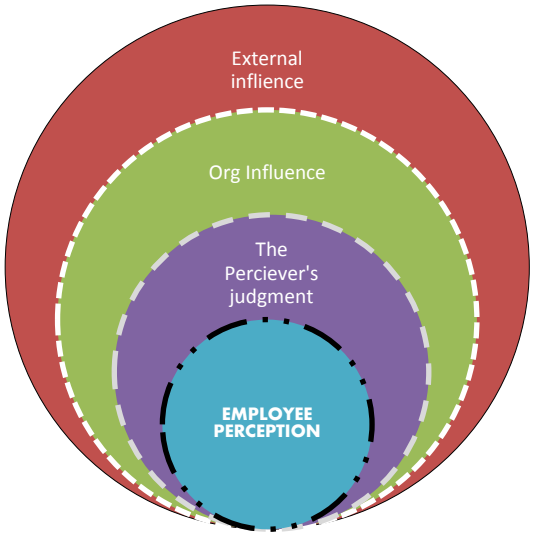


Figure 4 – The Corporate Perception model (Ruck, 2015)

The constructs that shape and influence an employee's perception external to the organisation are:

1. Realism - The public may be misinformed and the experts may be making realistic risk assessments (Pamela, 2013)
2. General political ideology – There is a difference in political ideologies between experts and the public. This dimension may explain some of the different social groups which employees form part of.
3. Media contents – Authors have questioned the hegemony of content in the media process. McLeod states that this medium has an inherent effect of society and the members of a focused industry. However, media content informs employees on what society deems acceptable or not, based on their response to media content (McLeod, 2007).

Those internal to the organisation are:

1. *Communication* – Perception acts as a filter through which all communication passes as it travels from one person to the next. Common perceptual distortions that may reduce communication effectiveness include stereotypes, halo effects and selective perception (Wiley, 2014).
2. *Leadership* – Leader behaviour is crucial during organisational change, as leaders provide a vision to an initiative; give direction and support to employees and model appropriate behaviour. These actions help to build stability and enhance employees' commitment (Leitner, 2001).
3. *Self-selection* – The differences may be embedded in a discipline, age or gender. This influence exists even before scientists receive their professional training in college and graduate school, (Sjöberg, 2004).
4. *Socialization of values* – Conformity pressures and vested economic and career interests has a role in employees supporting their organisation's interests (Ferrell, 2012).

5. *Diversity* – Diversity climate refers to the attitudes of individuals towards the differences among employees in the workplace. It helps managers to mitigate conflicts and negative attitudes, leverage organisational performance and provides an efficient workplace (Sezerel, 2014).
6. *Management Commitment to Safety* – Employees' perceptions of management and organisational leadership's commitment to safety demonstrates a positive impact on their working environment. This commitment alters their perception of their organisation (Daft, 2016).
7. *Collaboration* – An unfamiliar environment or business initiative may construe a loss of employee identity, as it may threaten self-esteem and work validation/s of employees (Boyd, 2014). Effective management is required to build positivity around change initiatives through collaboration (King, 2007).
8. *Organisational Governance* – Organisational governance is the extent to which employees perceive workplace procedures, interactions and outcomes to be fair in nature (Baldwin, 2006). An individual will be satisfied and behave positively towards an organisation if fairness is upheld.
9. *Public Service Management* – One of the perceived practical benefits of PSM is that it helps strengthen employee ties with the public sector, providing a basis for loyalty, motivation, and commitment that is more effective than monetary incentives (Donald, 2007).
10. *Different risk definitions* – The perception of NPP employees are regarded as experts in a given field as they pay more attention to the probability of risk and the degree of severity, while the public may react to the consequences of such risks (Sjöberg, 2004).

Elements incorporated into the perceiver's judgment are:

1. *Appropriation* – It is an element of OCB and includes the behaviours of loyalty through, and commitment by employee's actions by representing an organisation proudly (Newport, 2016).
2. *Culture* – As employees are socialized into various cultural identities, they internalize beliefs, attitudes, and values shared by others in our cultural group (Sharon, 2010).
3. *Psychological Ownership in Organisations* – Pierce (1991) in a review of employee ownership, literature theorize that formal ownership may produce positive attitudes and behavioural effects through psychologically experienced ownership (Pierce, 1991).
4. *Trust and Relationship Management* – Led by directive leadership, this is based on the relationship between employees and management within the workplace (Tushman, 1985).
5. *Perceived control and familiarity* – Experts directly involved in an area perceive that they have control over its risks, and long experience may have habituated them to these risks (Illeris, 2008).
6. *Professional role* – Some experts may have a role of protecting the public (e.g. physicians or fire fighters) while others are concerned with the promotion of a certain technology (Lattefe, 2008).

2.8 PERCEPTUAL INFLUENCE

The influences of employee opinions vary. Influence may be exerted quickly or slowly, it may change over time or remain constant, and its impact may be direct or indirect (Low, 2013). The extent of influence depends on a number of factors, including the degree of agreement from employees, the intensity with which opinions are held and the extent of organisational support for employees (Eisenberger, 1986).

Pickens (1998) shares that people have two behavioural motives, (1) the need to understand the world around them; and (2) the need to control their environment. He proposed that people act on the basis of their beliefs and if these beliefs are valid it is inclined to be promoted (Pickens, 1998). The corporate environment has a pervasive influence on public perception. People's attitudes are formed and influenced by the opinions prevailing in social groups to which they belong (Konstic, 2014).

The reality is that employees have an influence on their family, friends, community, and school in developing and spreading public perception on various economic, political and ideological topics affecting their community and state. Interestingly, Liang (2010) highlights in figure 5 that once employee's perception is managed, they mentally move to the physiological realm of interpretation and motivation. If an employee has positivity in relation to the perceptual factors and an understanding to support an organisational initiative, they have the ability to become change agents and to drive organisational initiatives by influencing those around them (Battilana, 2004).

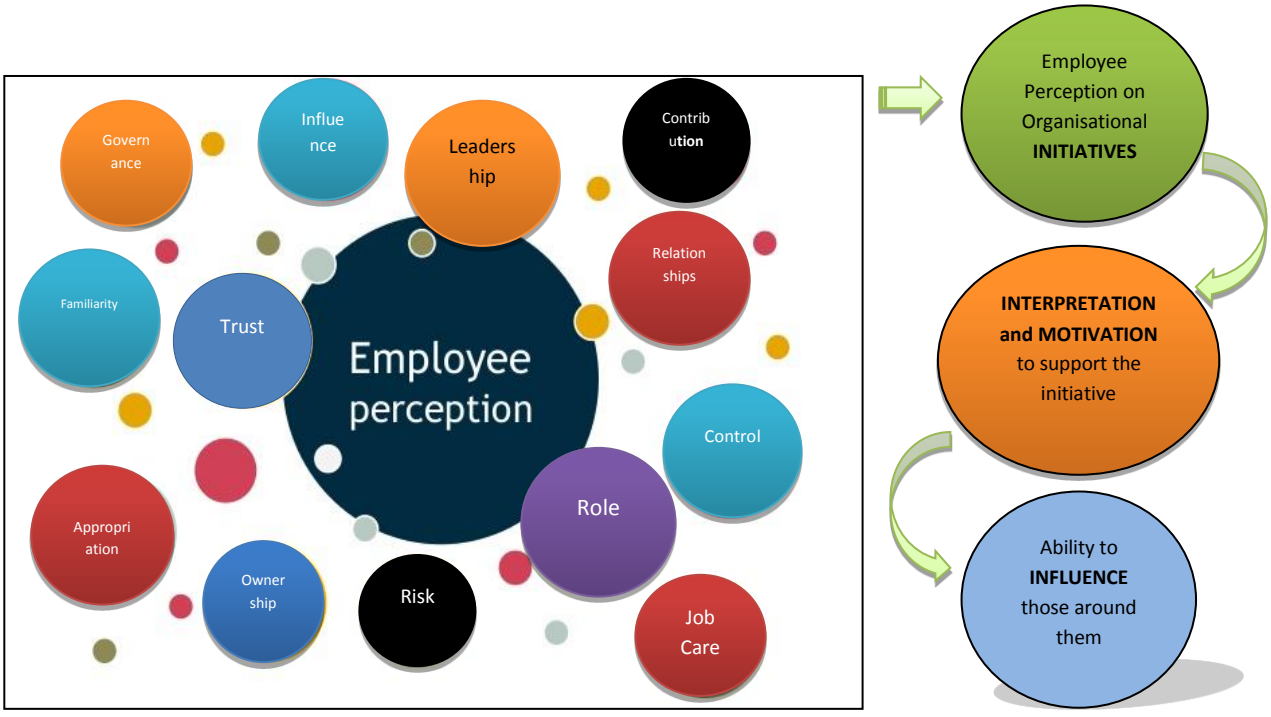


Figure 5 – The process of Perceptual Influence (Liang, 2010)

2.9 THE ROLE OF LEADERSHIP IN INDUSTRY

The importance of leadership to guide a project to completion without risk is of essential value. According to Miller (2007), leadership is the process of creating clarity and consistency of direction and making that direction important, exciting, and worthy to others. In addition to the activities outlined in table 2, leadership traits include emotional intelligence, resourcefulness, flexibility, enabling people in positions of authority to help employee's complete initiatives and to meet business goals (Mathis, 2013).

The importance of safety leadership has long been recognised in safety culture literature. Most definitions of safety culture emphasises the integral influence of an organisation's leadership group on safety attitudes and behaviour of employees (Lowe. 2016). For example, Flin (2001) states that a safety culture is in fact "determined by perceptions of management's commitment to safety, as judged by the workforce" and that any effort towards safety culture improvement must begin with measuring the perceived management commitment to safety.

Table 2 – Leadership activities in NPP (Lowe, 2016)

Safety Leadership Dimension ("Attributes")	Behaviours
[B1] Senior management is clearly committed to safety	• Senior managers should treat supervisors as a crucial part of the management team as they translate safety culture into practice, and should provide them with their full support; • Senior corporate leaders should periodically visit operating facilities to assess management effectiveness first hand.
[B2] Commitment to safety is evident at all management levels	• Leaders should establish clear expectations for performance in areas that affect safety and these should be documented where appropriate; • Leaders should adhere strictly to policies and procedures in their individual conduct, and should not expect or accept special treatment; • Leaders should not accept or ignore sub-standard safety performance for any reason; • Leaders should exhibit a strong sense of urgency to correct significant weaknesses or vulnerabilities.
[B3] There is visible leadership showing the involvement of management in safety related activities	• Leaders should be able to recognise degraded safety conditions (physical or organisational); • Leaders should individually inspect performance and conditions in the field by walking, observing and listening to individuals, and should intervene vigorously to fix safety problems (walk, look, listen and fix); • Managers should ensure situations adverse to safety are corrected; • Supervisors should spend time observing and coaching individuals at their work locations and should provide constructive feedback to reinforce expected behaviour; • Supervisors should frequently discuss safety issues with their teams/work groups; • Leaders should visit individuals at their work locations.

To cement leaderships' role within the nuclear industry, the IAEA (2006) Safety Fundamental Principles (SF-1) number 3 requires effective "leadership and management for safety that must be established and sustained in organizations concerned with, and facilities and activities that give rise to, radiation risks." This includes safety culture that governs the attitudes and behaviour, management systems, continuous safety assessments and precursors to accidents that need to be identified.

2.10 NUCLEAR SAFETY

Employee's ambivalent perception toward nuclear power is due to a variety of factors, including the ongoing debate among experts over reactor safety, individual perceptions of the likelihood of a catastrophic reactor accident, changing personal values and the negative media coverage of the technology (Bandura, 2013). Perceptual differences between employees tend to give rise to similar social, psychological and political problems (Pamela, 2013), although the nuclear ones tend to give rise to particularly strong opposition.

Nuclear safety is defined by the International Atomic Energy Agency (IAEA) as "The achievement of proper operating conditions, prevention of accidents or mitigation of accident consequences, resulting in protection of workers, the public and the environment from undue radiation hazards" (IAEA, 2016). Employee's perception on nuclear safety is largely influenced by general views shared amongst employees through interpersonal relationships, reporting lines, management's commitment to enforce safety practices, group boundaries, employee work unit grading and the social identities associated with group memberships (Jones, 2010). It is often expected that employees who form part of the same organisation share similar views to nuclear safety.

Among the many reasons, the biggest arguments from anti-nuclear parties that fight against the development of the nuclear industry are based on TMI and Chernobyl (Singh, 2011). Aldrich (1985) points out that the underlying factors that affect employee nuclear confidence to safety are the increased doubt on its technical capabilities, and credibility of both the nuclear industry and governmental regulators to comply with safety standards. These factors shape and form nuclear safety perceptions in the minds of field experts and the general public, and thereby influence energy policy decisions (Lippmann, 2012).

2.11 ENVIRONMENTAL COMMITMENTS TO LOWER GHG EMISSIONS

In its early stages of development, nuclear power promised almost limitless energy to an increasingly industrialised planet. However, RSA, Africa's largest economy (Davies, 2016) has large, although not unlimited amounts of coal that generate 86% of the country's electricity (Batyashe, 2011). At a time when the grime and smog from the coal and oil industries have become almost intolerable, climate change becomes one of the most important environmental challenges facing the world today. Khan (2014, pg 166) advocates that "…energy consumption is increasing every coming day, hence it signifies the fact that emissions are by and large causing harm to society, it reaches the conclusion that we are heading toward a systematic fatal disorder of society"

Taking this into consideration, Lungberg (2015) reminds us that the "climate negotiations in Paris set in place national commitments to reduce greenhouse gas emissions (GHG)". The agreement was adopted by parties to the United Nations Framework Convention on Climate Change (UNFCCC) in December 2015, and signed in early 2016. Its main objective is to keep global temperature increases below 2 degrees Celsius within this century, and drive efforts to limit overall temperature increases to below 1.5 degrees Celsius. With this in place, the UNFCCC state that it is a "significantly safer" defence against climate change (WNA, 2016).

This commitment requires RSA to seek alternatives in generating electricity with a low carbon footprint. The two dominant options available are either through renewable energy and/or nuclear power. Renewable energy is the energy that is derived from a limitless source, in contrast to fossil fuels derived from a finite source. Types of renewables include solar energy (power from the Sun), wind energy, tidal energy (power from the seas) and geothermal energy (power in the form of heat from within the Earth) (Mosaic, 2017).

Similar to RE, Nuclear power proves attractive because it continues to spew relatively little in the way of carbon emissions into the atmosphere. Akhmat (2014) stated that "NPP's produce virtually no GHG emissions or air pollutants during operation". Supported by the International Atomic Energy Agency (IAEA), it points out that nuclear power makes significant contributions in reducing GHG emissions, while delivering energy in large quantities that is needed to aid socioeconomic developments as base load (IAEA, 2015).

Although both options are beneficial, they are principle competitors to investment decisions. However, commitments of low carbon emissions may see the need for both technologies to feature in a countries energy mix, in order to avoid irrefutable harm to future generations (Khan, 2014).

2.12 NUCLEAR PROCUREMENT ALIGNED TO BUSINESS BEST PRACTICE

As corruption was cited as one of the biggest concerns to nuclear risk in the public perception survey, and the State Capture report with specific reference to Eskom, it will be briefly discussed. Business best practice is a method or technique that has been generally accepted as superior to any alternative, as it produces results that are superior to those achieved by other means. Examples are a standard way of complying with legal or ethical requirements.

Procurement tenders is one of the government activities most vulnerable to corruption (Adams, 2008). In addition to the volume of transactions and the financial interests at stake, corruption risks are exacerbated by the complexity of the process, the close interaction between public officials and businesses, and the extensive number of stakeholders involved (Hargreaves, 2015). Sub-optimal performance of the nuclear procurement market was mostly ascribed to the industry not being inclined on transparency, accountability and adherence to safety regulations (Pierce, 2001). The governance of SOE's is primarily based on the command and control approach that may ingest corruption into tender deals (Cheng, 2012), which have substantial values attached. In many countries, major corruption risks arise from a conflict of interest in decision-making that has the potential to distort the allocation of resources through public procurement (Eurocomm, 2014).

Various types of corrupt acts may exploit these vulnerabilities, such as embezzlement and undue influence on the needs assessment and bid-rigging, which may further compromise the procurement process (Barrett, 2013). Corruption in public procurement may occur at the national and provincial levels, hence open to political influence at all levels of government. Opportunities for corruption are due to weak alignment to business best practices and close community contacts between public officials and business representatives (Davies, 2011).

2.13 SUMMARY

The literature discussed in this chapter reveals that perception is a complex process and has a number of factors that contribute to its creation. It is formed by what a person finds favourable or unfavourable, depending on the degree of exposure to a focused area. Although perceptions may be altered by concerns over nuclear safety, literature indicated that there is growth in the nuclear industry. However, due to global commitment to lower carbon emissions, renewable energy may be an alternative energy source to nuclear power. It was clear from the literature that there are different nuclear perception between employees and the public, mainly due to a lack of trust and transparency from experts associated with state authorities. This is one of the reasons why authors have emphasised the importance of employee's personal values and OCB that impacts an employee's ability to influence those around them.

Chapter 3
Theory Development

In this chapter the theory development will be examined. Research propositions that will inform the design process will be determined and applied, in order to demonstrate that an adequate amount of theory is available and may be used to answer the research questions.

3.1 PERCEPTUAL DIMENSIONS EVALUATED BY NECSA

In the literature review chapter, it was found that perception is a powerful tool that can be shaped to aid abstract thinking. Through integrated efforts, it may aid support to organisational initiatives. As perception has a big role in society, in 2011 the Nuclear Energy Corporation of South Africa (Necsa) commissioned a public opinion survey, which focused on the public's attitudes to nuclear energy. The elements evaluated were climate change, nuclear safety, cost and reliability (Wyk, 2013).

As per figure 6 and 7, the survey revealed that RSA perceived nuclear energy as a means of ensuring a reliable supply of electricity (23%), and as an energy source that would help combat climate change (16%) (Scarce, 2016). A smaller group (14%) considered nuclear generation as competitive in cost and offers an unlimited supply of power. One-third (34%) believed nuclear accidents to be a future risk, while nuclear waste disposal and risk of radiation were regarded as its main disadvantages. The survey also revealed that 40% agreed/strongly agreed that KNPS should continue to operate, while 42% were not sure. Below one-fifth (18%) disagreed / strongly disagreed that KNPS should continue to operate.

