

**AN ASSESSMENT OF SELECTED STAKEHOLDERS' ATTITUDES
TOWARDS, AND PERCEPTIONS TO THE CONSTRUCTION OF NEW
NUCLEAR POWER PLANTS IN THE WESTERN AND EASTERN CAPE
REGIONS, SOUTH AFRICA.**

Submitted in partial fulfilment of the requirements for the degree of

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Declaration

I, the undersigned do certify that the content of this dissertation is my own original work and was not previously submitted to any other university for a degree either in part or in its entirety.

Signature

Mandla Mbusi

Date.....

Dedication

I dedicate this work to:

- My heavenly Father whose indwelling spirit is within me ever since and forever
- My late Mother, Mrs Noblom Constance Mbusi, intombi kaNkebi kwa Platyi, Yesu langa lomphfumlo akumnyama xa ukhoyo.

“Eternal rest grant unto her oh Lord, and let perpetual light shine upon her” we shall meet again.

Acknowledgments

As a boundary-spanning function in organizations, public relations can enhance strategic decision-making by providing relevant information to inform management decision-making. The conceptualisation of this study was motivated by this principle.

I am eternally grateful to Professor Nirvana Bechan, one of the best teachers in the field of public relations education. I wanted to learn from the best — and I have. Her inspirational leadership, brilliant understanding of our discipline, and demand for attention to detail made me a better student of public relations. Her knowledge has guided me as a professional.

Dlabazana, Njiyela, Dr Mgwebi may even the spirit of the departed return to bless you, for “you are a ladder the young people use for reaching up, you expect no reward other than peace of mind, that rare thing arising from being useful”. Enkosi.

DoE - Department of Energy

EIA – energy Information Agency

EIA – Environmental Impact Assessment

IRP – Integrated Resource Plan

NEA – Nuclear Energy Agency

NIABY – Not in anyone’s Backyard

NIMBY - Not In My Backyard

OECD - Organisation for Economic Co-operation and Development

CHAPTER ONE: INTRODUCTION	3
1.1. Background to this study	3
1.2. Problem Statement.....	7
1.3. Aim of the study.....	8
1.4. Research Questions	9
CHAPTER TWO: LITERATURE REVIEW	10
2.1. The early 1970's and the Three Miles Island	10
2.2. Chernobyl to pre-Fukushima	11
2.3. International Trends	11
2.4. Public risk perception of nuclear power.....	12
2.5. Theoretical Framework	13
2.6. Public relations paradigm associated with this study: The Strategic Management, Behavioural Paradigm	15
CHAPTER THREE: METHODOLOGY.....	19
3.1 Choice of survey method	19
3.2 Study sites.....	19
3.3 Ethical considerations	20
3.4 Proposed construction sites	20
3.5 Questionnaire design	21

3.6 Data analysis.....	22
CHAPTER FOUR: RESULTS	24
4.1 Demographic details of respondents	24
4.2 Knowledge about energy generation.....	27
4.3 Beliefs and opinions about aspects of nuclear energy	28
4.4 Attitudes towards the construction of power plants	34
4.5 Attitudes towards the construction of nuclear power plants.....	41
4.6 Perceptions about the effects of nuclear power plant construction.....	47
4.7 Drivers behind public preferences for nuclear energy	51
CHAPTER FIVE: DISCUSSION.....	55
5.1. Background variables.....	56
5.2. Knowledge and preferences for energy generation.....	57
5.3. Knowledge and perceptions about nuclear energy	57
5.4. Perceptions about the effects of construction.....	58
5.5. Conclusions and Recommendations	58
5.6. Recommendations for further study	59
REFERENCES.....	61

CHAPTER ONE: INTRODUCTION

The increased demand for electricity has persuaded a number of countries world-wide to re-evaluate their strategies on energy production. These strategies largely focus on expanding the power generation capacity and adjustment of the amount of energy generated from various sources, in the light of global climate change, security of energy supply and fossil fuel price volatility (OECD report, 2010). In the United States of America (USA), for example, according to Ansolabehere & Konisky (2009), a projection of 40% rise in electricity demand is forecast over the next three decades presenting a need for diversifying the energy mix and expanding power generation capacity.

The need for expanding energy supply is increasingly becoming more pronounced in a number of developing countries as well. The demand for energy warrants generation of energy from a variety of sources: coal-fired power plants, gas turbines, wind farms and nuclear power facilities. In order to transmit electricity efficiently these facilities need to be located near residential centres. The challenges associated with the construction of such centres are multi-fold.

The option of nuclear power generation is a very divisive issue with as many opponents as supporters, and it has certainly been put back on the agenda in many countries including China, India and Russia, with over 250 nuclear projects in the pipeline globally. The construction of nuclear power plants is often masked with opposition from the public resulting in huge delays in completing the projects yet, nuclear energy is considered as one of the most comprehensive and cost-effective generating options which has the potential to reduce carbon dioxide emissions, meet the ever-increasing demand for electricity as well as making a crucial contribution to energy independence and security of supply.

1.1. Background to this study

In an effort to meet the envisaged electricity demands in the long term, the South African Government passed the Electricity Regulation Act, 2006 (Act no. 4 of 2006)

which provides a framework for addressing the severe shortage of electricity and planning for new power generation capacity. Emanating from this Act, the Department of Energy (DoE) was mandated to ensure increased supply that will meet the increasing energy demands in South Africa. Consequently, the DoE developed a strategic plan for meeting the demands of the future. The plan is fully described in the department's strategic document for increasing electricity capacity in the country over a twenty-year period, the Integrated Resource Plan (IRP). The IRP provides an indication of the country's electricity demand, the required supply to meet this demand and also provides supply cost implications. However, the strategy does not provide a comprehensive plan for the overall energy needs of the country nor does it deal with the wider infrastructure requirements.