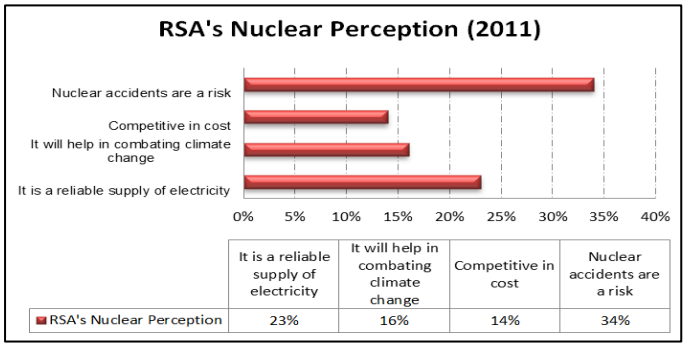


Figure 6 - Perceptual Judgment (Liang, 2010)

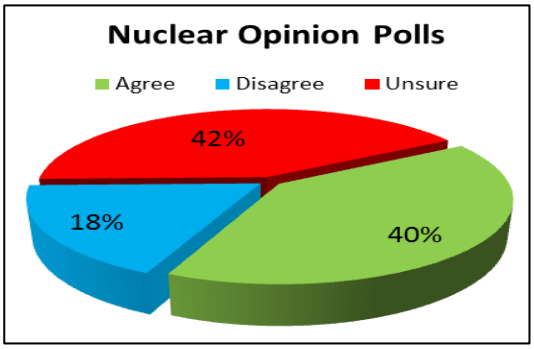


Figure 7 - Nuclear Opinion Polls (Liang, 2010)

3.2 ESTABLISHING THE TEST PROPOSITIONS

In order to aid reliability and validity of this research, this study will use similar focus areas that were employed by Necsa's 2011 perceptual evaluation exercise. Necsa's focus areas were climate change, nuclear safety and cost. This study will focus on (1) nuclear knowledge, (2) nuclear safety, (3) renewable energy (climate change), (4) leadership and (5) business best practices. This will be established through five (5) proposition statements, below.

3.2.1 NUCLEAR INCLUSION IN RSA'S IRP 2010

RSA's population has increased from 40.50 million in 1996 to 52.98 million in 2013 (SSA, 2013). However, 6.35 million households (12%) still do not have access to electricity (DBSA, 2015). Amongst developing countries, RSA is notable for its IRP, prepared mainly by DOE that should be regularly updated. The primary objective of an IRP is to determine the long-term electricity demand and detail how this demand should be met in terms of generating capacity, type, timing and cost. In 2011, the DOE released its draft IRP2010 report. It outlined the country's forecasted electricity demands, how these demands might be met and what it is likely to cost. Ms. Dipuo Peters, RSA's then Minister of Energy in her budget speech indicated in the National Assembly that RSA's energy mix would be re-engineered (Batyashe, 2011). Peters indicated that by 2030, the energy mix should include 13% nuclear; 26% other renewables; 57% coal; 3% hydro; and 1% peaking OCGT's, as outlined in Annexure 2 (Peters, 2012).

In December 2016, the DOE decided that Eskom would be the owner operator and procurer of the 9.6GW(e) nuclear fleet. In the same month, the 3 year later draft IRP2016 was released for comments. The draft plan adjusted the 2010 energy forecast of the country over the next 20 years, which includes various options for nuclear power expansion.

As the 2016 report is out for public scrutiny, it places emphasis on Eskom's staff and their understanding of such plans. If there is a lack of knowledge, there will most likely be a lack of support in driving the country's nuclear objectives, unless employees are being exposed to the nuclear plans from secondary sources other than the draft IRP report. These secondary sources may be from the leadership of the organisation, who are responsible in ensuring a knowledgeable workforce is at hand to meet RSA's needs. However, this does not circumvent those in junior positions to show initiative and educate themselves on energy developments. With dynamics around the way the IRP reports were compiled, energy priorities possibly being influenced by socio-political heavyweights and broad socioeconomic challenges, the first proposition (P1) is:

P1: Eskom employees support the IRP2010 and draft IRP2016 nuclear energy plans.

3.2.2 NUCLEAR SAFETY AND SECURITY

The safety of NPP employees is of primary concern; however it is realistically not an absolute in any endeavour. Even with the implementation of IAEA's safety principles, it cannot guarantee that a NPP will be risk free. When the principles are adequately applied, a NPP should be safe enough to effectively meet society's needs for abundant useful energy. Notwithstanding the few major accidents that have occurred, the nuclear industry has enjoyed a good safety record that can compete with power plants such as Coal, OCGT's and RE. The concept of safety in scientific terms is often vaguely defined and there is still a lack of consensus regarding its meaning. A commonly accepted view is that safety must be understood in relation to the presence of some hazard or risk (Fischhoff, 2012).

Eskom's nuclear workforce has sophisticated analytical methodologies to monitor the probability and potential consequences of NPP accidents, through concepts such as PSA. Besides these techniques, employees that work in a NPP may have discipline-specific concerns that must be addressed head-on. There are two common components of employee safety performance behaviours, which are (1) safety compliance and (2) safety participation (Kayiem, 2014). It must be noted that safety compliance deals with activities prescribed by formal job descriptions, while safety participation deals with individuals voluntary actions that back the establishment of a good safety culture. From this, accidents based on human error can be further categorised into two segments, these being skill-based and mistakes. Since Eskom's safety performance depends on employees' skills, knowledge and compliance to set rules, it is necessary to investigate both staff categories (management and employees) safety participation in close juxtaposition with the entire structure of managing health and safety in a NPP.

Eskom's staff regards to safety has the potential to influence their personal decisions of residing within an area close enough to a KNPS. With a typical exclusion zone of 100km radius, employees that are not confident in the safety measured at KNPS may decide to live outside this zone, thereby limiting their exposure to potentially detrimental effects experienced from past nuclear accidents within this industry. In June 2011 in the wake of the Fukushima, Eskom leadership demonstrated its commitment to safety by concluding an agreement with the IAEA to assist with stress testing of KNPS in the event of a flood or an earthquake (Wyk, 2013). The exercise supports the IAEA's safety standards that protects health and minimise danger to life and property. As the safety of employees is a primary gatekeeper for any industry, the second proposition (P2) is:

P2: Eskom employees are of the opinion that there are adequate nuclear safety and security measures in place to safeguard society against the effects of a nuclear accident.

3.2.3 THE LOW GHG ALTERNATIVE – RENEWABLE ENERGY

As per the literature review, it is unlikely that SA will build another coal power station other than what is presently being constructed due to GHG commitments. This has led policy makers around the world to search for alternative energy sources. The two principal competitors in lowering GHG emissions are nuclear energy and renewable energy (RE). However, both technologies draw support and opposition due to various reasons (Elliott, 2015).

RE is derived from natural processes that are replenished constantly. Their source of 'fuel' includes wind, solar, hydro, geothermal, biomass, tide and wave energy that are promoted as being clean and endless. As RE technologies have grown in volume and investment, it has become cheaper. RSA is fortunate in that, over and above its rich coal resources, it's also well-endowed with non-depletable RE resources. The country has an average of more than 2,500 hours of sunshine per year and average direct solar radiation levels range between 4.5 and 6.5 kWh/m^2 per day, placing it in the top-3 in the world (Dauvergne, 2012).

However, nuclear proponents and deniers of climate science have doubts about RE due to the technological disadvantages. Some of the challenges are that it is not readily dispatchable; hence they must be backed up by reliable storage capacity that can be counted on to meet base-load needs. For solar and wind energy, the reasons for their lack of reliability are obvious, the sun never shines at night, and does not always shine during the day, while wind speed consistency varies in almost all locations. Although windmills have been used on a small scale for millennia, the modern technology for building aggregations of dozens of wind turbines are relatively recent (Bosselman, 2009).

Inclusive of the literature cited and technological reasons mentioned above, age and gender of Eskom staff have an inherent influence on the acceptance of renewable energy over nuclear power. Akyazi (2012) mentions that nuclear power is perceived as being 'modern'' and 'technologically advanced', they are seen as reliable, have a low-carbon footprint and efficient in operation. This may appeal to middle aged personnel that are able to understand the complexities of nuclear power, and able to make independent, informed decisions due to life experience without fear of the unknown (Bremmer, 2005). However, males and females may consider RE from the perspectives due to their gender roles in a family unit (Oláh, 2014).

Clearly the question of renewable energy verses nuclear power is not a simple one to answer. Hence the third (3^{rd}) proposition (P3) is:

P3: Eskom employees view RE as a preferred energy source over nuclear power.

3.2.4 LEADERSHIP SUPPORT

Organisational change is a societal constructed reality with negotiated means to outcomes of power relationships and struggles for supremacy. Employee perception to change management should be a priority to organisations, as it determines if an organisation will succeed or fail in its change processes. Organisational change can be viewed as the greatest source of stress on the job, and perhaps in an employee's life (Abraham, 2012). While each is important, the core problems of organisational changes, as in the case with the IRP2010 report, is not the strategy, structure, or systems. Rather, the real problems arise when deciding on how to help employees adapt to change.

RSA's decision to change the nuclear contribution to the energy mix is heavily weighted on the shoulders of Eskom's leadership. Such leadership could apply a process of influence, which may make employees feel included, supported and reinforced. Relationships between employees and their leadership may affect perceived leader effectiveness during transient stages of business initiatives.

The beneficial factors of the nuclear new build program may be limited to economic risk, the eradication of short-term load shedding and a reduction in water consumption, to name a few. Through these benefits, employees have the ability to influence society and improve Eskom's operational efficiency and reputation. While Eskom may have done the basics correctly via stakeholder management, employees are the individuals that put a face to the company and have a far greater influence on local communities. They are the ones who gain the trust of the public when mistrust exists between organisations and society, as they are the staff compliment that make up the fabric of society. For one to overlook their influence is to make a grave mistake. For better or for worse, employees through their social influence may even educate members of the public, thereby creating localised support to national initiatives.

A manager's involvement with their staff may also impact external employee engagements. The executive level buy-in is compounded with the buy-in of the employees themselves, funnelling through influence that may impact the nuclear power program. Peripheral aspects such as a demanding organisational culture and substandard leadership practices may constrain an employee's ability to influence society. Therefore, the fourth (4^{th}) proposition is:

P4: Eskom employees believe they can influence members of the public on nuclear power, when they have the support of the organisations leadership.

3.2.5 NUCLEAR BUILDS COMPLIANCE TO BUSINESS BEST PRACTICES

When the new nuclear build program becomes a reality, it may bring aid to stimulate economic growth and better the lives of all who reside in RSA. However, the nuclear plans need to be well governed to key deliverables, particularly when one considers the cost. Economists inclined to this initiative have stated that RSA would need to borrow at least R1.2 trillion (trn), which would result in a repayment of an R100 billion a year. This will put a dent in government's budget to supply basic needs such as education, healthcare and social welfare. With RSA's current debt level is at R1.89trn, the nuclear deal may escalate this to above R3tn (Omarjee, 2016).

For these reasons and to avoid an escalation in the projects estimated cost, the compliance of the nuclear deal to business best practices is essential. While there are many tasks and sub-tasks to the realisation of the 9.6GW (e) nuclear fleet, main compliant elements may be nuclear safety, procurement oversight, responsible decisions taken by Eskom leadership and adherence to the scale and timing of approved nuclear plans set out in the IRP report/s. Employees' may view Eskom's adherence to global standards as an indicator of becoming a world class organisation. While standards may vary within each industry, the commitment to align to set standards hinges on corporate governance.

Nye (2009) reveals that the Nuclear Threat Initiative (NTI) scores RSA low in terms of (1) poor physical security during transport, (2) corruption, (3) to specify quantities of nuclear materials and (4) political stability (Nye, 2009). These ratings increase the potential for substandard acts and rework that incurs greater costs. Actions of this kind may be avoided by employees that have experience with KNPS enhancement projects. It is expected that through experience, perceptions are created on the likelihood and consequences of an action. In order to determine if there is a difference between the years of experience and the agreement to compliance, respondents will be screened in three different service categories. These categories are (1) more than one but less than two years, (2) more than two years but less than five years, and (3) those that have more than five years of service.

In the midst of all of these developments and a generation that changes jobs and companies frequently, Eskom's workforce on the ground continues to keep the lights burning and adapted to socio-political decisions taken by their principals. They foster growth and expertise by being team players and sharing knowledge for the betterment of the industry, thereby driving continuous improvement. Therefore, the fifth (5^{th}) proposition is:

P5: Eskom employees perceive that the new nuclear build program will be well aligned to business best practices.

3.3 SUMMARY

In this section, the five propositions to the study were evaluated and determined in order to answer the four research questions. They were identified through Necsa's 2011 public opinion evaluation of nuclear power. The propositions were as follows:

P1: Eskom employees support the IRP2010 and draft IRP2016 nuclear energy plans.

P2: Eskom employees are of the opinion that there are adequate nuclear safety and security measures in place to safeguard society against the effects of a nuclear accident.

P3: Eskom employees view RE as a preferred energy source over nuclear power.

P4: Eskom employees believe they can influence members of the public on nuclear power, when they have the support of the organisations leadership.

P5: Eskom employees perceive that the new nuclear build program will be well aligned to business best practices.

Chapter 4

Proposal for Testing

This chapter will discuss the research methods, which is a systematic, theoretical analysis applied to a field of study. It incorporates concepts such as paradigms, theoretical models, phases, techniques and a basis which outlines the research approach.

4.1 RESEARCH DESIGN

The research design is a structure that ensures that appropriate data is collected to answer the research questions. Obtaining relevant evidence involves specifying the type of evidence needed to answer the research question, to test a theory, to evaluate a program or to accurately describe a phenomenon (David, 2016). According to Jones (2010), "research design refers to a plan, blueprint or guide for data collection and interpretation. It is a set of rules that enable the investigator to conceptualise and observe the problem under study". The research strategy within this study will consist of the following main steps, (1) selection of research method, (2) research instrument, (3) applying ANOVA to test the propositions, (4) questionnaire design, (5) sampling strategy, (6) data collection, (7) pilot for test, (8) data analysis, (9) limitations of the study, and (10) elimination of bias.

According to Creswell (2003), there are five types of research designs, namely (1) Exploratory, (2) Correctional, (3) Descriptive, (4) Explanatory; and (5) Casual-comparative (Creswell, 2003). For this study, descriptive quantitative research design methods will be applied. Zikmund (2003) emphasises that the major purpose of descriptive research is to describe the characteristics of a population or phenomenon.

Quantitative research is used because it quantifies the problem by way of generating numerical data or data that can be transformed into useable statistics. It is commonly used to quantify attitudes, opinions, behaviours, and other defined variables, as in the case with nuclear perception. Quantitative research uses measurable data to formulate facts and uncover patterns in research (Wyse, 2011).

4.2 RESEARCH INSTRUMENTS

According to Smith (2006), there are three most common survey methods used for research, namely, observations, interviews and questionnaires. An observation is an action or process of observing something or someone carefully in order to gain information. Interviews are meeting people face to face, especially for consultation. Questionnaires are a set of printed or written questions with a choice of answers, devised for the purposes of a survey or statistical study. The research instrument used in this study will be survey questionnaires, which will be termed henceforth as the Employee Survey Questionnaire (ESQ).

Comparatively, the selection of an ESQ is due to its advantages over interviews and observations. Ladimeji (2013) claims that interviews produce interview bias due to unknowing manipulations. Akama (2015) states that observations are subjective and contravenes ethical principles of the researcher, while Sekaran (2003) advocates that questionnaires are the most efficient data collection mechanism, provided the researcher knows exactly what is required and how to measure the variables of interest. Stewart (2008) indicates that data collected through survey questionnaires is a non-personal technique, as respondents complete the questionnaires without the researcher being present. This research instrument also addresses issues of cost, time and geographical constraints; therefore it is a means of expediting research in an efficient manner.

Although questionnaires may seem to be positive, not all researchers agree with Sekaran and Stewart. Nye (2011) cautions that one cannot determine the amount of thought a respondent has put into their response to ESQ's. Additionally, the researcher may make decisions and assumptions as to what is and is not important from their perspective, thereby limiting the respondent's views to questions. To address Nye's concern, respondents will be given an opportunity to note their views not mentioned in the ESQ by responding to an open-ended questionnaire. There will also be a correlation to the type of questions used in a public perception survey, therefore limiting potential researcher bias.

4.3 MEANS OF ANALYSING THE PROPOSITION STATEMENTS

The propositions P1 – P5 will be examined by using three-way analysis of variance (ANOVA). Three-way ANOVA is a change to the simple two-way analysis by including a third factor. With the three-way interaction effect, three factors are considered at the same time, the thus providing more comprehensive data for observation. Additionally, effects between factors are easier to test if there is more than one observation (Coolican, 2014). The benefit is enhanced validity and reliability in a focus area, resulting in a wide-range of outcomes to inform conclusions. The survey questions that make up the three-way ANOVA for each of the five (5) propositions are outlined in Annexure 4.

4.4 QUESTIONNAIRE DESIGN

Questionnaire design is a multistage process that requires attention to many details at once. Its design is complicated because surveys can ask about topics in varying degrees of detail, questions can be asked in different ways, and questions asked earlier in a survey may influence how people respond to later questions.