Electricity consumption in South Africa (SA) has been growing rapidly since the 1980's and the country is geared for the diversification of its energy generation options in order to increase the supply and minimise costs. Currently, the total installed electricity generating capacity is mostly from fossil fuel, and largely under the control of the state utility Eskom, a parastatal mandated by an Act of Parliament, the Eskom Conversion Act and the Companies Act, 1973 (Act No. 61 of 1973). Based on Eskom's projections, there is a requirement of more than 40 000 Megawatts (MW) of new electricity generating capacity over the next 20 years. It is Eskom's intention to investigate the feasibility of pursuing up to 20 000 MW of nuclear power generating capacity. To this end, Eskom is planning for the construction of additional base-load generation capacity in parallel with energy efficiency advancements and the development of alternative energy generation capacity and to deliver on the IRP 2010 – 2030.

According to Eskom's plan, the required additional generating capacity will come from a variety of energy sources, such as coal, liquid fuels, gas turbines, natural gas, uranium (nuclear), hydro and pumped storage schemes, wind and solar energy. Currently over 1600MW is generated from nuclear power and the target is to produce at least 17% of the energy mix from nuclear power by 2030 (Eskom Intelligence Brief: 29 January

2010). At least three sites have been selected for constructing and developing nuclear power plants; two in the Western Cape and one in the Eastern Cape. These sites are all in close proximity to residential and/or commercial sites and are shown in Figure 1(a) and (b) below.

Proposed site 1: Duynfontein is situated adjacent and to the north of the existing Koeberg Nuclear Power Station on the Cape West Coast, approximately 35 km north of Cape Town. The site falls within the existing Eskom-owned property, which includes a nature reserve. Koeberg Nuclear Power Station is surrounded by densely populated urban communities, 15 kilometres east (Atlantis) and 7 kilometres west (Table View).

Proposed site 2: Bantamsklip is situated along the southern part of the Western Cape coast, mid-way between Danger and Quoin Points. The site is utilised for flower harvesting and fishing.

Proposed site 3: Thyspunt is situated on the Eastern Cape coast between Oyster Bay and St. Francis Bay. The site identified for nuclear plant construction is currently vacant, but there are a number of houses on the adjacent properties, outside the proposed nuclear power station. Oyster Bay (Oesterbaai) is a small village and lies approximately 3,5 km to the west of the existing Thyspunt nuclear site. It includes an informal settlement and low cost housing estate Umzamowethu. In 2002, approximately 90

people were permanently resident in Oyster Bay. It is also a holiday destination peaking to 2000 occupants during the holiday seasons.

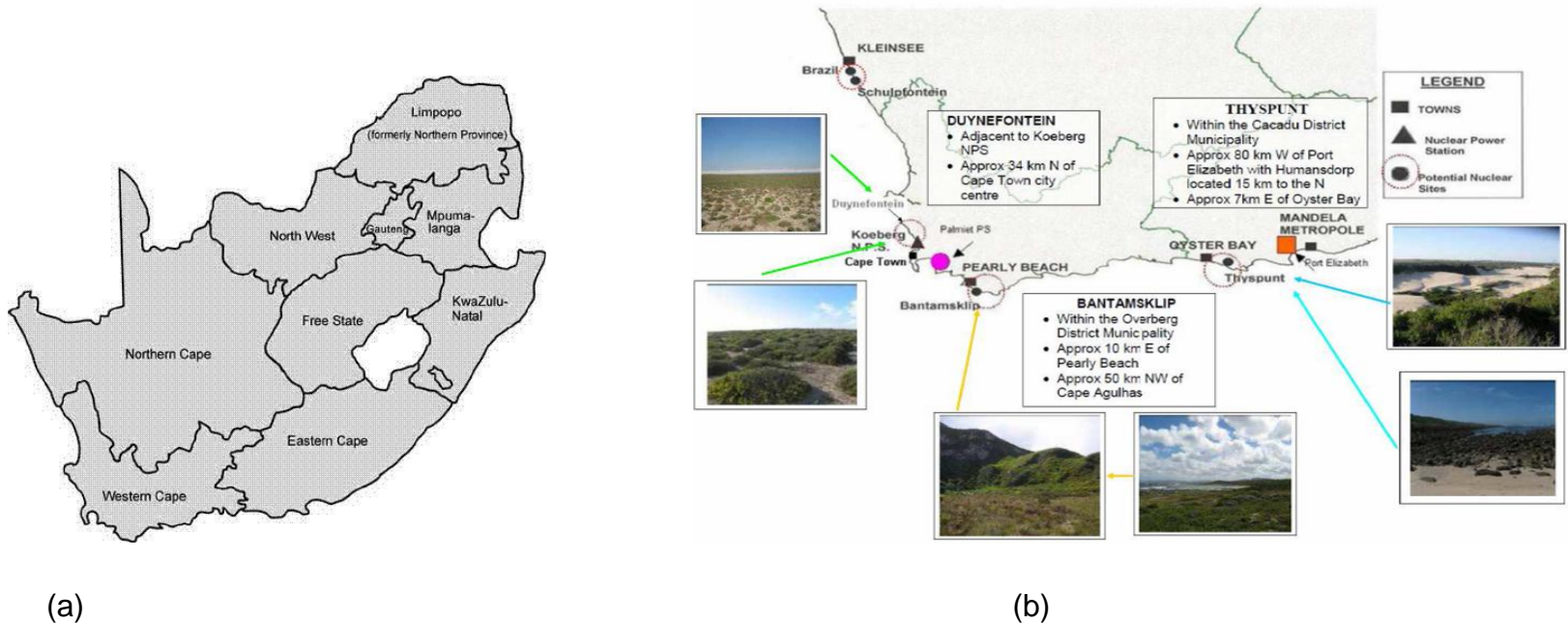


Figure 1. (a) Map of South Africa showing the provinces and (b) the detailed geographical location of the proposed construction sites in the Western Cape region of South Africa (t Draft Environmental Impact Assessment Report, Eskom, 2010).