The design of the questionnaire will make use of the Likert scale and yes/no questions. The Likert scale is a set of items, composed of favourable and unfavourable statements concerning a research area (Takona, 2002). Respondents may be offered a choice of four, six or even nine pre-coded responses, with a neutral point being neither agree nor disagree, if required. Respondents may be asked to respond to each statement in terms of their own degree of agreement or disagreement. Considering the above, the 4-point scale will be used in certain survey questions. The benefits are that it produces an impassive (forced choice) measure where no indifferent option is available, meaning there is no "safe neutral" (Jamieson, 2004). An example of the scale is in figure 8 below:

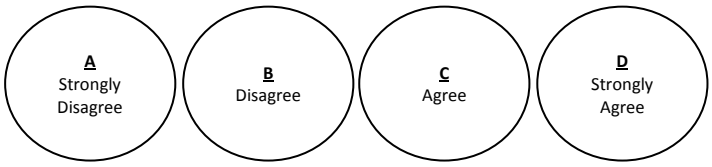


Figure 8 - The 4 Point Likert Scale

Secondly, the 4 point Likert scale has the advantage that it doesn't allow neutrality to answer from respondent, but rather allow for degrees of opinions,(Pallant, 2016). In all surveys, the validity of the Likert Scale measurement can be compromised due to social desirability (Berg, 2004). To limit this, anonymity will be applied to reduce social pressure and possible biasness.

A covering letter and consent form will be attached to the ESQ for population. It is anticipated that all questions will be responded to. However, if respondents feel uncomfortable in providing feedback, or if the question appeared unclear or ambiguous, they may opt to leave questions blank. Respondent's anonymity will be maintained as their names will not be requested on the ESQ (McQuerrey, 2012).

The authorizing letter from Eskom Senior Management accompanied the ESQ, to address respondent's potential resistance due to anxiety.

4.5 SAMPLING STRATEGY

The sampling method involves taking a representative selection of the population and using their views as research information as a representation of the whole population (Mora, 2016). For the purpose of this study, probable stratified sampling strategy will be used. Stratified sampling is categorised under random sampling methods. With stratified sampling, the population is divided into separate groups, called strata. Thereafter, a probable sample (often a simple random sample) is drawn from each group.

The reason why stratified sampling is used is due to the several advantages over simple random sampling. For example, it may be possible to reduce the sample size required to achieve a given precision, or it may be possible to increase the precision with the same sample size. The application of stratified random sampling will be demonstrated by applying the following strata:

- Total population - Eskom - RSA
- Sample - Western Cape
- Strata - Generation, Transmission, Distribution, Customer Service, Finance, Human Resources
- Sub-strata - Leadership and employees (collectively termed staff)

4.6 TARGET POPULATION

Approximately 250 staff members will be requested to participate in the ESQ; however the targeted response level that will be used to draw conclusions in this study will be 200. The reason for the difference in respondents (250 vs 200) is due to the expectation that a few ESQ's will not be returned. The sample of 200 represents approximately 5% of Eskom employees in the Western Cape.

Due to the sampling type, sub-strata between the Eskom's leadership and employees have been identified, but not limited to this select group. The staff categories that formed part of the study are 40% leadership and 60% employees. The reason for the 40/60 split is to test if consensus is present from the staffs that work on the "workshop floor" and the leadership/management to who make strategic business decisions. The target population and strata will be as follows in table 3 below:

Table 3 - Population Sample

Designation	No. of respondents
Leadership (>T13)	80
Employees (<T13)	120
TOTAL	**200**

4.7 DATA COLLECTION

In an attempt to avoid disruptions to Eskom's business operations and to ensure that the respondents receive the survey documents in the shortest possible time, the ESQ was distributed through the organisations internal mailing system (i.e. email). To avoid respondent bias and potentially clustered responses to questions due to group influences, the researcher did not disclose who formed part of the study.

The cover letter requested respondents to place feedback to ESQ's in a white, non-translucent envelope and place it in their out-tray at their respective departments. The internal Mail and Print department facilitated the collection and return of the ESQ to the researcher. This approach allowed respondents total anonymity, as it restricted the researcher in identifying whom the respondent were, apart from information populated on the ESQ.

4.8 VALIDITY AND RELIABILITY

Reliability is an indicator of consistency and how stable a test score or data is across applications or time (Singleton, 2015). A measure should produce similar or the same results consistently if it measures the same "thing". Without the agreement of independent observers able to replicate research procedures, or the ability to use research tools and procedures that yield consistent measurements, researchers would not be able to satisfactorily draw conclusions, formulate theories, or make claims about the generalizability of their research (Levesque, 2006). In addition, reliability is critical for many parts of our lives, including manufacturing, medicine, sports, etc.

The use of reliability types (test-retest, split half, alternate form or internal consistency) depends on the nature of the data (nominal, ordinal, interval/ratio). The factors that may result in the ESQ becoming less reliable are (Lee, 2005):

1. Traits of the respondent (e.g. health and well-being)
2. Testing conditions (e.g. location)
3. Chance factors (e.g. random selection due to time constraints)

Reliability will be upheld in this study by urging respondents to complete the ESQ within a business location they are most comfortable in (i.e. their office, place of work, etc.). The authorizing letter from Eskom Senior Management will also accompany each ESQ distributed.

In order to avoid respondents exceeding the authorised time limit of the survey, the ESQ will be independently tested by non-nuclear personnel to ensure that it can be completed within 15 minutes. Additionally, nuclear terminology was tested for understanding on non-nuclear respondents. It is acknowledged that if the ESQ is ambiguous and irrelevant to the subject matter, it may influence the quality of feedback provided. Therefore, the questions posed in the ESQ will be phrased in a concise and clear manner.

Validity refers to how sound a research study has been conducted. More specifically, validity applies to both the design and the methods of research. Validity in data collection means that findings truly represent the phenomenon the researcher is claiming to measure (Lankshear, 2004). Validity will be upheld in this study by ensuring that the sample of the targeted population is representative in terms of gender, age, business experience, departmental representation and the level of sensitivity the questions may impose. Further means of promoting the validity of the research will be to allow respondents sufficient time to respond. Respondents will be required to have a minimum of 24 months unbroken service in Eskom order to participate in the survey. This is due to the research focus being on employees who have been well exposed to the culture and leadership of the utility. If employees have less than 24 months of service, their mind-set may be of that of the public, which will result in conflicting or inconsistent outcomes within the study.

4.9 PILOT FOR TESTING

Pilot testing means finding out if a survey, key informant interview guide or observation form will work in the “real world” by trying it out first on a few people. The ESQ was piloted on a small scale prior to implementation to the target sample. Five (5) staff members were selected by the author as a base to test the ESQ within the allocated 15 minutes at their workstations, as advised by Ladimeji, (2013). These employees had little experience within the nuclear power industry, which assisted in ensuring that the target sample would be understood by those within or outside the nuclear environment. Different grades were also selected; two (2) staff members were above T13 and three (3) were below T13. This was aligned to the desired 40/60 split of the population sample.

The ESQ was updated after a review meeting was held with the 5 respondents. Revisions included changes to the layout, limited use of acronyms and the order of questions. Additionally, jargon that is frequently used within the nuclear industry was reviewed, to ensure that employees from all disciplines understood what was being asked. It was confirmed that the authorised time of 15 minutes was sufficient to complete the ESQ.

The updated version of the ESQ was then used for the population sample.

4.10 DATA ANALYSIS

Data analysis is the process of bringing order, structure and meaning to the mass of collected data. It is a messy, ambiguous, time-consuming, creative, and fascinating process. Rossman (1990) cautioned that it may not proceed in a linear fashion and may not be neat. The purpose of analysing data is to obtain usable and useful information. The analysis may describe and summarise the data, identify relationships between variables, compare variables, identify difference between variables and forecast outcomes.

Once the data was collected and supplied to the researcher, it was necessary to employ statistical techniques to analyse the information. Software programs within the Microsoft Office package were used to convert the information received from the ESQ into a more meaningful format to inform the study. These statistical computer programs were Microsoft Excel and Microsoft PowerPoint, version 2007. Scatter (3D), tables, pie and run graphs represented the data in a meaningful form, of which comments, conclusions and recommendations were drawn from the represented data.

4.11 RANKING AND SCORING

Not all the survey questions applied the simple ranking technique which required a simple yes/no response. Questions 7, 9, 10, 11, 12 and 13 required respondents to think further than superficial knowledge. For this reason, proposition 2, 4 and 5 made use of questions that were aligned to the Likert scale. Engineering techniques were applied by allocating weightings in order of rank, thereby formulating a score for analysis. The formulae and weights applied are in table 4, below.

Table 4 - Ranking and Scoring Calculations

Proposition	Annotation	Calculation
1	-	Simple Ranking
2	NC – No Concern SC – Somewhat Concerned C – Concerned VC – Very Concerned	$\text{Score} = ((\text{NC x } 0) + (\text{SC}) + (\text{C x } 2) + (\text{VC x } 4))$ $\text{Total} = ((\text{Score 1 x } 4) + (\text{Scores 2 x } 2) + (\text{Score } 3))$
3	-	Simple Ranking
4	NI – No Influence LI – Limited Influence SI – Strong Influence VSI – Very Strong Influence	$\text{Score} = ((\text{NI x } 0) + (\text{LI}) + (\text{SI x } 2) + (\text{VSI x } 4))$ $\text{Total} = ((\text{Score 1 x } 3) + (\text{Scores 2 x } 2) + (\text{Score } 3))$
5	SD – Strongly Disagree D – Disagree A – Agree SA – Strongly Agree	$\text{Score} = ((\text{SD x } (-2)) + (\text{D x } (-1)) + \text{A} + (\text{SA x } (2)))$ $\text{Total} = ((\text{ Score 1 x } 4) + (\text{ Score 2 x } 2) + (\text{Score } 3))$

4.12 LIMITATIONS OF THE RESEARCH

The limitations of a study are those characteristics of design or methodology that impact or influence the interpretation of findings within research. They are the constraints on generalizability, applications to practice and/or findings that are the result of the ways in which one initially chooses to design the study, or the methods used to establish internal and external validity (Edward, 2016). The limitations identified in this study were:

1. Respondents had to be permanently employed by Eskom.
2. As KNPS is located in Western Cape, the sample was selected from this province.
3. Respondents with a minimum of 24 months unbroken service in the sub-strata were requested to complete the ESQ. The reason unbroken service is required is to ensure that the employees are effectively exposed to matters related to the organisation.
4. To ensure that the feedback from respondents are a balanced representation of Eskom employee perception, the study attempted to ensure gender, race and the discipline of respondents are aligned to Eskom's demographic data of employment.
5. As English is the primary language within Eskom, all communication to respondents was written in English to better aid understanding of the research.
6. The limitation on time to complete the ESQ was 15 minutes in total, which had been granted by Eskom Senior Management.
7. This study did not include the views and thoughts of the media. The reason being is that these views are in constant flux, and may not represent a true picture of what employees' views are in respect to nuclear perception.

4.13 ELIMINATION OF BIAS

The elimination of bias is any tendency which prevents prejudicial consideration of a question. In research, bias occurs when "systematic errors are introduced into sampling or testing by selecting or encouraging one outcome or answer over others" (Merriam, 2015).

To ensure the elimination of bias, question structure was screened by an external, independent individual. Furthermore, respondents were requested to provide objective, unbiased feedback to the ESQ. The ESQ's was not personally collected by the researcher, in order to avoid the pressures exerted on respondents by the presence of the researcher, if personal collection was to take place. The authorizing letter from Eskom Senior Management accompanied the ESQ.

Chapter 5

Results, Discussion and Interpretation of Findings

This chapter discusses and interprets the results of the ESQ. Propositions P1 – P5 will also be tested, which will be informed by 15 survey questions. Chapter 6 forms a second discussion chapter, due to the complexities a study of this nature brings.

The structure of this chapter is divided into two sections, namely section 5.1 and 5.2. The first section discusses the response to each question in the ESQ, using a singular analysis technique. Due to the density of over 2700 sets of potential responses from the 200 respondents, the feedback to questions and statements here were represented in percentage format.

Section two draws conclusions to the propositions made in chapter 3, through three-way analysis techniques. It uses the outcomes of three interrelated questions to inform the validity of the propositions. To ensure that the integrity of the results was maintained, actual numbers and weighted scores were applied in this section.

It was expected that there would be disparity between the public and employee perception, due to different points of reference. Through the results, interpretation and discussion, it will be determined if this holds true.

5.1 SCORING TO INDIVIDUAL QUESTIONS

This section outlines the response to each survey question, with discussions to noteworthy observations made. The responses are also represented in figures for ease of interpretation.

The expectation from respondents due to previous research experience was that not all questionnaires issued would be returned. Once the target of 200 respondents was met, remaining ESQ's were not included in the study. In order to gain a comprehensive view from staff in different levels of the organisation, 40% (80) of respondents were above T13 and 60% (120) were below T13 grading.

5.1.1 Question 1: What gender are you?

The response to question 1 is depicted in figure 9. The data reveals that the majority (58%) of the respondents were males and just over a third (42%) were female. As nuclear perception is being evaluated with society regarding it as a risky generation source, many researchers have agreed that females avoid risk more than their male counterparts. For instance, Byrnes (1999) concluded that females are more risk averse than males after analysing 150 studies from 1967 to 1997 (Byrnes, 1999). Eskom's employee equity has a target is 45.7% female representation within the organisation by 2020 (Eskom, 2015b). If achieved and Byrnes view holding true, Eskom's nuclear perception may be altered due to the developmental roles females may have in society and business.

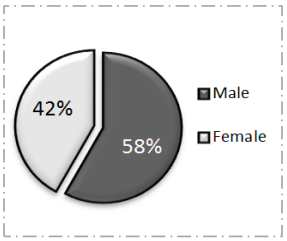


Figure 9 - Gender

5.1.2 Question 2: How many unbroken years of service do you have in Eskom?

A person's awareness and acceptance of the stimuli has an important role in the perception process. Receptiveness to the stimuli is highly selective and may be limited by a person's existing beliefs, attitudes, motives and personality (Assael, 1995). Employee's perception is largely influenced by their exposure and length of time within a specific working environment. For this reason, the number of years of service was evaluated to avoid premature conclusions made from respondents with exposure less than 2 years. The data gathered is represented in figure 10, which depicts that 48% of employees had more than 5 years of service, 45% had between 2 – 5 years of service and 7% have between one and two years. It can be concluded that the views of those participating in the study are of a sound nature, as 93% of respondents had more than 2 years of service.

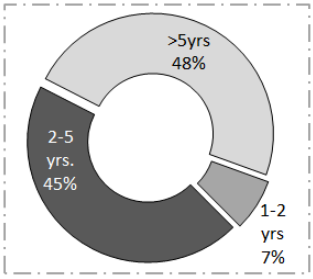


Figure 10 - Years of Service

5.1.3 Question 3: What group do you represent?

In Eskom, those in leadership roles are often of a grading T13 and above (excluding Organised Labour representatives). The leadership (management and organised labour) within an organisational environment frequently have an influence over those who report to them. This may be due to a leader's characteristics, traits, authority and experience. An important aspect of leadership is their degree of involvement in developments within an organisation. This may create a perceptual difference between leaders and followers due to the interpretation of such information. From the data analysis, 60% of respondents were below a T13 grading, while 40% were higher than a T13 grading. This data closely correlates with Eskom's provincial employee statistics, as 35% of WC employees are in the leadership category identified.

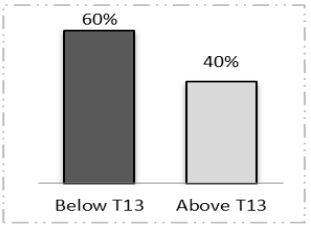


Figure 11 - Grading

5.1.4 Question 4: In what age category are you currently in?

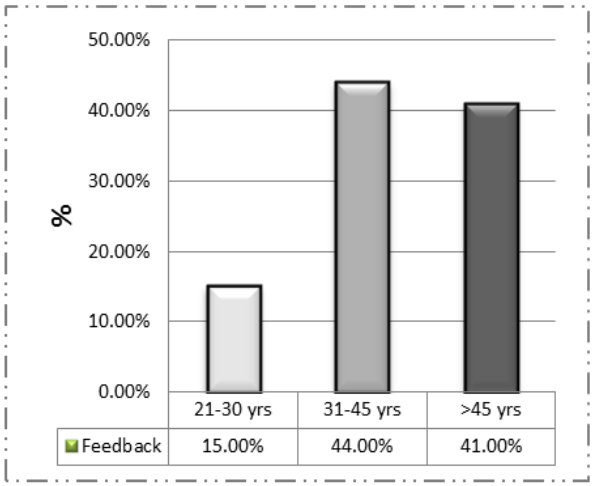


Figure 12 - Age of Respondents

As with other psychological phenomena, age is among the variables that affect decision making, or rather, that allows one to establish individual differences (Naeurt, 2015). The older one is the more life experience they have; hence a person will be more selective in their decision making (Anthony, 2005). Young adults (between 21 – 30 years of age) often feel significant amounts of pressure on emotional and social aspects of their decisions, while adults and retired persons to a lesser extent (Cohen, 1998). From figure 12, the survey indicated that 15% of respondents were between the ages of 21 and 30 years of age, 44% were between 31 and 45 years of age, while 41% were older than 45 years of age. Collectively, 85% of respondents were above 31 years of age. This population sample demonstrates that respondents are able to make informed decisions to organisational initiatives based on their age.

5.1.5 Question 5: Are you knowledgeable of the IRP2010 and Draft IRP2016 plans?

This question evaluated the respondent's knowledge of RSA's energy plans. In 2010, the DOE released a respectable version of the IRP report for electricity planning for the next 20 years, called IRP2010. It was further promulgated by the DOE in March 2011, based on work done in 2009 and 2010. In both plans, RSA's energy mix is outlined, with nuclear being included as an energy source. From the feedback received and illustrated in figure 13, 84% of employees indicated that they are knowledgeable of the contents in the outdated IRP2010, however 16% were not. On the 25th of November 2016, the draft IRP2016 was released for public comment up until the 30th March 2017. Data reveals that only 38% of respondents were aware of its content, however 62% were not aware. A low knowledge level of the draft IRP2016 may be linked to the newness of the plan, which respondents may still need to familiarize themselves with the content.