1.2. Problem Statement

Public concern about nuclear energy has been in the increase since the 1970's. As a consequence, it is now well recognized that the future of nuclear energy will not only depend on technical and economic factors, but that public acceptability will play a crucial role in its long-term future. In their study of trends in public reactions to nuclear power in various countries, on public beliefs and attitudes to nuclear power in general, and to the building of a nuclear power plant near to one's home, Van der Pligt, Eiser and Spear (1984), showed that the qualitative aspects of possible risks of nuclear energy play an important role in the public's perception of this energy option. They also found that differences in public reaction is also related to more general beliefs and values, such as emphasis on economic versus social priorities, attitudes to technology and environmental concern. Similarly, a number of studies in the US and Europe have also reiterated that the opinions and attitudes to power plant construction depend on perceptions of environmental harm and cost (Ansolabehere & Konisky, 2009).

In developed countries such as the United States and Europe, it is also clear that the construction of nuclear power plants requires public acceptance of this energy source. Surveys conducted about public attitudes towards energy in general and nuclear power in particular show that a majority of Americans and Europeans oppose building new nuclear power plants to meet future energy needs. A report by (Ansolabehere, Deutch, Driscoll, Gray, Holdren, Joskow, Lester, Moniz, Todreaz, 2003), from a study where they conducted survey assessing the basis of this attitude amongst the US public showed that the U.S. public's attitudes are informed almost entirely by their perceptions of the technology, rather than by politics or by demographics such as income, education and gender and the public's views on nuclear waste, safety, and costs are critical to their judgments about the future deployment of nuclear energy. No difference was observed in support for building more nuclear power plants between those who are very concerned about global warming and those who are not. Recommendations from this study were the introduction of public education to help improve the understanding about

the link between global warming, fossil fuel usage, and the need for low-carbon energy sources.

While the general public views and attitudes about nuclear plant construction are associated with environmental harm, safety and cost, much opposition has been observed from affected stakeholders residing near proposed waste disposal and nuclear power plant sites. These developments have been subjected to “Not In My Backyard” (NIMBY) and ‘not in anyone’s backyard” (NIABY) phenomena.

However, support for the expansion and development of nuclear plants has been noticed in areas where the residents have already experienced the benefits of nuclear energy and familiar with the plants. In 2007, a study on attitudes of people living close to US nuclear power plants showed that the majority of the people already near nuclear plants were supportive of construction and placing new reactors near their homes. The residents that had positive views of nuclear energy were familiar with the plant and knowledgeable of the benefits to the community.

In South Africa, the proposed areas for the sitting of the nuclear plants present a variation of dynamics from residents previously exposed to and familiar with nuclear plants, tourists who may or may not have been familiar with power plants, to those who have never been exposed to nuclear plants. All of these groups present a further complexity of varying socio-economic status, education and knowledge. It therefore becomes important to solicit public opinion and support from all affected groups for the construction of these plants in order to gain an understanding of the issues and level of support to construction. Such information is valuable for the implementation of the projects and to avoid opposition and delays in construction.

1.3. Aim of the study

The aim of the study is to determine and assess the perceived benefits and risks associated with constructing a new nuclear power station in close proximity to residents' establishments in the Eastern and Western Cape regions, in order to gather information

on the stakeholders' understanding of nuclear energy use in these regions and to further contribute to the formulation and design of intervention strategies that may be needed in delivering on the electricity expansion strategy as outlined in the IRP 2010- 2030.

1.4. Research Questions

The central research question to be addressed in this study is: To what extent are Eastern and Western Cape residents currently residing near a nuclear energy construction site conversant about risks and benefits associated with nuclear energy generation?

1.5.1. Research Objectives

This study aims to:

- Determine the level of awareness of energy generation options in a population of current residents in selected regions in the EC and WC
- Compare public attitudes towards building a nuclear power plant locally to attitudes toward nuclear energy in general
- Assess the perception of respondents about the short and long term impacts or consequences of construction of a nuclear station in close proximity to the place of residence
- Determine the level of support for the construction of a nuclear power plant in the identified sites

CHAPTER TWO: LITERATURE REVIEW

Literature has shown that public views and opinions about nuclear have been shifting throughout history since the pre 1960's. A number of incidents have contributed to the manner in which people formed their opinions, either for or against nuclear energy. In many instances, particularly in the developed world, the media played a crucial role in relaying messages to the public. In the earlier years from the 1960's, most of the information on public opinion has been derived from studies conducted in Europe and the United States.

2.3. The early the 1960's including the Hiroshima incident

In 1960, there were only 17 nuclear power plants in operation in four countries: France, the US, Russia and the United Kingdom (Char N.L. and Csik B. J, 1987). In the US, the major news during this time period in nuclear energy awareness was the coverage of the nuclear bomb that caused devastation in Hiroshima in the 1960's. The use of nuclear energy itself was not prominent. Most people dissociated the bomb from nuclear energy, as a result, there was no major public opinion for or against nuclear energy. In Britain, however, the issue of public concern about nuclear was recognised as early as 1956 and mainly was about reactor safety, radiation hazards and mistrust of nuclear authorities (Welsh I, 1993).

2.1. The early 1970's and the Three Miles Island

It was during this period that the initial antinuclear discourse was noticed. In France, various pro-nuclear campaigns were initiated in order to solicit public acceptance of nuclear. In the United States, political and media influence was on the rise as the country pushed for reduction in America's dependence on foreign sources of energy such as the Arab oil in the 1970's. During this time, nuclear energy, domestic oil, natural gas, and coal were presented as feasible alternatives to this foreign dependence. In many countries, there was a significant split in public opinion and the increased public concern occurred because of the association of nuclear with the bomb, danger, secrecy,

stories about invisible radiation and fear of the unknown. Adding to the debate that supported anti-nuclear lobbyists, the major Three Miles Island (TMI) nuclear disaster occurred in 1979. The anti-nuclear lobbyists were in support of saving the environment from harm; whilst the proponents for nuclear energy focused on nuclear power's relatively low carbon emissions.