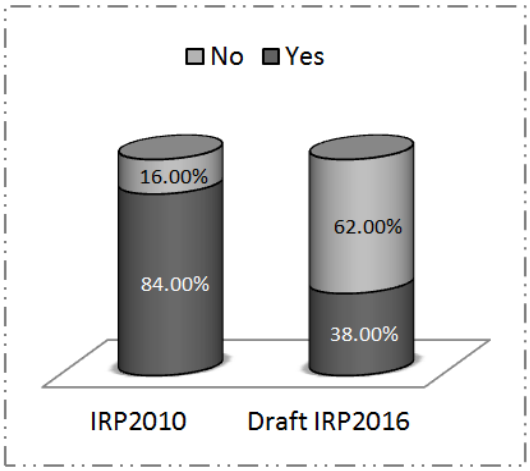


Figure 13 - IRP Support

5.1.6 Question 6: Approximately how far do you reside from Koeberg Nuclear Power Station?

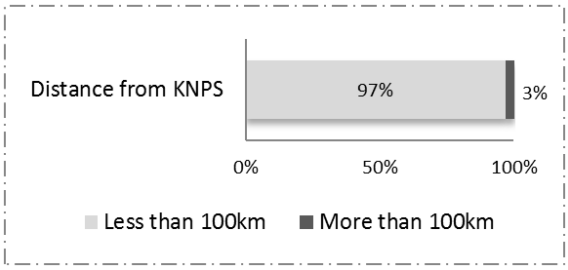


Figure 14 - Distance of residence from KNPS

The origins of nuclear science can be traced back to the explorations on the nature of the atom. It was the discovery of radioactive elements that spurred various experiments to investigate nuclear reactions (WNA, 2016). Despite assurance from experts on the relative robustness of the nuclear industry, there are still fears about its safety, especially the possibility that NPP's could meltdown and release dangerous radioactive materials (McNeill, 2011). If Eskom employees have similar fear, it would be expected that employees would not consciously decide to reside in close proximity to a NPP. On the contrary, data reveals that 97% of respondents chose to live within a 100km radius from KNPS. This may be due to respondents having accepted the inherent risks and dangers a NPP possesses. From this data alone, it cannot be conclusively determined that respondents are ignorant to radiation exposure and may be a result of economic necessity.

5.1.7 Question 7: Procurement of the nuclear new build will be well managed and aligned to business best practices.

A "best practice" is commonly defined as "a technique or methodology that through experience and research, has proven to be reliable to lead to the desired results" (WHO, 2008). As Eskom will be the procurer of RSA's nuclear new build program, Earthlife had stated that "the designation of Eskom as the procurer, rather than the DOE, was not merely a formality". It argued that "it raises serious questions of sound management in the procurement of the nuclear fleet …" (Cordeur, 2016). In response to the above question and with this context, more than 64% of respondents believed that the procurement of the nuclear deal would not be aligned to business best practices, while 36% agreed or strongly agreed that it would. With the majority of respondents seeming pessimistic, it alleges potential procurement mismanagement and a lack of skills to soundly manage a deal of this scale.

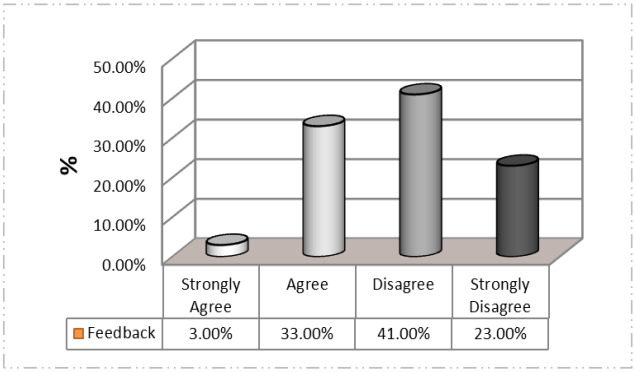


Figure 15 - Nuclear procurement aligned to business best practice

5.1.8 Question 8: Do you view Renewable Energy (RE) as an alternative energy source to nuclear power?

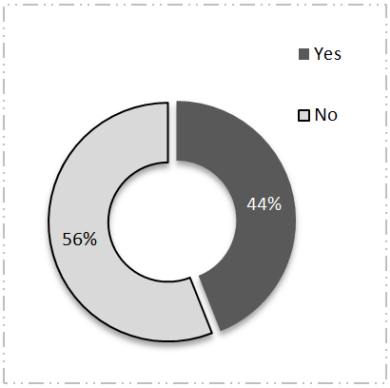


Figure 16 - The Renewable Alternative

The world has recently demonstrated its commitment to a cleaner and more sustainable future by making responsible decisions regarding power generation. Countries have displayed this by moving to nuclear energy while others towards RE, many opt for both (Timilsina, 2012). Although efforts have been made, many anti-nuclear bodies and members of society are still not convinced that nuclear power is the means to meet RSA's commitments. From the data evaluated, there seems to be a close divide on this controversial topic. A remarkable 44% of respondents indicated that RE is an alternate energy source to that of nuclear power to support low GHG emission, while 56% indicated that nuclear power is the way to go. Such a divide is not unique to RSA.

5.1.9 Question 9: With respect to RSA's nuclear expansion of 9.6GW (e) that need to be added to the grid by 2030 (IRP2010), what degree of influence do you feel you have to impact the perceptions of the public in a positive light?

The involvement of employees in educating stakeholders is a crucial aspect within organisations. Employee participation may contribute to achieving several interrelated goals, such as better-informed stakeholder groups, up to date developments on projects, socially accepted mitigation measures and a reduction to the potential conflict between such stakeholder groups (Lauber, 2000). This is also true when it comes to Eskom employee's influence on the general public. Out of the 200 respondents sampled, 10% indicated that they have no influence over the public. However, collectively 90% felt that they can in some way have a positive influence on society that supports the IRP2010 nuclear plans. Of the 90%, 48% indicated that they had limited influence on the public, 23% had indicated strong influence, and a noteworthy 19% indicated that they can very strongly influence members of the public. With influence comes a process of educating the misguided, hence this view is also an indication that employee's feel they are able to become change agents due to their commitment to the organisation.

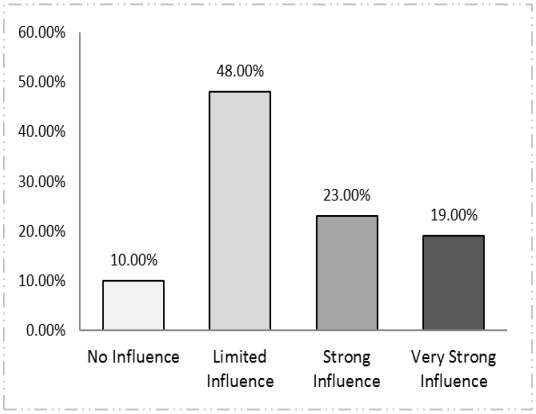


Figure 17 - Employee Influence

5.1.10 Question 10: In your opinion, of the potential dependencies to the nuclear new build program, which will be most aligned to their industry standards?

Out of the options available for selection in question 10, 11 and 12, respondents were requested to respond in terms of the significance of risk in order of one, two and three, with only three of the five/six options being selectable. The most significant was one (1).

To question 10, it was originally thought that employees would highlight nuclear safety or ineffective leadership as a potential danger, due to a suggested lack of competence or compliance to business rules. However, through the analysis it was confirmed that this did not even feature in the top three levels of significance, relative to the alignment to industry specific standards.

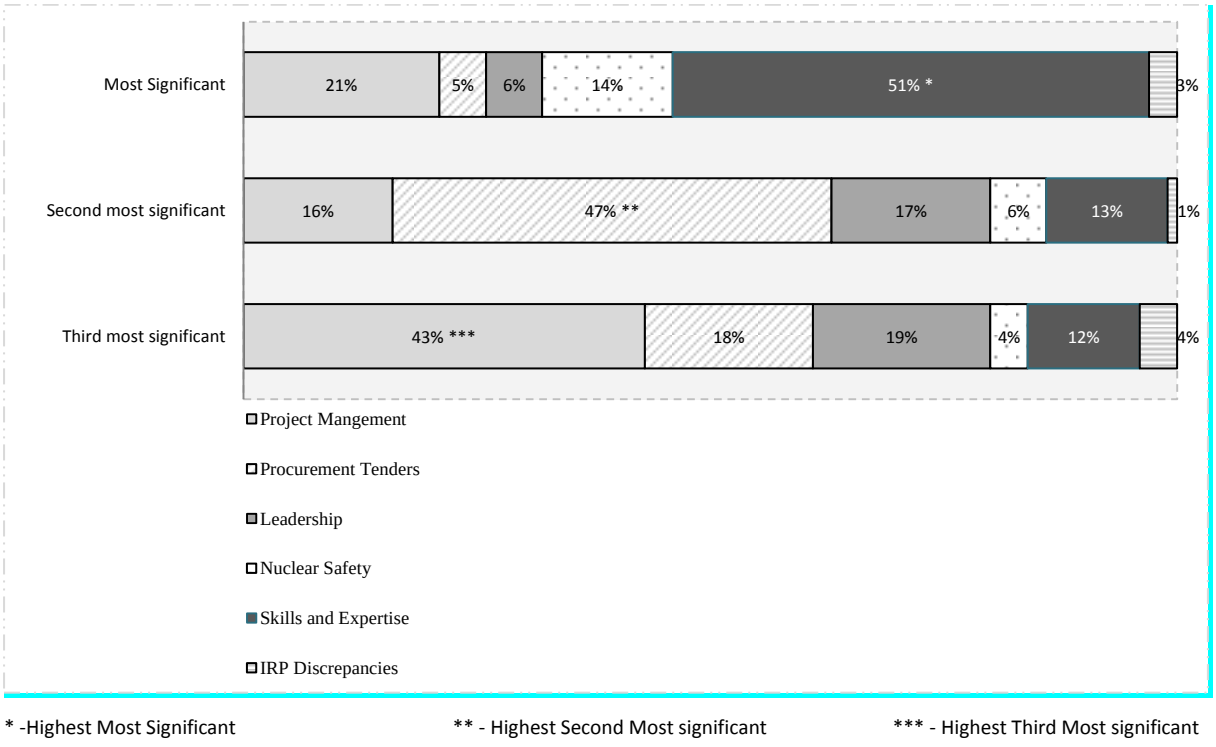


Figure 18 - NPP associated dangers

As per figure 18 above, respondents indicated that the most significant compliant element to the new nuclear build program is "skills and expertise" at 51%. This was closely followed by, "Procurement Tenders" at 47%. Lastly, "Project Management" featured as third at 43%. The least significant out of the six options was that of discrepancies between the IRP2010 and draft IRP2016.

Evidently, respondents are not concerned about the scale and changes of nuclear plans. It seems from the survey data that respondents are more concerned about compliance with approved energy plans and commitment to nuclear safety in the nuclear new build program.

5.1.11 Question 11: In your opinion, what are the risks of nuclear power mostly influenced by?

Risk assessments are predominantly dependent upon prevailing community standards and case-specific determinations of an evaluated potential loss that may be incurred. Nuclear risks may be linked to long term waste, cost and safety, to name a few. The factors commonly influencing RSA in term of risk within this study was identified as (1) the government, (2) safety of society, (3) leadership within organisations responsible for its commissioning, (4) energy alternatives and (5) job creation, which influences local economies. For this reason, these factors were evaluated in question 11, to determine how respondents perceived nuclear risks and its degree of influence.

Out of the five (5) options available, figure 19 depicts that 39% of respondents suggested that the most significant influence to nuclear risk was, "leadership that creates a learning culture". The second most significant influence at 25% was, "the safety and security measures in place to safeguard society from a nuclear accident". The third most significant factor that influences nuclear power at a level of 35% was voted as being the government, industry decision makers and spokespeople.

Safety is of critical concern in any environment. It is thus expected that the well-being of those who work in a NPP and reside within the "danger zone" consider such dangers. Maslow's hierarchy of needs categorises "safety needs" in terms of protection from elements, security, order, law and stability, which are the fundamental needs of human beings (McLeod, 2007).

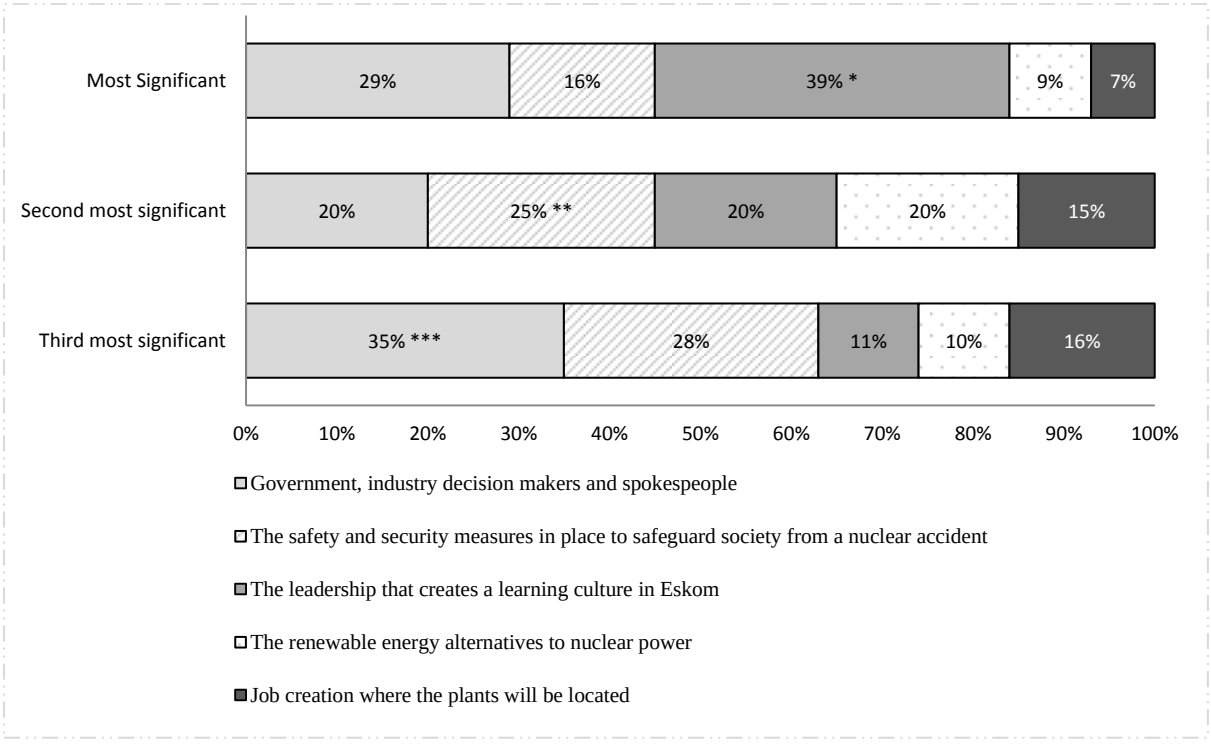


Figure 19 – NPP's Influential Risks

5.1.12 Question 12: What do you think are the greatest benefits of building a nuclear fleet in South Africa?

The benefits of nuclear can only be truly appreciated by those who are involved in its operations and regulation. Some of these benefits include a reduction of harmful GHG emissions, cheap operating costs and long lifecycles. Response to the above question indicated that grid security and a means to improve Eskom's safety margin to avoid load shedding was the most significant benefit within the South African context, at 31%. This comes at a time when the RSA economy is making incremental improvements to its GDP, due to a healthy demand/supply ratio of late.

The second most significant benefit was that of environmental factors and lower CO_2 emissions, at 30%. This is a fair indication that employees are demonstrating a responsibility to society and acting in the best interest of humanity. In this regard, Eskom's leadership have displayed responsibility by educating employees on governmental commitments to lower carbon emissions.

The third most significant benefit at 27% was selected as a diverse generation source in the energy mix, thereby limiting economic risks. It is imperative for a country to effectively manage their natural resources and use the best mix that yields the greatest return in terms of sustainability and efficiency. Such diversity cultivates a multi-skilled labour market.

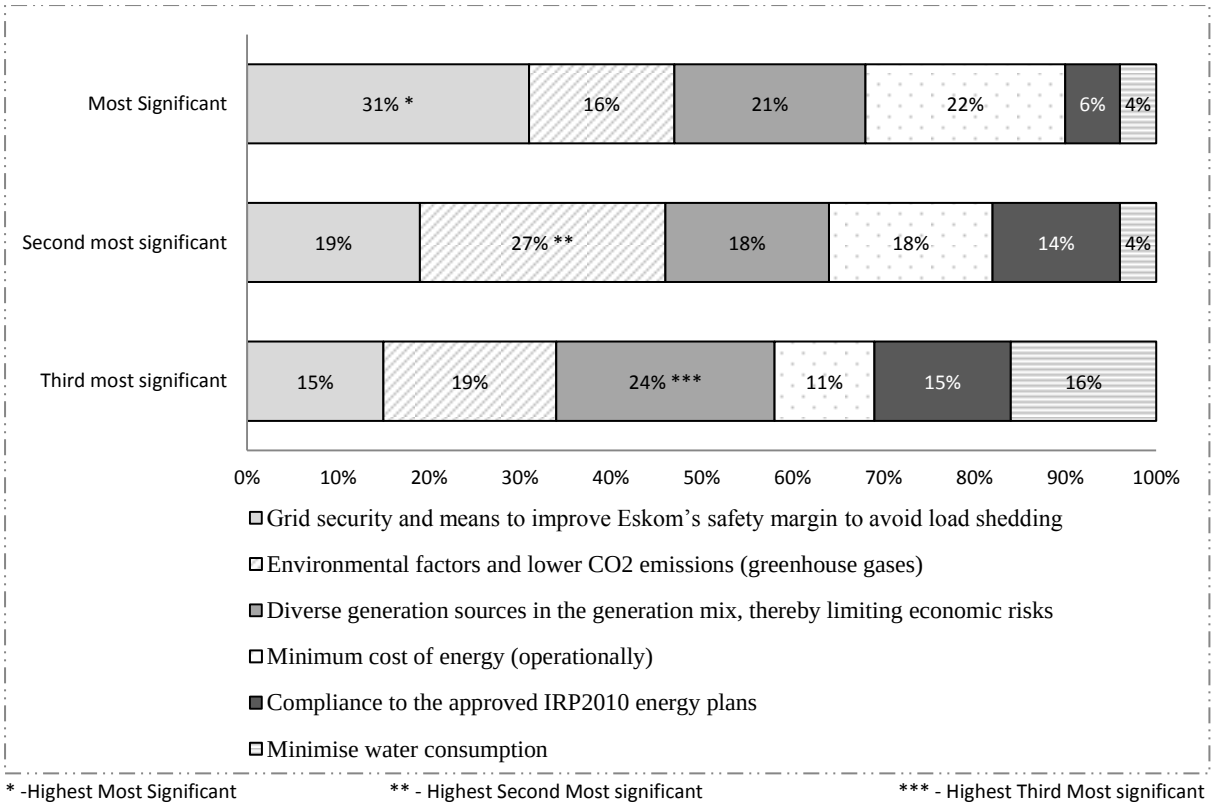


Figure 20 - NPP Benefits

5.1.13 Question 13a: What are your thoughts on nuclear safety and radiation poisoning stemming from nuclear power plants from its impact on historical nuclear accidents?