2.2. Chernobyl to pre-Fukushima

In 1986, the world experienced another major nuclear disaster with the Chernobyl in Ukraine. This raised the concerns from the public. The *NIMBY* (Not In My BackYard) attitude towards the building of nuclear reactors emerged strongly whereby proponents accept a need for nuclear energy plants to be built, but not when it is in or near where they live.

2.3. International Trends

Eurobarometers are used to measure European public opinion regarding issues relevant to Europe and other developed countries. In the 2007 Eurobarometers published by the Nuclear Energy Agency (NEA), some interesting trends appear that reflect US opinion. When asked what the biggest issue is related to energy, these polls showed that 8% answered nuclear energy, while the majority was held by cost and foreign dependence. However, price and the security of supply are more important than nuclear energy in all European countries polled.

When asked whether they favor or oppose the construction of new nuclear power plants, 20% were in support, while 37% opposed the construction.

In the European Union, it is clear that an increase in nuclear education leads to an increase in support of nuclear energy. In addition, an interesting case study outlined the importance of trust in nuclear power initiatives. In the United Kingdom, where nuclear power generates 20% of the country's power, the government rallied the public to support nuclear energy through transparency and trust initiatives. The Committee on Radioactive Waste Management was appointed in November 2003 and has been

involved in the development of primary and secondary school curricula and held public question and answer sessions. Through this initiative, there has been a significant increase in public support for nuclear energy, measured by the number of policies supported by the general public.

2.4. Public risk perception of nuclear power

A number of factors are associated with the NIMBY factor. The level of significance of these factors vary from location to location. In no particular order, these include, risk perception, trust and political association. All of these contribute in one way or another to shaping attitudes towards nuclear.

In the social sciences, studies on risk perception of nuclear energy are aligned with risk theory, social risk assessment and institutional responses to risk evaluation. This is based on the view that the general public view risks differently from experts and these views have been found to be very systematic and rational. A number of studies have shown that in different parts of the world, public's views and perceptions of nuclear energy risks have been very consistent, contrary to experts' views on this matter. The general public generally links nuclear energy to its effects on many facets of their lives. They do not base their perceptions on scientific or technical information. Over the years, since the emergence of the NIMBY phenomenon, studies by Slovic et.al., have shown striking differences between what they termed "lay risk perceptions" and "expert risk perceptions" of nuclear energy. The determinants of these differences are based on the fact that the general public draw their concern on broader issues. In many instances, the highly ranked risks are judged as "unknown, uncontrollable, dreadful, catastrophic and likely to affect future generations"(Slovic, 1987).

A number of studies have identified other factors that shape risk perception of the public to nuclear energy (Slovic, P, 1987; Slovic P, Fischhoff, B; Liechtenstein S. 1985.; Huang L , Zhou Y, Han Y, Hammit J, Bi J and Liu Y, 2013; . **Gender** differences have been noticed in concern regarding nuclear energy, with women more concerned about nuclear

energy than men (Freudenburg and Davidson, 2007). The reasons for these are not only because of greater aversion to risks amongst females nor the effect that radiation has on childbearing, but is also likely associated with the social association of women's role as linked to the well-being of future generations (McGregor, 2006).

Political association has been found to be an important factor in risk communication and risk perception. Although the media plays a very significant role and probably the most common means of communication risks associated with nuclear, literature shows that, knowledge, such as scientific or industry information, has no consistent effect on risk perception. This has been quoted by Slovic et al, "attitudes towards nuclear are conditioned by the interplay of psychological, social, cultural, historical and political factors that cannot be easily changed by public information of political campaigns" (Slovic, 2000. pg 98).

In many studies, **trust** has been shown to be an important determinant of public perception and attitude to nuclear energy.

2.5. Theoretical Framework

It is known that *beliefs*, *attitudes*, and *behaviours* are different and distinct variables, with different determinants, but with stable and systematic relationships among them. In the past, *attitudes* had been used in a generic sense to refer not only to a person's affective, or evaluative feelings about some object, but also to *beliefs* about the object as well as *behavioural intentions* with respect to the object.

By definition, an *attitude* is a bipolar evaluative judgement of the object. It is essentially a subjective judgement that one likes or dislikes the object, that it is good or bad, that he feels favourable or unfavourable towards it. One may have attitudes towards concepts, people, institutions, events, behaviours, outcomes (from Fishbein and Ajzen, 1975)

A number of studies have examined public attitudes toward nuclear, following the realisation that development and utilization of nuclear energy require public acceptance

and cooperation. Most of these studies are based on the expectancy-value model of attitude formation proposed by Fishbein and his colleagues (Fishbein 1963; Fishbein and Hunter, 1964). According to this model, attitudes are analysed in relation to the anticipated consequences accompanying the attitude object. Studies conducted using this model show that individual attitudes are based on perceptions of a number of potential negative and positive aspects of nuclear energy. Furthermore, these studies have shown that separate dimensions of the nuclear energy issue seem differentially salient for different groups. For example, in one study, Otway, Mauer and Thomas (1978), indicated that four factors associated with attitude groups:-Psychological Risk, Economic and Technological Benefits, Socio-political Risk and Environmental and Physical Risks. Subgroups of the most positive and most negative toward nuclear energy were further compared to determine the contribution of the factors to their attitudes. For the positive group who were pronuclear, Economic and Technical benefit Factor made the most contribution, whereas, for the anti-nuclear group, the risk factors were more significant.

Other models describing public acceptance or public attitude of nuclear energy (Ohnishi, 1991, 1995; Yamagata and Kanda, 1998) have been proposed. A statistical model to verify the relationships between perceptions and acceptance was developed by Yamagata. In this study, perception analysis made it possible to construct two main variables, perceived risk and perceived benefit. In the same context, a judgment model was developed to identify influential factors that improve the acceptance of nuclear energy. These models make explicit the significant relationships among aspects and enable the formulation of empirically testable propositions regarding the nature of these relationships (Choi, Kim and Lee, 2000). All of these methods use multiple regression analyses to correlate the relationship between variables.