Nuclear radiation arises from hundreds of different kinds of unstable atoms. The Fukushima Daiichi accident released about 940 PBq (iodine-131 equivalent) of radioactive material, mostly on days 4 to 6 after the tsunami (Gupta, 2013). Due to this accident along with TMI and Chernobyl, a combined 70% had noted concerns about nuclear safety and the inherent health risks it brings along with it. A fair majority of 42% indicated that they were somewhat concerned, 21% were concerned and 7% were very concerned. Surprisingly, just under a third (30%) of all respondents had no concern about nuclear risks and radiation poisoning a NPP possess. This result suggests that more extensive change management initiatives need to be implemented, in order to educate employees about the nuclear industries risks and controls to safeguard society.

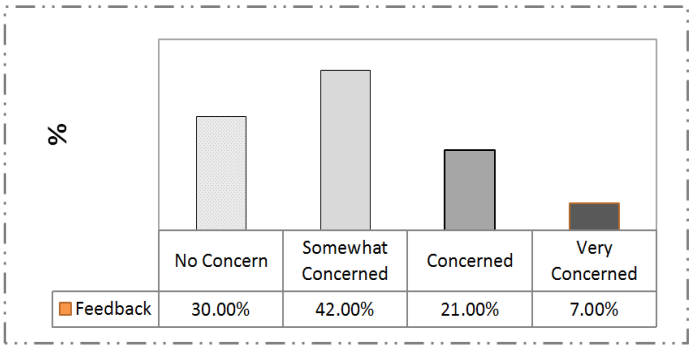


Figure 21 - Concern over Nuclear Safety

5.1.14 Question 13b: Are you able to speak freely about nuclear power due to the support you receive from your manager?

Leaders are continuously challenged to have a greater role in creating an effective workforce across all levels within an organisation (Burke, 2007). A key component to meet this task is a leader's ability to be effective in an environment, which is dependent on the degree to which subordinates and co-workers trust their leadership. Trust has also been conceptualized as an emergent state. An emergent state refers to cognitive, motivational or affective states that are dynamic and vary as a function of contextual factors, inputs, processes, and outcomes (Heuer, 1999). With reference to the survey data, it is evident that more than two-thirds (72%) feel that they are able to speak freely about nuclear power due to the support received from the Eskom leadership. 28% of respondents did not concur with the "yes group", by indicating that they did not have the support of their leadership.

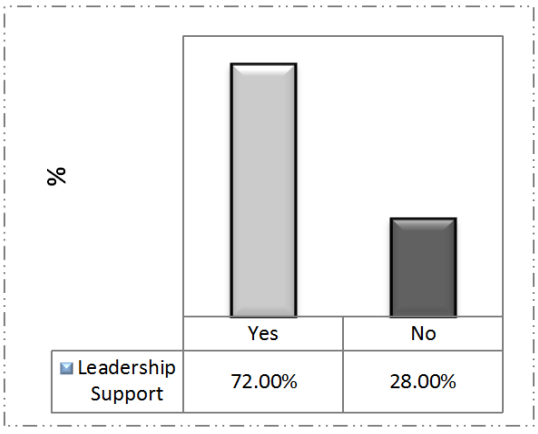


Figure 22 - Leadership Support on Nuclear

5.1.15 Question 14: The projected cost for the nuclear fleet is said to be in excess of R1 trillion. Considering the cost, do you believe the *approved IRP2010* and *draft IRP2016* nuclear plans meet South Africa's needs in the present political and economic conditions?

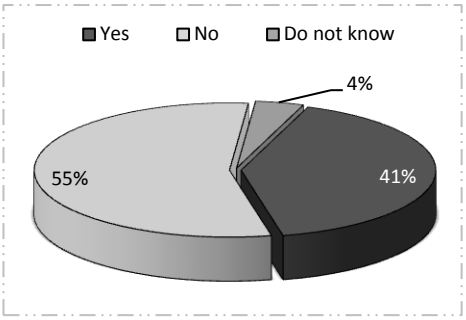


Figure 23 - IRP meets RSA's Energy Needs

Nuclear plans are included in both the IRP2010 and draft IRP2016 reports. Due to an energy mix that aims at promoting lower GHG emissions, the inclusion of the technology differs in scale and timing of implementation, and therefore cost. The projected cost of more than R1trn for the 9.6GW (e) (IRP2010), creates widespread fear in the minds of employees who have a vested interest in the well-being and development of RSA. This stated, 41% of the population sample indicated that both IRP's nuclear plans will meet RSA's energy requirements. As the DOE has requested Eskom to be the owner operator and procurer of the envisaged nuclear fleet, benefits would be job creation, sustained work for SME's and an expansion of the nuclear industries footprint into Africa. These benefits comfort politicians and economists, as it secures votes and public support. It must be noted that 55% of respondents viewed that both IRP's do not meet RSA's needs. This is potentially attributed to an unstable political environment and a deteriorating economy.

5.1.16 Question 15: If you have any further comments to offer this researcher, please write them below, indicating to which topic they are relevant from (1) IRP2010, (2) Draft IRP2016, and/or (3) Other

Although few respondents provided feedback to the above question, the responses of those who did respond are logged below.

Table 5 - Further Comments to the IRP Nuclear Plans

IRP2010	- The two versions released within a short space of time creates confusion
	- Project timelines are a concern
Draft IRP2016	- Long procurement process will impact the start date

5.2 PROPOSITIONS OUTCOMES

This section will discuss the propositions made in chapter 3 of this study. The research questions will be informed by this section; hence it is of critical importance to the hypothesis.

Proposition 1: Eskom employees support the IRP2010 and draft IRP2016 nuclear energy plans.

This proposition is with reference to nuclear support, of which nuclear power is considered in both the IRP2010 and draft IRP2016 reports, however it differs in scale and timing. Conclusions were made by bringing together the outcomes of three interrelated questions. These were question 3 (grading), question 5 (IRP knowledge) and question 14 (IRP's meet RSA's needs). The targeted 120/80 split of grades below and above T13 was achieved, with the results depicted in table 6 and tabulated in Annexure 7.

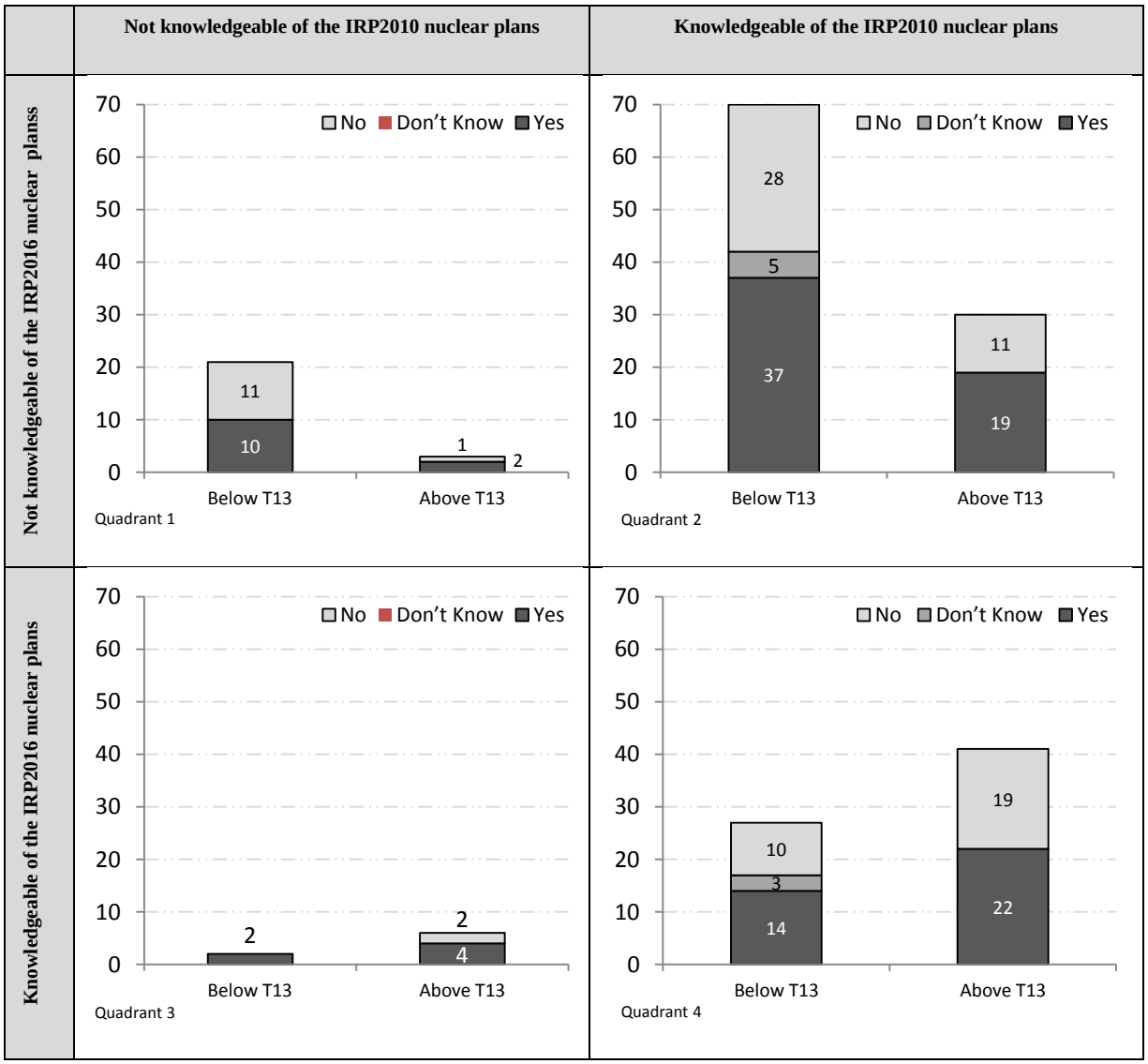
The IRP reports outline the country's projected electricity demand, how this demand might be supplied, and what it is likely to cost. The IRP2010 nuclear plans constitute the first tangible attempt to commence the process of integrating and aligning RSA's generation fleet to climate change mitigation objectives. This is implemented through education of greenhouse gas (GHG) emissions associated with electricity usage, resulting in industrial competitiveness to achieve security of supply.

From table 6, the reasonably significant group of respondents (in quadrant 1) who are unfamiliar with both IRP reports and yet express the adequacy of the nuclear plans, possibly indicate that they are guessing or are receiving information and opinion about the plans from other sources. The majority of the collective are in the grading category of T13 and below. These respondents often make coessential decisions within social clusters which may have influenced the result. A small number of Eskom's leadership was also represented in this quadrant. Due to these respondents seniority, it is expected that they are knowledgeable of RSA's nuclear energy plans. If these respondents are not knowledgeable of such plans, they are also not in a position to make informed decisions. Therefore, the ability of respondents in this quadrant to provide meaningful insight to the IRP's viability can thus be discredited, as there is no tangible point of reference to base their judgment on.

The IRP2010 is currently 6 years old with a number of discussions around its viability having been conducted over the years. Those familiar (in quadrant 2) with the 2010 report, however unfamiliar with the 2016 report have expressed conflicting views regarding the suitability of the plans, to such a degree that a few were not able to provide a view. This may be attributed to the newness of the 2016 report, in addition to the controversy relative to affordability and nuclear safety of the new nuclear build program. This group also has the largest number of respondents who support the IRP reports in meeting RSA's energy needs.

This strong acquaintance to the 2010 report may be indicative of the need to overcome limited economic growth, which RSA has experience sporadically from 2008 to 2016, mainly due to electricity demand that exceeds supply. The country is still recovering from such effects with a strong drive to address the energy shortfall..

Table 6 – Support and knowledge of the IRP2010 and draft IRP2016, categorised according to seniority



Regarded as the most significant and ideal group within this proposition (quadrant 4), a sound number of respondents are familiar with both versions of the country's energy plans, with the majority forming part of the leadership of Eskom. In context, Eskom has been named as the owner operator and procurer of the new nuclear build program, in accordance with the Nuclear Energy Policy of 2008. It may be for this reason that the leadership of the organisation (who are closely follow its developments), will be responsible for orchestrating the delivery of the nuclear new build program, in line with an official IRP2016 report.

As the comments period of the draft IRP2016 report has been extended, it is expected that disagreements to the draft nuclear plans and particularly its scale and timing to continue beyond its finalisation. It is hoped that responsible comments to the plan are submitted and considered upon merit to its revision.

In conclusion, a larger number of respondents in both grading categories are knowledgeable of the IRP2010 nuclear plans and have suggested agreement to its viability in meeting South Africa's energy needs. However, there is contrast when evaluating knowledge of the 2010 and 2016 reports. The results revealed that the majority of respondents in the leadership group are acquainted with the draft IRP2016, with respondents below T13 requiring further exposure. It is therefore concluded that overall, P1 is true. Eskom employees **support** the nuclear plans as outlined in the IRP2010. However, there are **reservations** to the draft IRP2016 report.

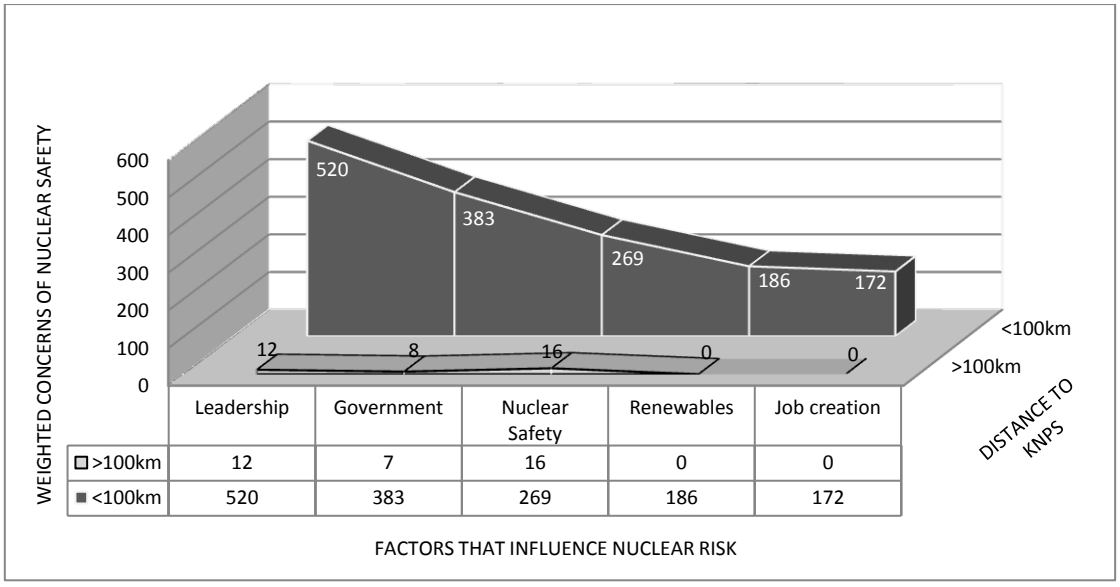
Proposition 2: Eskom employees are of the opinion that there are adequate nuclear safety and security measures in place to safeguard society against the effects of a nuclear accident.

This proposition is with reference to nuclear safety. Conclusions were made by bringing together the outcomes of three interrelated questions. These were question 6 (residential distance to KNPS), question 11 (influence of dangers in NPP) and question 13a (nuclear safety). The results are depicted in figure 25 and tabulated in Annexure 8.

The way an employee thinks about a hazard and organizes information about it, is an important factor that informs our understanding of risk perception relative to nuclear safety (Hillson, 2004). Nuclear safety involves two basic questions: (1) what are the chances of a serious malfunction of the nuclear plant? And (2) what would the consequences of such a malfunction be? Although RSA has not experienced serious accidents, if they do occur, the consequences may be catastrophic. An employee's nuclear safety concern may be internal or external to an organisation. In order to maintain consistency to prior public perception survey's, similar factors of influence were identified for selection.

As per the figure 24, the majority of respondents (194) chose to reside within a 100km radius from KPNS, with 6 respondents residing outside this exclusion zone. Each respondent was requested to select three of the five factors that influenced their nuclear concern, in order of significance.

Through the formulae described in section 4.11, the major group (<100km) of respondents had cited Leadership as the most significant influential factor that impacted their concern over nuclear safety, followed by the Government, Nuclear Technology, Renewable Energy and lastly Job Creation.



Please refer to section 4.11 for formulae to scores

Figure 24 – The Influential Factors of NPP to the weighted concern of Nuclear Safety

This result may be due to Eskom making regular changes to their senior leadership (with 520 points). Respondents may view the lack of stability at a strategic level as a significant contributor that increases the risk of a potential nuclear accident, due to their commitment to safety.

Voted as the second most influential factor were governmental stakeholders (with 383 points) such as the DOE, DEA, Necsa, Eskom, etc. This places emphasis that this group (<100km) are knowledgeable of the role these stakeholders have in ensuring a safe working environment is created. This may have been cited due to the nature of RSA's socio-political environment, where there are strong pressures to make dubious decisions, which must be avoided.

The third highest concern (269 points) was that of the safety and security measures within a NPP, which is the first line of defence that protect employees from harm or explicit danger. This group has placed emphasis on the technological advancements in a NPP, such as active and passive safety features which are entrenched in the design and operation of advanced reactors. It further highlights the importance of a competent and skilled workforce in ensuring the proper functional operation of such systems, which respondents seem somewhat confident in. The IAEA's nuclear safety culture requires strict adherence with a strong dependency on NPP leadership, via governmental support. It can be summated that Eskom's leadership, governmental structures and nuclear safety are co-dependencies that influence nuclear safety concerns.

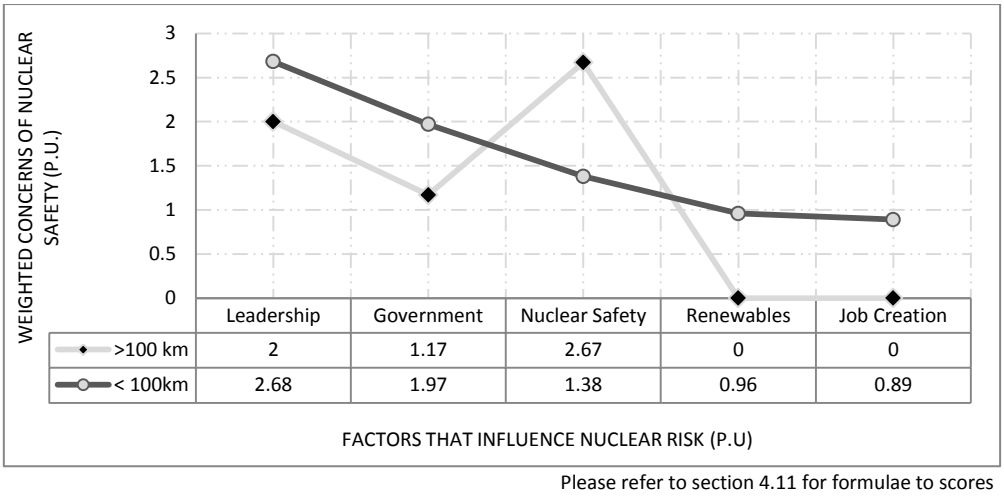


Figure 25 - The Influential Factors of a NPP to the weighted concern of nuclear safety (p.u)

In order to appropriately represent potentially significant feedback from the second group of respondents, their feedback had been recalculated using the per unit approach, From figure 25, it can be noticed that nuclear safety was cited as the biggest concern of this group, so much so that their p.u score was twice that of the first group of respondents (<100km). It suggests that this group of respondents had made conscious decisions to reside further away from KNPS, mainly due to safety concerns. Leadership and the Government were cited in order of second and third.

From the above data, the weighted concern for nuclear safety stemming from NPP was voted as most heavily dependent on Eskom leadership and government by those living in the exclusion zone. The second group cited nuclear safety and security measures as the most significant by those living outside the exclusion zone. Collectively from the two groups examined, it can be concluded that P2 remains true. The majority of respondents are of the opinion that **there are** adequate safety and security measures in place to safeguard employees against a nuclear accident.

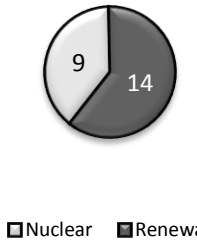
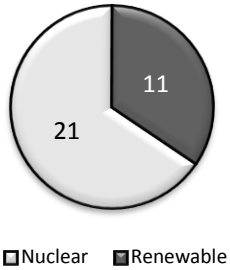
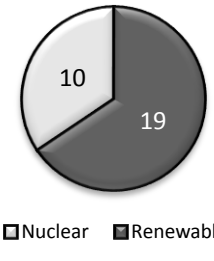
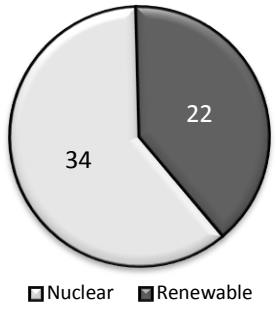
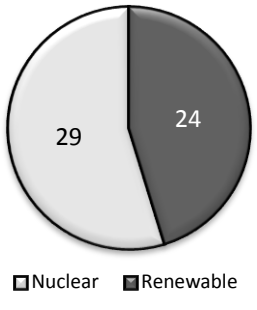
Proposition 3: Eskom employees view RE as a preferred energy source over nuclear power.

This proposition is with reference to low GHG emissions, either from RE or nuclear power. Conclusions were made by bringing together the outcomes of three interrelated questions. These were question 1 (gender), question 4 (age) and question 8 (RE alternative to nuclear). The results are depicted in table 7, with further tabulation of the data in Annexure 9. Collectively, 93 respondents preferred RE while 107 respondents preferred nuclear power. The gender split was 84 females to 116 males.

Table 7 - Dates of nuclear accidents

Nuclear Accident	Date
Three Mile Island	28 March 1979
Chernobyl	26 April 1986
Fukushima	11 March 2011

Table 8 – A comparison of age vs gender, relative to generation sources that emit low GHG's

.	21 – 30 years old	31 – 45 years old	More than 45 years old
Females	Segment 1  23 respondents	Segment 2  32 respondents	Segment 3  29 respondents
Males	Segment 4  7 respondents	Segment 5  56 respondents	Segment 6  53 respondents

From table 8, it is noticeable that there were two groups that preferred RE over nuclear power. These groups were in the female group of segment 1 and segment 3, however on opposite ends of the age spectrum. The outcome reveals that younger and older females may be risk averse, thereby avoiding the nuclear option. The majority of respondents in segment 1 (being pro-renewable) are most likely in the childbearing period of their lives. Additionally, it may be due to females being disproportionately responsible for reproduction, hence they may be concerned about the consequences that nuclear power will have on their own reproductive bodies.

Females beyond 45 years old (in segment 3) may be seen as the protectors and providers over recent years. They have also been exposed to three of the most significant nuclear accidents dated in table 6. Being exposed to the effects and influences of such events may have altered their confident in the safe and reliable operation of nuclear power, therefore explaining their selection of RE over nuclear power. This is supported by Peart (2013) who states that the older one is, the more risk-averse they may be when choosing between possible gains, but more risk-seeking when choosing between losses (Peart, 2013).

The majority of the largest females group (segment 2) of respondents have supported nuclear over RE. This is enlightening and has challenged the modus operandi, due to previous thoughts that most females would be anti-nuclear. This outcome may be due to a generation that is able to think outside social norms and possibly be perceived as becoming more risk takers due to their independence, education and economic status that is progressively increasing. The increased support for nuclear may also be attributed to Eskom who aims at improving the female representation in this industry over the next 20 years, at least.

As the nuclear industry is male dominated, it may be the reason why there was sizeable support for nuclear as oppose to RE. Support for nuclear was evident in all male categories (segment 4, 5 and 6). Experts claim that males are genetically programmed to heed the old saying 'fortune favours the brave,' at work, making them twice as adventurous and carefree as their female colleagues (Trickey, 2012). Across all age categories, males displayed that they are challenging the boundaries of being technologically competitive with first world countries.

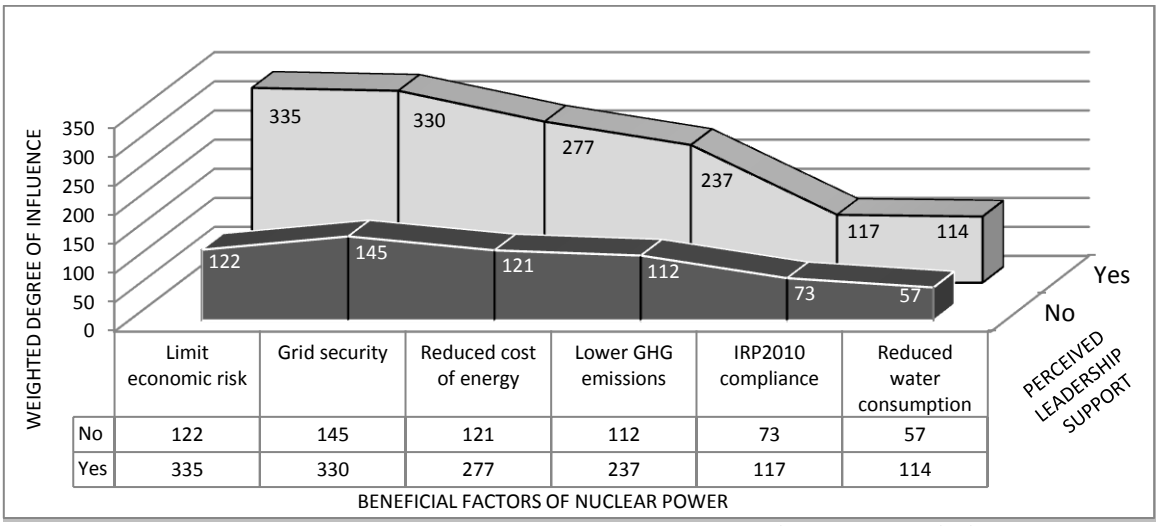
As the largest segment of males (segment 5) is between 31 - 45 years of age, it is also the only age category where their female colleagues share similar views. Similarities may be attributed to these respondents aiming at cementing their roles in their organisations, therefore being aggressive in their approach to business innovation.

It must be noted that relying exclusively on renewables may not be a realistic option given its intermittency problem. The wind turbines, for example, only generate power at about a third of their capacity, whereas NPP typically operate at more than 85 percent of capacity (Stover, 2014). The big question is whether either of these technologies, even if they joined forces, can be scaled up quickly enough to avert a climate disaster. With 4 of the 6 segments favouring nuclear power, it concludes that P3 has failed. The majority of Eskom employees **do not view** RE as a preferred energy source over nuclear power.

Proposition 4: Eskom employees believe they can influence members of the public on nuclear power, when they have the support of the organisations leadership.

This proposition evaluates Eskom's leadership and if respondents are able to influence society when having their support. Conclusions were made by tying the outcome of three interrelated questions. These were question 9 (ability to influence), question 12 (benefits of nuclear) and question 13b (leadership support). The results are depicted in figure 26 and tabulated in Annexure 10. The scores were generated using the formulae in section 4.11.

The group that had the support of their leadership relative to the nuclear benefits had weighted influential outcomes that were far greater than those who did not. Through the data examined, the "Yes" group indicated that they may positively influence society due to nuclear benefits of (1) diversity in the generation mix and thereby promoting economic growth. This was followed by (2) grid security to avoid load shedding and (3) a reduction in the cost of energy (operationally). Due to the order of nuclear benefits cited, respondents seem to be knowledgeable of the IRP2010 nuclear plans, which is set to increase the nuclear component in the energy mix from the current 4% (2010) to 13% by 2030 (DoE, 2011).



Please refer to section 4.11 for formulae to scores

Figure 26 – The Weighted Degree of influence perceived Leadership Support had on Nuclear Benefits

This group may have also recalled the load shedding saga that impacted the country's growth for at least 10 years to come, the result being limited developments in infrastructure and business. Additionally, respondents being inclined on technical matters may be mindful that nuclear power is ideally designed for base load (without load following), which may remedy RSA's close supply to demand ratio. Nuclear power has low operational costs and may have been factored in when considering tariff increases, particularly when one notices a cumulative increase of close to 250% from 2009 (Eskom, 2016).

Although RSA has a highly opinionated society with a pessimistic outlook on Eskom, this group has displayed courage and passion by being willing to positively influence society's nuclear perception, even with potentially strong opposition from the public. This is indicative of the respondent's organisational citizen behaviour, integrated with a strong commitment by their leadership to create a safe and coherent working environment.

Surprisingly, nuclear benefits remain consistent within the two groups (that did/did not have the supported of their leadership), but to a different order of magnitude. This reveals that there is consensus regarding nuclear benefits impact to employee influence. However, one must note that the weighted degree of influence reduced by more than 50% by those who did not have the support of their leadership (the "No" ribbon).

Eskom has taken strides by aligning itself to four pillars of leadership, which aim at exhibiting (1) good corporate governance, (2) leading with a heart of a servant, (3) creating a learning culture and (4) executing with disciplined execution. The outcome of this group's data reveals that there is still a lot of work to be done by Eskom Executives in aligning its business leadership to Eskom's leadership model. If soundly achieved, these change agents may educate society, improving societal support to the country's initiatives and address fear in the minds of the concerned pubic. It is therefore concluded that overall P4 remains true. The majority of Eskom employees believe that they **can influence** the public on business initiatives, if they have the support of the organisational leadership.

Proposition 5: Eskom employees perceive that the new nuclear build program will be well aligned to business best practices.

This proposition is with reference to compliance of the nuclear dependencies to business best practices. Conclusions were made by tying the outcome of three interrelated questions. These were question 2 (years of service), question 7 (procurement aligned to business best practices) and question 10 (dangers of the nuclear new build). The results are depicted in figure 27 and tabulated in Annexure 11. The higher the score an element achieved, the greater it's perceived compliance level to business best practices. The scores were generated using the formulae in section 4.11.

On average, most respondent categories have indicated that (6) Skills and Expertise, (5) Project Management and (4) Leadership may be well aligned to its relative compliance level and associated business best practice. The most compliant was that of skills and experience from respondents in the last service category (more than 5 years). Holding the most experience, this group may have considered initiatives from the Department of Public Enterprise to improve skills, by implementing a nuclear program termed Project 100, in preparation of the 9.6GW nuclear fleet.

This project is aimed at developing 100 robust nuclear operators in the pipeline for South Africa's nuclear new build program. Additionally, educational service providers have been contracted over the years, to ensure NPP staff are supported and adhere to leadership and project management business best practice.

There is consensus from all three service groups to the order of the lowest compliant dependencies in the nuclear new build program. It was (1) IRP2010/6 discrepancies, (2) Procurement tenders and (3) Nuclear Safety. Respondents citing discrepancies may attribute their view to the draft IRP2016 nuclear plans that have recently been released and shows significant changes, when compared to the IRP2010 report. This citing may be because respondents disagree with the approach and integrity of the reports, due to procedural non-adherence. The DOE is required to release an IRP every 3 years; however the draft IRP2016 is 3 years late and still not approved.

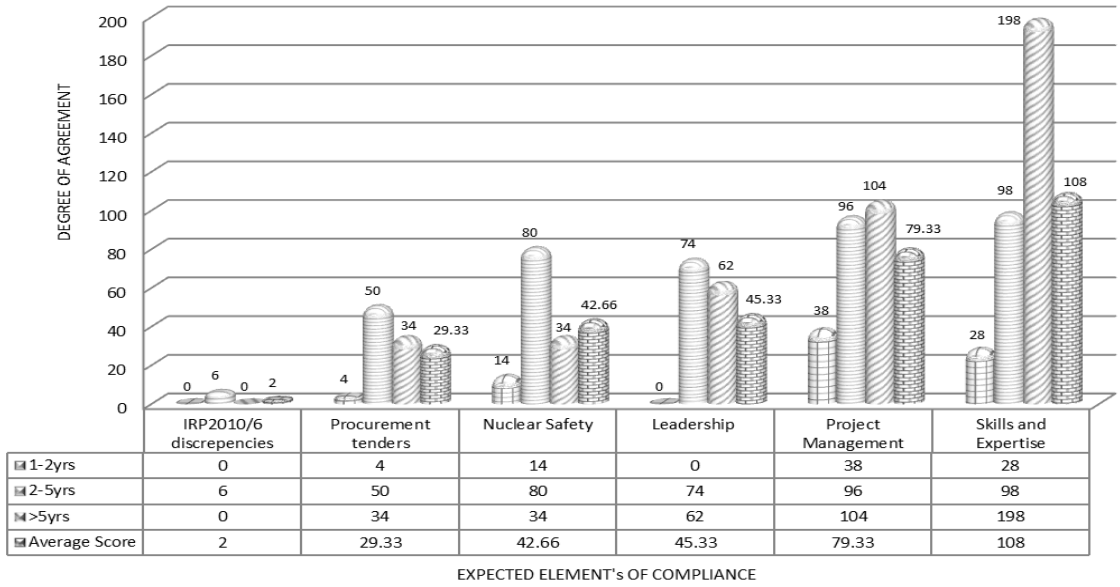


Figure 27 – Expected Compliance to Business Best Practices

Procurement tenders were cited as the second lowest compliant element. Eskom has been mandated by the DOE to manage the nuclear deal, with an estimated value of R1trn. This stated, MP's have contracting companies, possess political influence to tender decisions and Eskom is overseen by the governmental ministry termed the DPE. Therefore, respondents may have considered RSA's corruption perception index rank which is conducted by the Transparency International Agency. In 2016, RSA was ranked 64th out of 176 countries which are most likely to be vulnerable to corrupt practices.

Nuclear safety was cited as the third least compliant, particularly by the first group of respondents (1-2 years of service). This may be attributed to the lack of experience these employees possess. Consequently, it has been rated the third most compliant by the second group of respondents (2-3 years of service). Safety compliance may be dependent on which department one works for, as well as the level of exposure to nuclear safety systems. For example, a respondent actively involved in compiling a safety analysis report (SAR) would deem nuclear safety compliance higher than a respondent performing power factor correction in a NPP.

From the survey data, it is concluded that the majority of measured elements to P5 remains true. The majority of Eskom employees perceive that the nuclear deal **will be** aligned to business best practice. However, it must be noted that IRP discrepancies and corruption are potential risks to its compliance.

5.3 SUMMARY

In summary, the five propositions have been constructed to answer the research questions. Propositions P1and P2 proved to be true with P3 proved to be false, however in favour of nuclear power. The positivity around nuclear can be attributed to Eskom employees and the leadership taking their societal responsibility seriously, swimming upstream against the masses that have a negative view of the industry.

Propositions P4 and P5 had proved to be true. Points of observations to these propositions were that a minor group of respondents consciously decided to live further away from KNPS due to NPP safety concerns. However, most employees have a perception that they can influence society due to Leadership's support.

External political decisions that ingest IRP discrepancies and corruption are outside Eskom's sphere of control. These elements constrict respondents from creating positive perceptions about nuclear power, in line with the IRP2010 and draft IRP2016. Further discussion will take place in the next chapter.

Chapter 6

Further Discussion

This study investigated a narrow set of issues about the perceptions of Eskom employees relative to the nuclear industry in SA. The propositions to the study were informed by inter-related questions asked in the ESQ, with a summary of the results being in table 9.