These studies have largely focused on public attitudes toward nuclear energy in general. From the late 1970's onwards, a number of studies were conducted on public attitude toward the construction of nuclear power plants in one's locality, and were

based on the Fishbein expectancy-value model (Hughey, Lounsbury, Sundtrom and Mattingly, 1983; Sundtrom, Lounsbury, Schuller, Fowler and Mattingly, 1977). They revealed the importance of expected economic benefits and possible health and environmental risk concerns about the construction and operation of a nuclear power plant in one's locality. Similarly, based on the expectancy value model, a study of attitudes and salience towards the construction nuclear power station in one's locality by Van der Pligt, Eiser and Spears, (1986) showed that the Psychological Risks were more differentially perceived by the attitude groups and were the best predictor of the individual attitudes.

In this study, the relationship between local people's attitudes toward the construction of a nuclear power station in their locality, their beliefs about the consequences, and their perceptions of the importance of these consequences was conducted. The results could not be predicted and will be used in guiding management decisions on best approaches to the management of stakeholder expectations and attitudes towards the proposed construction of nuclear plants in South Africa. The study is part of a strategic approach in communications and stakeholder relationship management within Eskom. It is therefore a public relations approach and grounded in theories and paradigms of public relations management in organisations.

2.6. Public relations paradigm associated with this study: The Strategic Management, Behavioural Paradigm

This study is of particular interest and relevance to Eskom as it directly relates to the organisation's public relations approach. As an organisation, Eskom supports a public relations strategy whereby the participation of internal and external stakeholders form an essential part of management's decision-making process. Eskom's stakeholder engagement practices are based on the AA1000 Stakeholder Engagement Standard (SES) principles of materiality, completeness and responsiveness. The processes are influenced by the organisation's commitment as a signatory to the United Nations Global Compact and alignment with King III. At Eskom, stakeholders are defined as

people, groups, or organisations that have a direct stake in the organisation's business because they can either affect or be affected by Eskom's activities, objectives and policies.

In organisational theory, Hatch (1997) describes three perspectives in organisations; i) the modernists, ii) the symbolic-interpretive and iii) the post-modernist perspectives. The modernist perspectives are linked to the classical management theories whereby reality is objective and management is a set of activities designed to meet tangible organisational objectives. The symbolic-interpretive approach views reality as subjective and classifies organisations, their environment and management behaviours as subjective "enactment" of reality. According to Hatch, post-modernism evolved from the symbolic-interpretive organisations.

Grunig (2009) argues that the three approaches explained above are embedded in the two major competing paradigms in public relations – **the symbolic, interpretive paradigm** and the **strategic management, behavioural paradigm**. The former paradigm largely relegates public relations to a tactical role through the use of communication tools. In this paradigm, the goal is for the organisation to buffer itself from the external environment. On the contrary, the strategic management, behavioural paradigm utilises public relations as a bridging activity designed to build relationships with the stakeholders. This necessitates the use of a number of tools in addition to the traditional communication and information dissemination approaches. Such tools are broadened and fitted into a framework of research and listening. Based on this approach, and aligned to Eskom's public relations approach, a model of public relations through which this study is based can be explained in Figure 2 below:

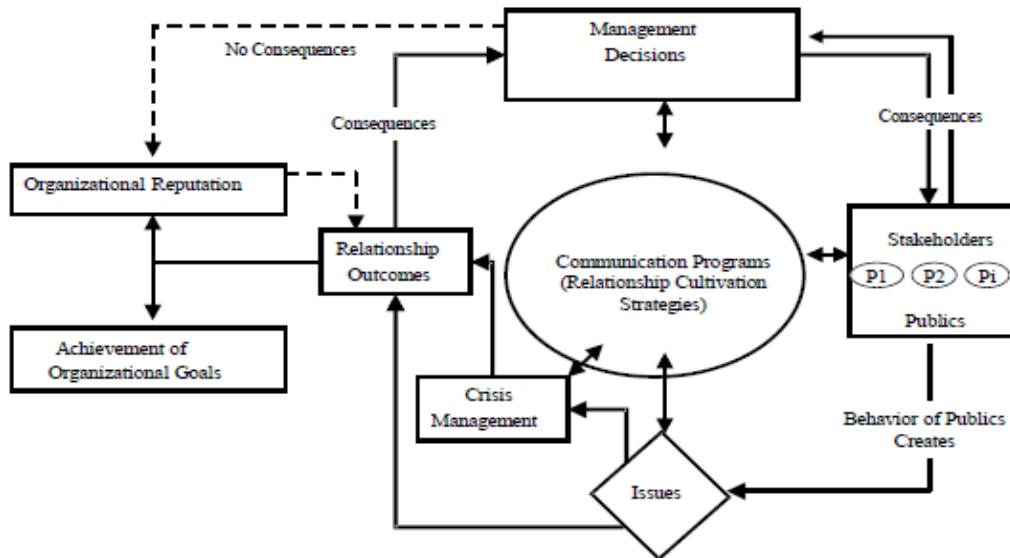


Figure 2: Models of strategic management of public relations (Grunig, 2009).

In Figure 2 above, the path with the dotted lines on the left represents approaches in the interpretive paradigm whilst the path with bold lines on the right represents approaches utilised in the strategic management, behavioural paradigm. The diagram illustrates and challenges public relations practitioners and scholars to recognise the extent to which the symbolic, interpretive paradigm promotes engagement between the organisation and its stakeholders. The meaning expressed encourages a paradigm shift that will revolutionise public relations to become more symmetrical. Such paradigm is the strategic management, behavioural paradigm that uses research, listening, and dialogue to prevent and manage conflict and to cultivate relationships with both internal and external strategic publics. The need for public relations is created by the interdependence between the organisation and its environment as represented by “consequences” between management decisions and stakeholders/publics. Strategic communication programmes, designed to cultivate relationships with stakeholders are represented by the oval at the centre. It is important to note that Figure 2 emphasises the need for communication with publics before decisions are made, in order to avoid

conflict. Such communication strategy should ideally be implemented in a four-step programme starting with i) informative research, ii) develop achievable and measurable objectives, iii) implement the programme and end with iv) evaluation to determine whether the objectives have been met. This informs the strategic, behavioural paradigm. On the other hand, the dotted lines represent the approach taken by practitioners who are guided by the symbolic, interpretive paradigm. In this approach, management decisions are mostly communicated through the use of mass media, and in such instances, the organisation is more concerned about reputation. Eskom's approach in supporting this study, subscribes to the strategic management, behavioural paradigm.

CHAPTER THREE: METHODOLOGY

3.1 Choice of survey method

A number of factors determined the type of survey to choose for conducting this study. The most important factors to consider were: - how best to communicate with respondents, sample size, timing and the available resources. Consideration was given to the need to generate statistics that can be used to discuss the responses from the target population. In addition, scientific research in both small and large scale studies around the world on attitudes to nuclear energy use questionnaire surveys to determine people's attitudes to nuclear (van der Pligt, J, 1985; Ansolabehere S. and Konisky D. M. 2009; Ningle Yu, Yimei Zhang, Jin Wang, Xingjiang Cao, Xiangyong Fan, Xiaosan Xu and Furu Wang, 2012).

3.2 Study sites

A questionnaire survey was used to assess people's knowledge and perceptions of, and attitudes towards the construction of nuclear power plants. At least three sites have been selected for constructing and developing nuclear power plants; two in the Western Cape and one in the Eastern Cape. These sites are in close proximity to residential and/or commercial sites. Subsequent to the identification and selection of the three sites for nuclear plant construction, Eskom embarked on a roll out for the project. One of the main steps was to ensure that all interested parties are consulted prior to the implementation of the project. As per legal requirements, an Environmental Impact Assessment (EIA) study led by Eskom was initiated in which all interested and affected parties were involved. Following the consolidation of stakeholder comments; public open days, focus group meetings and stakeholder workshops were held. Such meetings were composed of local residents, specialists, and interests groups either from community organisations or from the general public. This process provided an opportunity to access all relevant stakeholders for the purpose of administering questionnaires for this study. The people that were present at the three sites during

Eskom public participation meetings and who were willing to participate in the survey constituted a random sample.

3.3 Ethical considerations

Participation in the study was completely voluntary and participants were assured of confidentiality and the right to withdraw from the study at any time. Informed consent was obtained prior to data collection and the contact details of the researcher and the supervisors were provided and made available to the participants. To obtain informed consent to participate in this study, briefing sessions through oral presentations at the public participation meetings were conducted and concentrated on the purpose of the study. These sessions provided a platform for answering questions from participants.

3.4 Proposed construction sites

Proposed site 1: Duynefontein is situated adjacent and to the north of the existing Koeberg Nuclear Power Station on the Cape West Coast, approximately 35 km north of Cape Town. The site falls within the existing Eskom-owned property, which includes a nature reserve. Koeberg Nuclear Power Station is surrounded by densely populated urban communities, 15 kilometres east (Atlantis) and 7 kilometres west (Table View)

Proposed site 2: Bantamsklip is situated along the southern part of the Western Cape coast, mid-way between Danger and Quoin Points. The site is utilised for flower harvesting and fishing. Approximately 13 km west of the proposed nuclear power plant, is a small residential village called Gansbaai, situated in the centre of a number of small bays with miles of unspoiled beaches, nature reserves with over 1500 species of Fynbos, ancient Milkwood forests, rocky inlets, caves and scenic views across Walker Bay. It is a well-known whale watching and great white shark viewing destination. This quaint traditional fishing village is situated on two harbours where many fishing trawlers and boats come and go daily, supplying fresh catches to fishmongers and local restaurants.

Proposed site 3: Thyspunt is situated on the Eastern Cape coast between Oyster Bay and St. Francis Bay. The site identified for nuclear plant construction is currently vacant, but there are a number of houses on the adjacent properties, outside the proposed nuclear power station. Oyster Bay (Oysterbaai) is a small village and lies approximately 3,5km to the west of the existing Thyspunt nuclear site. It includes an informal settlement and low cost housing estate Umzamowethu. In 2002, approximately 90 people were permanently resident in Oyster Bay. It is also a holiday destination peaking to 2000 occupants during the holiday seasons.

3.5 Questionnaire design

The questionnaire was designed to obtain information on the socio-demographic profile of the respondents, their knowledge of power plants as well as to assess their knowledge and perceptions of, and attitudes towards the construction of the proposed power plants. The socio-demographic characteristics that were assessed were age, gender, standard of education and residential status. People's socio-demographic characteristics were assessed because they may influence knowledge, perceptions and attitude towards nuclear plants.

Knowledge of energy generation was assessed by asking respondents about how energy is generated in South Africa and their knowledge about the source of electricity in their locality was tested. Beliefs and opinions of respondents were assessed by determining whether respondents agreed or disagreed with certain statement about nuclear energy. For example whether they thought that nuclear energy is the only practical and cleaner energy source for the future and whether South Africa should abandon all plans to build nuclear power.

Attitudes and beliefs were assessed by means of 7-point Likert scale response questions. These were used to determine people's agreement or disagreement with the notion that nuclear energy provides economic benefits which are essential to society, or nuclear energy involves hazardous waste which could affect a large number of people.

In these questions people were asked to indicate whether they agreed strongly, agreed, disagreed, disagreed strongly or had no opinion with the statements made.

Closed questions were used to obtain information from the respondents. Closed questions were structured such that the respondents had to choose the response he/she felt was most appropriate. More than one response to a particular question could be made in these cases. The order of the questions was mixed to avoid bias in the response. A copy of the questionnaire is included as Appendix 1.