It is observed that the majority of respondents with lower levels of responsibility were not aware of the content within the draft IRP2016, while Eskom's leadership and governmental agencies are perceived as being the two dominant role-players that influence and safeguard society from potential nuclear accidents.

It must be noted that past nuclear accidents have caused significant harm, hence the probability that respondents would shy away from the nuclear option. While some have done so, the majority still have faith in nuclear power, by selecting it over RE in order to drive towards RSA's low carbon emission commitment. Employees seem committed to the nuclear expansion in RSA, so much so that they are willing to become change agents and influence society for the betterment. They have indicated that they are twice as likely to do so if they had the support of Eskom's leadership. Although committed to nuclear power, there is uncertainty about governmental compliance to the IRP2010/6 and the integrity of the procurement practices. This once again hinges on the leadership of Eskom to uphold good corporate governance.

Table 9 – A Summary of the Oucomes to the Research Propositions

Proposition focus area	Outcome
IRP Support	Most respondents support and are knowledgeable of the IRP2010, as this report received the greatest support. Consequently, very few respondents are knowledgeable of the draft IRP2016 report, inclusive of the leadership of Eskom.
Nuclear Safety	Leadership, Governmental Agencies and Nuclear Technology are the most significant factors that influence respondents nuclear safety concerns by those who live within the 100km exclusion zone. Those that live outside the exclusion zone rated nuclear safety twice as important as those that live within such zone. There was consensus in terms of the top three most influential factors by both response groups.
Renewable Energy	The majority of females supported RE; however the age group of between 31-45 years of age supported nuclear. The majority of male age groups preferred nuclear over RE, with the age group of 31-45 years of age having the largest support. This is the same age group within the female category that supported nuclear.
Leadership support	Respondents felt that if they have their leaders support, they are twice as likely to influence society as those who did not. Informants for the nuclear benefits were in the order of Limiting Economic Risk, Grid Security and to Reduce Energy Costs.
Business compliance	The least compliance to business best practice was selected as being aligned to the IRP2010/6, followed by Procurement Tenders and thereafter Nuclear Safety. The most compliant was that of Skills and Expertise.

Chapter 7

Conclusion

This discussion started with the hypothesis that employees of the national electricity utility may have different and lesser concerns about the proposed new nuclear build than identified in a public survey two years ago. The evaluated perceptual outcomes determined if it may impact the IRP2010 and draft IRP2016 nuclear plans from becoming a reality. The conclusions made in this chapter provide significant advancements in achieving the answers to these questions.

7.1 CONCLUSION

Chapter 2 provided the building blocks for the study. Literature research on the perceptual decision making process was highlighted to be one of the most complex mechanisms of human thinking. It also pointed out the various factors and courses of action that intervene that produce its result. Literature further suggests that global environmental commitments are strong drivers for either renewable energy or nuclear power.

Chapter 3 discussed the theory development and set up the propositions to answer the research questions. Results of a 2011 public perception survey conducted by Necsa revealed that NPP's are a means to combat climate change and is a reliable source of energy. The hypothesis was tested through five (5) propositions that were similar to the 2011 study. The study took a two prong approach which was, (1) what NPP employees nuclear perception were, and (2) are they able and willing to influence society to create a positive nuclear perception. The propositions identified were knowledge of RSA's nuclear plans, nuclear safety, renewable energy, leadership support and compliance to business best practices.

The experimental protocols to test the propositions were identified in chapter 4. It was determined that survey questionnaires that made use of the Likert scale would analyse views of a population sample of 200 respondents. The data was collected via non-personal means to enhance the reliability and validity of the study. A pilot was conducted that tested all research protocol before it was implemented to the population sample.

The fundamental aspect of this study was in chapter 5, where the results and interpretation of the findings were discussed. Three way ANOVA and singular analysis was used to convert the masses of information into meaningful forms. A split of 60% employees and 40% management/leadership informed the propositions.

While 84% of respondents were aware of the IRP2010 nuclear plans, 62% were not aware of the IRP2016 nuclear plans. The majority of respondents (90%) of respondents were willing to become change agents. At a time when Eskom is experiencing changes at a strategic level, employees were willing to become ambassadors of change and attempt to make the IRP2010 nuclear plans a reality. The barriers identified that influenced public perception were questionable procurement practices and an unstable socio-political climate.

7.2 ANSWERING THE RESEARCH QUESTIONS

1. ***Which factors through identification and analysis appear to be most significant in determining the perceptions of employees about the proposed nuclear new build?***

From the literature survey and outcome of the propositions, the study discovered that nuclear safety and compliance to business best practices were the most critical aspects that influenced employee's nuclear perception. It also cited that these factors were strongly affected by the organisational leadership, who have the authority to effect changes for the betterment of NPP employees and society.

Deviations from business best practices and the support for renewable from select gender and age groups were limitations in creating widespread positive employee perceptions within the nuclear industry.

2. ***To what extent are the perceptions about nuclear power affected by the possible alternative or complementary to the renewable energy option?***

The reliance on renewable energy is a reasonably new competitor to nuclear power, which has been designed for base load applications. Of recent (between 5 -10 years) there have been a number of wind turbines that have been erected in RSA to serve societies energy needs. From this study, it has been revealed that there is support for nuclear power, but dependent on an employee's age and gender.

The majority of males, regardless of age category supported nuclear power. Within the female camp there are interesting observations made relative to age. The majority of female employees in the age category of 31-45 years supported nuclear power. However, females in the 21-30 years age group and beyond 45 years also supported renewables.

In summary, the majority of employees support nuclear power. However, the nuclear perception is altered and unfavourable within the abovementioned gender and age categories. Through literature, the selection of renewable energy over nuclear can be ascribed to the inherent nature for care and reproduction that this gender possesses.

3. ***To what extent does the leadership within Eskom influence their employee's nuclear perception?***

RSA's nuclear plans relative to its scale and timing are outlined in the IRP2010 and draft IRP2016 reports, compiled by the DOE. Although plans have been developed, the implementation is equally important. The DOE has decided that Eskom would be the owner operator and procurer of the next nuclear plant. Therefore Eskom's leadership have the responsibility to maneuver through socio-political and socio-economic barriers in order to meet this mandate.

This study revealed that through leadership support, employees perceived that they are twice as likely to positively influence the public's nuclear perception. On the other hand, employees who felt that they did not have their leaders support indicated that they were not empowered to educate society on matters relating to the nuclear industry.

4. ***Are Eskom employees confident that nuclear dependencies will be aligned to business best practices?***

From experience and the analysis of this study, it was found that business best practices have a significant role in corporate governance and supports the actions within a business process. From the six (6) identified elements of compliance that may aid the realisation of the nuclear new build program, employees are confident that skills and expertise, project management, leadership practices and nuclear safety will be aligned to business best practices.

Employees were least confident in RSA's compliance to the IRP2010/16 and the awarding of lucrative contracts through the procurement process that deviate from business best practices. These factors significantly impacted Eskom employee's nuclear perception. The delayed release of a revised IRP report, impractical timelines of past IRP's and the perceived political influence to the awarding of tenders have reduced the confidence levels of employees.

7.3 ASSESSING THE HYPOTHESIS

This study tested the hypothesises that *employees of the national electricity utility may have different and lesser concerns about the proposed new nuclear build than identified in a public survey two years ago.* The validity of the hypothesis was determined through four (4) research questions that focused on a narrow yet critical set of issues, which was progressively investigated. **The hypothesis proved to be valid, although there were shades of perceptual similarities between the public and Eskom employees, as originally thought.**

The conclusions drawn in the 2014 public's perception study revealed that "nuclear risk perception was not expected to effect the new nuclear development decision. However, the public was cited to have the potential to delay or halt nuclear projects if the perception of nuclear risk is not managed correctly". Corruption featured as the biggest impact on public perception (Hide, 2014).

After reviewing the perceptual outcomes, it is confirmed that both studies correlate in terms of corruption. However, the studies differ in terms of its priority, as Eskom employees cited procurement tender irregularities as the second biggest impact to nuclear perception.

In this study, the most significant dependency of the IRP2010 nuclear plan was discovered to be deviations and non-compliance to approved energy plans. This is mainly due to the outdated IRP2010 report that scheduled the operation of the 9.6GW (e) NPP's for 2023. With a construction period being between 8-10 years and numerous delays experienced, there is little employee confident in the IRP2010 nuclear plans becoming a reality, especially to the approved 2023 timeline. One of the critical observations made here within was the role of Eskom's leadership, and the influence they have in empowering employees in creating change that emanates from supporting the workforce.

In summary, fundamentally this study revealed that the public and Eskom staff do not have the same perception on nuclear power. Unlike the public perception study, if employee perception is mismanaged by Eskom leadership, it has the potential to delay the realisation of the 9.6GW NPP set out in the IPR2010. This is mainly due to concern over adherence to good corporate governance.

7.4 LIMITATIONS

It must be noted that after conducting this research and performing the analysis, it was learnt that the questions that were relative to a proposition could have been re-engineered to provide a clearer interpretation of the results. There may have also been more efficient means of performing data mining, due to the complexities that was experienced with three-way ANOVA and weighted score analysis.

Additionally, limiting the respondents to WC may not have been an ideal base to make sound judgment on. The nuclear decision will be felt by all of RSA; hence the inclusion of nuclear employees based at Eskom's head office - MegaWatt Park, who integrate with Necsa frequently, may have produced a different set of results. This may be because these staff members have a greater appreciation of the complexities a new nuclear build program has.

7.5. THE RESEARCH EXPERIENCE

It must be also noted that where the research journey started and where it finished had many twists, turns and speedbumps along the way. It extended from unpacking how to phrase survey questions correctly, holding meetings off campus during the time of the "# Fees Must Fall" protests, to finding suitable methods to depict the proposition outcomes on 3D graphs with 3 way ANOVA.

To this end, I have gained a tremendous amount of knowledge on how to apply the research process. It has also taught me perseverance from a personal standpoint by means of searching large data repositories for research relevant information, and overcoming obstacles that are on a researcher's path.

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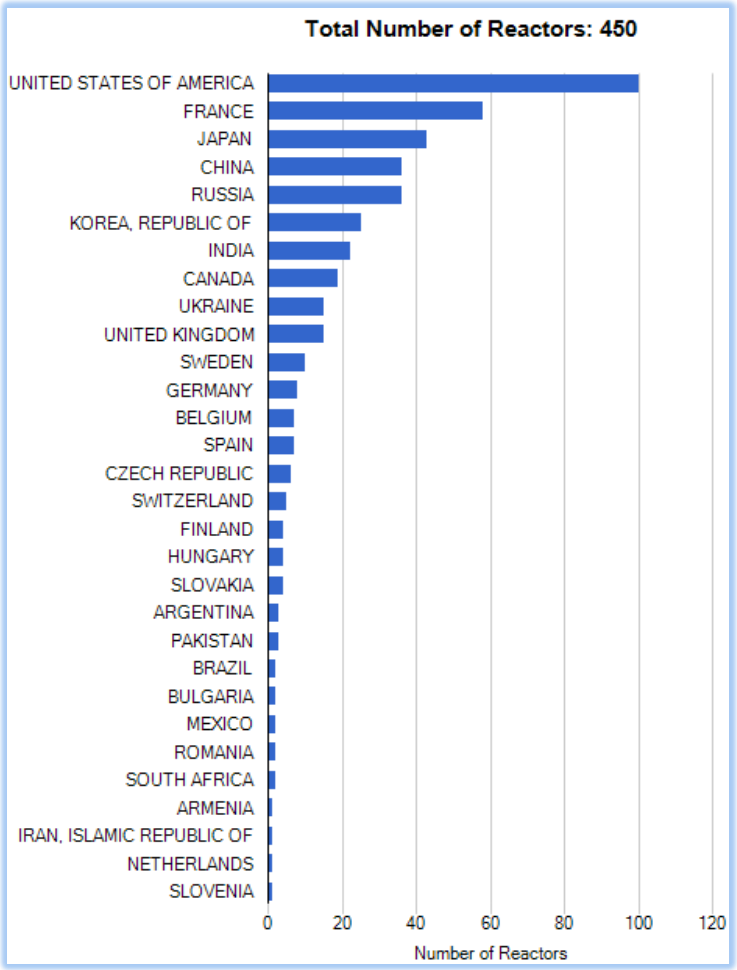
LIST OF ANNEXURES

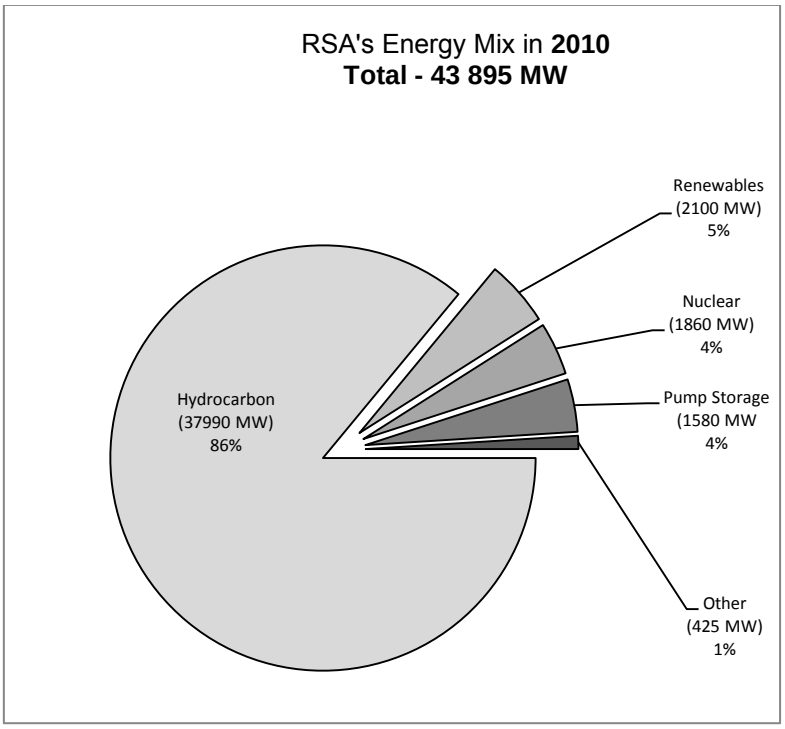
Annexure 1

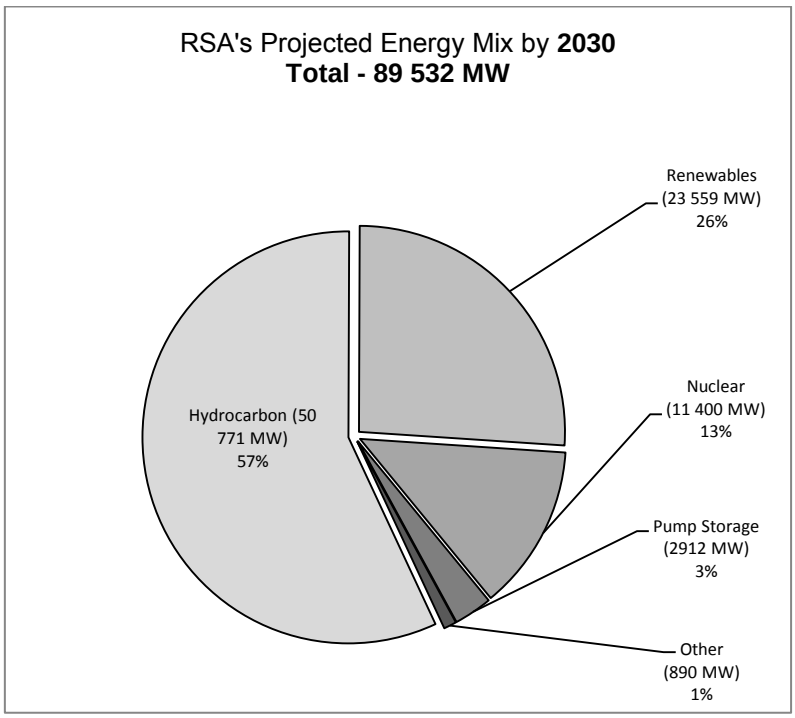
Nuclear Power Plants Location - Globally



Annexure 2

Integrated Resource Plan 2010 - 2030





Annexure 3
Employee Survey Questionnaire

Dear Eskom Guardian,

As a Master's in Engineering (M.Eng) student in Nuclear Power at UCT, I have embarked on the challenging task of completing a minor dissertation that forms part of the completion of my studies. Considering that the Integrated Resource Plan of 2016 (IRP2016) has not been finalised, the research area will be focused on determining the nuclear perception of Eskom employees in relation to the **IRP2010** that has been authorised by Eskom Management (consent form attached). This energy plan includes the provision for South Africa to commission a nuclear fleet with a capacity of 9.6 GW (e).

It would be appreciated if you could respond to the statements below as openly as possible. Kindly note that your participation is voluntary and feedback will be handled with confidentiality due to anonymity. It will require a total of 10 – 15 minutes of your time. Once complete, please insert your feedback into a non-translucent envelop and place it at your out-tray for the internal mailing department to collect.

Thank you for your time and participation in completing this valuable survey.

Kind regards,
Mukesh Chutri
(+27) 83 431 5660

☑ Tick the most appropriate box PLEASE NOTE THAT ALL INFORMATION ON THIS SURVEY QUESTIONNAIRE WILL BE KEPT STRICTLY CONFIDENTIAL	
1. What gender are you? ☐ Male ☐ Female	2. How many unbroken years of service do you have in Eskom? ☐ 12 - 24 months ☐ 25 – 60 months ☐ More than 60 months
3. What group do you represent? ☐ Below T13 ☐ Above T13	4. In what age category are you currently in? ☐ 21 - 30 years ☐ 31 - 45 years ☐ More than 45 years
5. Do you knowledgeable the following plans? IRP 2010 ☐ Yes ☐ No *Draft* IRP 2016 ☐ Yes ☐ No	6. Approximately how far do you reside from Koeberg Nuclear Power Station? ☐ Less than 100km ☐ More than 100km

7. Procurement of the nuclear new build will be well managed and aligned to business best practices.

☐ Strongly agree ☐ Agree ☐ Disagree ☐ Strongly disagree

8. Do you view Renewable Energy (RE) as an alternate energy source as opposed to nuclear power?

☐ Yes ☐ No

9. With respect to RSA nuclear expansion of 9.6GW that need to be added to the grid by 2030 (IRP2010), what degree of influence do you feel you have to impact the perceptions of the public in a positive light.