3.6 Data analysis

The analytical method used in this study was quantitative as it is the best method used to measure social realities. Contrary to qualitative analysis, which is used to understand phenomena; the quantitative approach is often used to generalize about the results found in the samples to the population.

In particular, the quantitative approach was best suited for this study based on the following reasons:-

- The major goal of this study is to quantify opinions, attitudes and behaviours and find out how the whole population feels about certain issues. The study sought to establish quantitative answers in determining the level of awareness of energy generation options and quantifying the number of responses and number of respondents to each statement.
- Quantitative analysis allowed for segmentation of the population into groups whose members are similar to each other and distinct from other groups.
- Lastly the approach provided the best tools to explain some phenomena by correlating certain perceptions with attitudes.

In the case of questions resulting in multiple responses, the frequency with which a particular response was made was calculated as a percentage of the total number of

people interviewed. These frequencies are presented and summarised as pie diagrams and graphs.

The responses made to questions on knowledge, attitudes and perceptions were cross-tabulated with the responses made on the socio-demographic profile in order to identify any relationships between two sets of variables. Spearman's R/correlation was used to assess the significance of the relationship between two sets of ranked responses (e.g. one of the socio-demographic factors vs attitude questions based on the Likert scale responses). The relationship between pairs of categorical variables or between open categorical and ranked variables were assessed by means of Maximum Likelihood chi-square tests, with positive correlation at $p \leq 0.05$.

CHAPTER FOUR: RESULTS

The study was conducted during the period April and November 2011. A total of 120 questionnaires were distributed to consenting participants comprising of males and females above the age of 20. A total of 64 participants from the three nuclear power plants construction sites completed the survey, giving a response rate of 53%. These participants were recruited through public participation forums and information sessions arranged by Eskom, as part of pre-environmental impact assessment studies. The distribution of the respondents across the study sites is given in Table 4.1.

Table 4.1. The total number of individuals from the construction areas where the questionnaire survey was conducted.

Province and Nuclear sites	Study site	Number of respondents
Eastern Cape:	Thyspunt	27
Western Cape:	Bantamsklip	17
Western Cape:	Duynefontein	20
TOTAL		64

4.1 Demographic details of respondents

Data on age, gender, education and residential status of respondents was collected in order to correlate some of these variables with opinions, beliefs and attitudes towards nuclear energy. Age and gender details of the participants are shown in Figure 3 below.

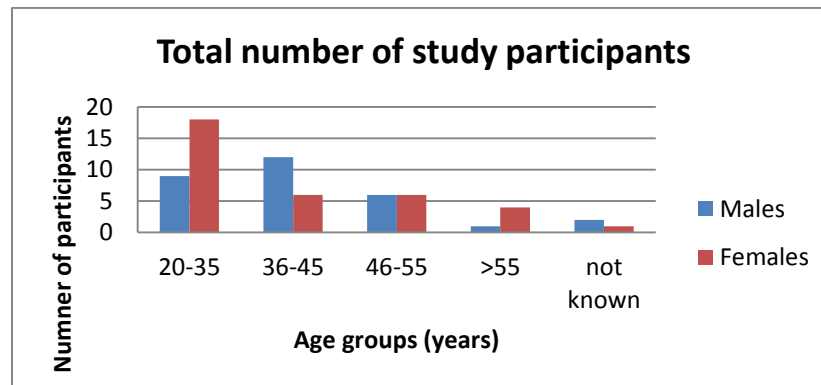


Figure 3. Demography of participants combined from the three construction sites; Thyspunt, Bantamsklip and Duynefontein.

From the graph above, it is clear that the majority of the participants were from the 20-35 age group and largely composed of females. Further breakdown of the participants' data per study site reveals that the majority of participants come from the Thyspunt construction site (42%) with a total of 27 participants. Twenty participants (20) were from the Duynefontein construction area and comprised 32% of the total. Seventeen of the participants (26%) were from the Bantamsklip construction area.

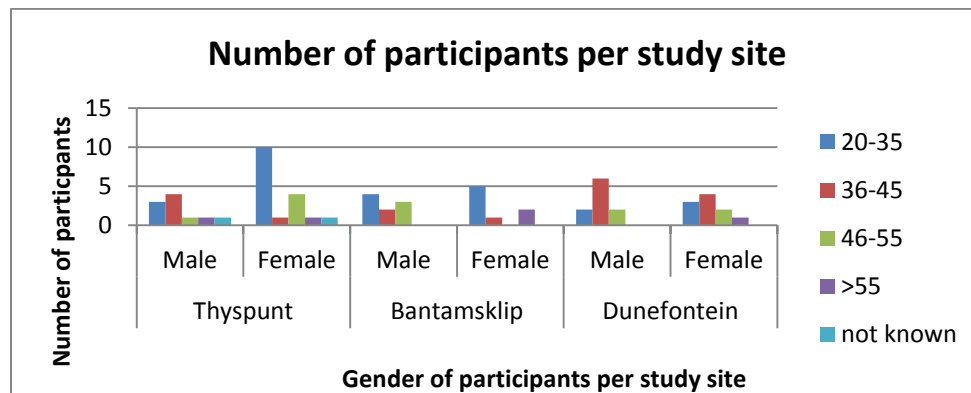


Figure 4. The number of respondents from the three construction sites, Thyspunt, Bantamsklip and Duynefontein.

The majority of the participants were in the 20 – 35 age group (27%) and largely composed of females (55%). Only 3% of the respondents did not indicate their gender.

Further analysis of the respondents' data indicate that the majority of people from the Thyspunt area are property owners in the areas (67%), with 22% residing in the area as tenants and only 4% living at home (Figure 4). A different scenario emerges at Bantamsklip in which % of respondents were owners and % residing as tenant. Combined, the majority of respondents in this study are property owners.