☐ No influence ☐ Limited Influence ☐ Strong Influence ☐ Very Strong Influence

For questions 10 - 12, please rank **any three** of the five/six options with 1 being the most significant (1–2–3).

10. In your opinion, of the potential dependencies to the nuclear new build program, which will be most aligned to their industry standards?

a)	Delay or failure to complete the project	[1] [2] [3]
b)	Corruption of involved parties	[1] [2] [3]
c)	A lack of leadership in Eskom to educate employees on the technology	[1] [2] [3]
d)	Nuclear power not being a safe generation option	[1] [2] [3]
e)	A lack of expertise and skills in South Africa to operate a new nuclear fleet	[1] [2] [3]
f)	Discrepancies between the IRP2010 and draft IRP2016	[1] [2] [3]

11. In your opinion, what are the risks of nuclear power mostly influenced by:

a)	Government, industry decision makers and spokespeople	[1] [2] [3]
b)	The safety and security measures in place to safeguard society from a nuclear accident	[1] [2] [3]
c)	The leadership that creates a learning culture in Eskom	[1] [2] [3]
d)	The renewable energy alternatives to nuclear power	[1] [2] [3]
e)	Job creation where the plants will be located	[1] [2] [3]

12. What do you think are the greatest benefits of building a nuclear fleet in South Africa?

a)	Grid security and means to improve Eskom's safety margin to avoid load shedding	[1] [2] [3]
b)	Environmental factors and lower CO_2 emissions (greenhouse gases)	[1] [2] [3]
c)	Diverse generation sources in the generation mix, thereby limiting economic risks	[1] [2] [3]
d)	Minimum cost of energy (operationally)	[1] [2] [3]
e)	Compliance to the approved IRP2010 energy plans	[1] [2] [3]
f)	Minimise water consumption	[1] [2] [3]

13. What is your stance/thoughts on the following:

a) Nuclear safety and radiation poisoning stemming from nuclear power plants from its impact on historical nuclear accidents.

☐ No concern ☐ Somewhat concerned ☐ Concerned ☐ Very concerned

b) Are you able to speak freely about nuclear power due to the support you receive from your manager?

☐ Yes ☐ No

14. The projected cost for the nuclear fleet is said to be in excess of R1 trillion. Considering the cost, do you believe the *approved IRP2010* and *draft IRP2016* nuclear plans meet South Africa's needs in the present political and economic conditions?

☐ Yes ☐ No ☐ I do not know

15. If you have any further comments to offer this researcher, please write them below, indicating to which topic they are relevant from (1) IRP2010, (2) Draft IRP2016, and/or (3) Other

1) IRP2010 2) *Draft* IRP2016 3) Other

Annexure 4

Relationships between Survey Questions

Proposition 1 **IPR2010 review** **(3-5-14)**	Proposition 2 **Nuclear Safety** **(6-11-13a)**	Proposition 3 **Renewable alternative** **(1-4-8)**	Proposition 4 **Leaderships influence (9-12-13b)**	Proposition 5 **Corruption** **(2-7-10)**
1a) Response to question 3 will be analysed against the response to question 5. *Sub-test:* Employee grading will be tested against the support employees have for the IRP2010 and draft IRP2016.	**2a)** Response to question 6 will be analysed against the response to question 11. *Sub-test:* An employee's residential location will be tested against the perceived risks of nuclear power.	**3a)** Response to question 1 will be analysed against the response to question 4. *Sub-test:* An employee's gender and age will be compared.	**4a)** Response to question 9 will be analysed against the response to question 12. *Sub-test:* Employee's ability to influence society on nuclear power will be compared against the benefits of nuclear power plants.	**5a)** Response to question 2 will be analysed against the response to question 7. *Sub-test:* An employee's years of service will be examined against their perception that the procurement deal will be aligned to business best practices.
1b) Response to question 5 will be analysed against the response to question 14 *Sub-test:* The support employees have for the IRP2010 and draft IRP2016 will be examined against the cost of nuclear within the RSA's context.	**2b)** Response to question 11 will be analysed against the response to question 13a. *Sub-test:* An employee's perceived risks of nuclear power will be examined against nuclear safety.	**3b)** Response to question 4 will be analysed against the response to question 8. *Sub-test:* The age of an employee effects their support/opposition to RE.	**4b)** Response to question 12 will be analysed against the response to question 13b. *Sub-test:* The benefit of nuclear power plants will be examined against Eskom's leadership supporting employees on speaking freely about nuclear power.	**5b)** Response to question 7 will be analysed against the response to question 10. *Sub-test:* An employee's perception that the procurement deal will be aligned to business best practices will be examined against the dangers of the nuclear build program.
1c) Response to question 14 will be analysed against the response to question 3 *Sub-test:* The cost of nuclear within the RSA's context will be examined against employee grading.	**2c)** Response to question 13a will be analysed against the response to question 6 *Sub-test:* Nuclear safety will be examined against an employee's residential location.	**3c)** Response to question 8 will be analysed against the response to question 1. *Sub-test:* The decision to support RE will be examined against an employee's gender.	**4c)** Response to question 13b will be analysed against the response to question 9 *Sub-test:* Eskom's employees speaking freely about nuclear power due to leadership supporting will be examined against an employee's ability to influence society's nuclear perception.	**5c)** Response to question 10 will be analysed against the response to question 2. *Sub-test:* The dangers of the nuclear build program will be examined against the employee years of service.

Annexure 5

Request to Conduct Research within Eskom – Western Cape

Eskom

To: The Eskom Senior Manager
62 Voortrekker Road
Bellville, Cape Town
Western Cape
7550

From: Mukesh Chutri
Tel: 021 915 9296
Fax: 086 538 4683
Cellular: 083 431 5660
Email: ChutriM@eskom.co.za

REQUEST TO CONDUCT A RESEARCH STUDY

To whom it may concern.

Dear Sir/Madam,

I hereby formally request permission to conduct a research study on "Eskom's Perception on Nuclear Power with respect to the IRP 2010". The distinct focus will be on the proposed Nuclear New Build Program that makes provision for 9600MW as part of the energy mix of RSA. The research will be comparative to public perception of the aforementioned research area conducted in 2015.

I would like to confirm that the target population of the study comprises of 30 representatives within each division, namely Generation, Transmission, Distribution and Customer Services within the Western Cape, respectively. The research consists of a short questionnaire of approximately twenty (20) questions which will take each participant approximately 15 minutes to complete.

The study will attempt to minimize the impact on operations to absolute zero, so I hereby wish for this request to be considered favourably. This research is attempted with the sole purpose to fulfil the requirements for the Masters in Engineering: Nuclear Power (UCT).

I hope you find this to your understanding and satisfaction.

Yours sincerely
Mukesh Chutri
Student No: CHTMIT003

Annexure 6

Consent to Conduct Research within Eskom – Western Cape

Eskom

To: Mukesh Chutri
62 Voortrekker Road
Bellville, Cape Town
Western Cape
7550

From: Rene Darby
Tel: 021 915 2804
Cellular: +27 84 675 3859
Email: DarbyRE@eskom.co.za

REQUEST GRANTED TO CONDUCT A RESEARCH STUDY

Dear Mukesh,

I, **Rene Darby** (unique number **0954947)** in my capacity as a Senior Manager within Eskom, hereby formally **grant permission** to **Mukesh Chutri** to conduct a research study on "Eskom's Perception on Nuclear Power with respect to the IRP 2010". The distinct focus will be on the proposed Nuclear New Build Program that makes provision for 9600MW as part of the energy mix of RSA. The research will be comparative to public perception of the aforementioned research area, undertaken in 2015.

I would like to confirm that the target population of your intended study will comprise of 30 representatives from each division of Eskom, namely Generation, Transmission, Distribution and Customer Services within the Western Cape, respectively. The research will consist of a short questionnaire of approximately twenty (20) questions which will take each participant approximately 15 minutes to complete.

Request is granted with the distinct understanding that the study will not impact operations within the Western Cape. In addition, the sole purpose of the research is to fulfil the requirements for the Masters in Engineering: Nuclear Power (UCT) and may not be the view of Eskom as a whole.

I wish you every success with the study and will await recommendations on your findings.

I trust you find this to your understanding and satisfaction.

Yours sincerely

.....

Rene Darby
Eskom Senior Manager
Western and Northern Cape

Annexure 7

Proposition 1

Q3: Grading	Below T13	Q14: IRP's meets RSA's energy needs		
		No	Don't Know	Yes
Q5: Knowledge of the following	IRP2010 Yes	38	8	51
	IRP2010 No	11	0	12
	IRP2016 Yes	10	3	16
	IRP2016 No	39	5	47

Q3: Grading	Above T13	Q14: IRP's meets RSA's energy needs		
		No	Don't Know	Yes
Q5: Knowledge of the following	IRP2010 Yes	30	0	41
	IRP2010 No	3	0	6
	IRP2016 Yes	21	0	26
	IRP2016 No	12	0	21

Annexure 8

Proposition 2

Q6: Living distance from KNPS	<100km	Rank	Q13a: How concerned are you about NPP safety and radiation exposure				Score	Total
			No Concern	Somewhat Concerned	Concerned	Very Concerned		
		Weight	0	1	2	4		
Q11: Nuclear risks are mostly influenced by:	Government, industry decision makers and spokespeople	1	15	33	9	0	51	**383**
		2	14	13	6	5	45	
		3	19	25	16	8	89	
	The safety and security measures in place to safeguard society from a nuclear accident	1	10	14	6	0	26	**269**
		2	12	26	8	4	58	
		3	17	23	11	1	49	
	The leadership that creates a learning culture in Eskom	1	21	29	13	13	107	**520**
		2	10	19	8	0	35	
		3	5	12	5	0	22	
	The renewable energy alternatives to nuclear power	1	7	4	7	0	18	**186**
		2	13	11	13	3	49	
		3	6	12	2	0	16	
	Job creation where the plants will be located	1	5	1	6	1	17	**172**
		2	9	12	6	2	32	
		3	11	10	7	4	40	

Q6: Living distance from KNPS	>100km	Rank	Q13a: How concerned are you about NPP safety and radiation exposure				Score	Total
			No Concern	Somewhat Concerned	Concerned	Very Concerned		
		Weight	0	1	2	4		
Q11: Nuclear risks are mostly influenced by:	Government, industry decision makers and spokespeople	1	1	0	0	0	1	**7**
		2	0	1	1	0	0	
		3	1	1	0	0	1	
	The safety and security measures in place to safeguard society from a nuclear accident	1	0	1	1	0	0	**16**
		2	0	0	0	0	0	
		3	1	2	1	0	1	
	The leadership that creates a learning culture in Eskom	1	0	2	0	0	0	**12**
		2	1	2	0	0	1	
		3	0	0	0	0	0	
	The renewable energy alternatives to nuclear power	1	0	0	0	0	0	**0**
		2	0	0	0	0	0	
		3	0	0	0	0	0	
	Job creation where the plants will be located	1	1	0	0	0	1	**0**
		2	1	0	0	0	1	
		3	0	0	0	0	0	

$Score = ((NC\ x\ 0) + (SC) + (C\ x\ 2) + (VC\ x\ 4))$
$Total = ((Score\ 1\ x\ 4) +\ \ (Scores\ 2\ x\ 2) + (Score\ 3))$

Annexure 9
Proposition 3

Q8: RE is an alternative to nuclear power?	**YES**	**Q1: Gender**	
		Female	Male
Q4: Age	21-30 years	14	3
	31-45 years	11	22
	≥ 45 years	19	24

Q8: RE is an alternative to nuclear power?	**NO**	**Q1: Gender**	
		Female	Male
Q4: Age	21-30 years	9	4
	31-45 years	21	34
	≥ 45 years	10	29

Annexure 10
Proposition 4

Q13b - Leadership support with respect to nuclear power		Rank	Q9: Degree of influence employees have to impact the public perception in a positive light?				Score	Total
Yes			No Influence	Limited Influence	Strong Influence	Very Strong Influence		
		Weight	0	1	2	4		
Q12: what are the benefits of nuclear power?	Limit economic risk	1	1	20	7	3	46	**335**
		2	4	10	0	14	66	
		3	5	25	8	6	65	
	Grid Security	1	5	22	7	10	76	**330**
		2	3	13	6	4	41	
		3	2	8	6	0	20	
	Reduced cost of energy	1	4	13	11	6	59	**277**
		2	2	9	13	0	35	
		3	2	8	3	4	30	
	Lower GHG emissions	1	3	12	7	0	26	**237**
		2	6	24	8	3	52	
		3	3	9	11	6	55	
	IRP2010 compliance	1	2	3	0	2	11	**117**
		2	1	12	5	1	26	
		3	1	8	0	6	32	
	Reduced water consumption	1	1	1	0	4	17	**114**
		2	0	3	0	3	15	
		3	3	13	4	3	33	

Q13b - Leadership support with respect to nuclear power		Rank	Q9: Degree of influence employees have to impact the public perception in a positive light?				Score	Total
No			No Influence	Limited Influence	Strong Influence	Very Strong Influence		
		Weight	0	1	2	4		
Q12: what are the benefits of nuclear power?	Grid Security	1	2	10	3	3	28	**145**
		2	0	8	0	4	24	
		3	0	7	3	0	13	
	Limit economic risk	1	0	4	6	1	20	**122**
		2	1	1	0	6	25	
		3	1	6	3	0	12	
	Reduced cost of energy	1	1	3	2	4	23	**121**
		2	1	3	6	0	15	
		3	1	2	2	4	22	
	Lower GHG emissions	1	0	7	3	0	13	**112**
		2	2	10	6	1	26	
		3	0	3	3	3	21	
	IRP2010 compliance	1	1	1	0	3	13	**73**
		2	0	2	1	0	4	
		3	2	4	3	4	26	
	Reduced water consumption	1	0	0	0	2	8	**57**
		2	0	1	1	2	11	
		3	0	3	0	2	11	

$Score = ((NI\ x\ 0) + (LI) + (SI\ x\ 2) + (VSI\ x\ 4))$
$Total = ((Score\ 1\ x\ 3) + \ (Scores\ 2\ x\ 2) + (Score\ 3))$

Annexure 11
Proposition 5

Q2 –Years of service		Rank	Q7: Nuclear procurement will be managed to business best practices				Score	Total
1-2 years			Strongly Disagree	Disagree	Agree	Strongly Agree		
		Weight	-2	-1	1	2		
Q10: Relative Dangers of Nuclear Power in RSA	Delay or failure to complete the project	1	0	0	1	3	7	38
		2	0	0	1	2	5	
		3	0	0	0	0	0	
	A lack of expertise to implement the nuclear new build in RSA	1	1	0	3	3	7	28
		2	0	0	0	0	0	
		3	0	0	0	0	0	
	Nuclear Power not being a safe generation option	1	0	0	1	0	1	14
		2	0	0	3	1	5	
		3	0	0	0	0	0	
	Corruption of involved parties	1	1	0	1	0	-1	4
		2	2	0	2	3	4	
		3	0	0	0	0	0	
	A lack of leadership to educate employees	1	0	0	0	0	0	0
		2	0	0	0	0	0	
		3	0	0	0	0	0	
	Discrepancies between the IRP2010 and IRP2016	1	0	0	0	0	0	0
		2	0	0	0	0	0	
		3	0	0	0	0	0	

Q2 –Years of service		Rank	Q7: Nuclear procurement will be managed to business best practices				Score	Total
>2 - <5 years			Strongly Disagree	Disagree	Agree	Strongly Agree		
		Weight	-2	-1	1	2		
Q10: Relative Dangers of Nuclear Power in RSA	A lack of expertise to implement the nuclear new build in RSA	1	0	15	10	13	21	98
		2	0	2	1	4	7	
		3	0	0	0	0	0	
	Delay or failure to complete the project	1	0	3	8	7	19	96
		2	0	3	5	4	10	
		3	0	0	0	0	0	
	Nuclear Power not being a safe generation option	1	0	2	11	4	17	80
		2	0	0	0	3	6	
		3	0	0	0	0	0	
	A lack of leadership to educate employees	1	0	2	3	3	7	74
		2	0	1	8	8	23	
		3	0	0	0	0	0	
	Corruption of involved parties	1	0	1	2	0	1	50
		2	0	18	23	9	23	
		3	0	0	0	0	0	
	Discrepancies between the IRP2010 and IRP2016	1	0	3	1	0	-2	-6
		2	0	0	1	0	1	
		3	0	0	0	0	0	

Q2 –Years of service		Rank	Q7: Nuclear procurement will be managed to business best practices				Score	Total
≥5 years			Strongly Disagree	Disagree	Agree	Strongly Agree		
		Weight	-2	-1	1	2		
Q10: Relative Dangers of Nuclear Power in RSA	A lack of expertise to implement the nuclear new build in RSA	1	3	13	23	18	40	198
		2	2	2	5	10	19	
		3	0	0	0	0	0	
	Delay or failure to complete the project	1	0	5	4	11	21	104
		2	0	6	6	5	10	
		3	0	0	0	0	0	
	A lack of leadership to educate employees	1	0	1	1	2	4	62
		2	0	1	8	8	23	
		3	0	0	0	0	0	
	Corruption of involved parties	1	1	1	2	0	-1	34
		2	1	12	15	9	19	
		3	0	0	0	0	0	
	Nuclear Power not being a safe generation option	1	0	2	7	1	7	34
		2	0	1	4	0	3	
		3	0	0	0	0	0	
	Discrepancies between the IRP2010 and IRP2016	1	0	1	0	1	1	0
		2	1	0	0	0	-2	
		3	0	0	0	0	0	

$Score = ((SD\ x\ (-2)) + (D\ x\ (-1)) + A + (SA\ x\ (2)))$

$Total = ((\ Score\ 1\ x\ 4) + (\ Score\ 2\ x\ 2) + (Score\ 3))$