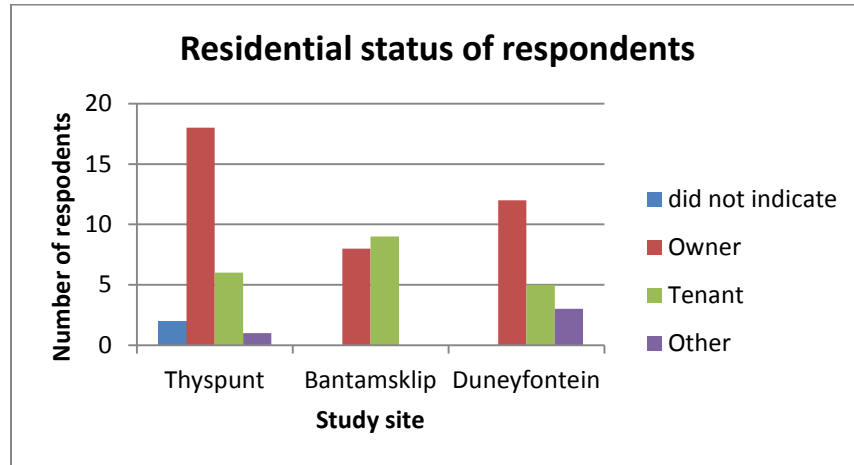


Figure 5. Residential status of respondents per study area

Respondents were also asked to indicate their level of education. Analyses of responses indicate that 56% of respondents held post matric qualification – either a national diploma or bachelor's degree as shown in Figures 6(a) and 6(b) below.

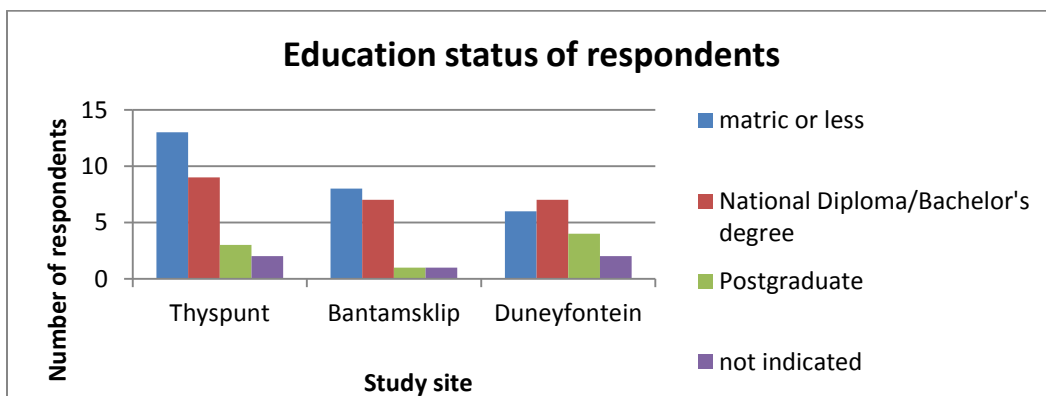


Figure 6(a). Education status of respondents per study site.

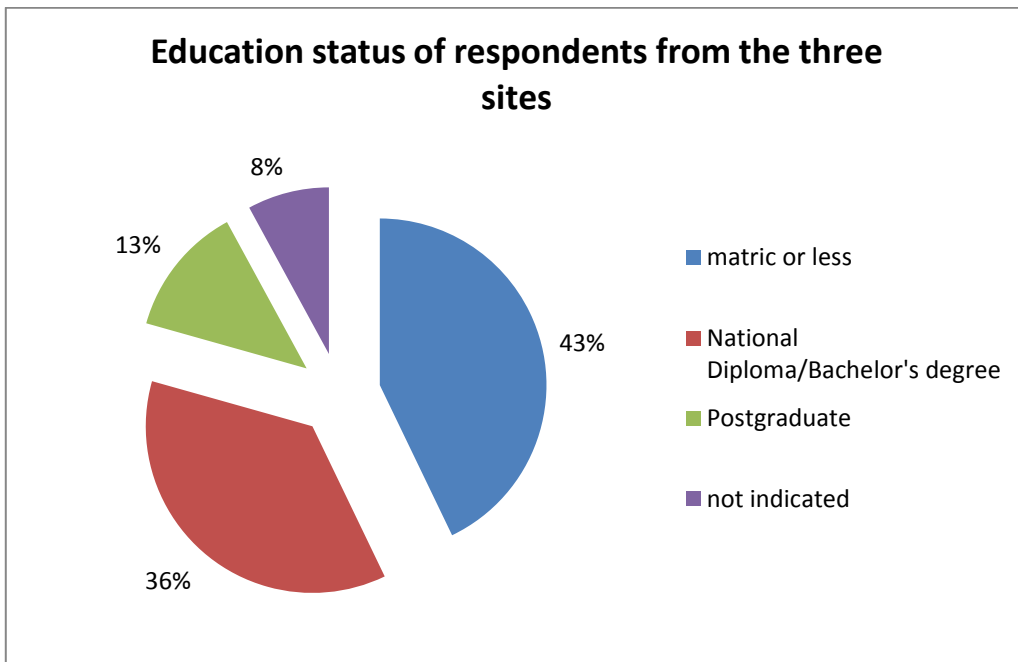


Figure 6(b) Education status of respondents

Figure 6 shows that 13% of respondents possessed a postgraduate qualification, whilst 8% did not indicate their education level.

4.2 Knowledge about energy generation

The majority of respondents from all three sites (62.6%) thought energy in South Africa is derived largely from coal; 26.6 % did not know; whereas 1.6% thought that it was largely derived from nuclear; 1.6% hydro and gas. There was a correlation between the level of education and knowledge of energy generation in the area, with the majority of less educated people indicating that they do not know the source of energy in the area. Statistical analysis using SPSS software (2010) at 95% confidence interval shows a p value of 0.001 and correlation coefficient of 0.026.

4.3 Beliefs and opinions about aspects of nuclear energy

In order to assess people's understanding of nuclear energy, respondents were asked to give an opinion about certain statements relating to nuclear energy. The statements were constructed based on literature on similar studies testing people's opinions and attitudes towards nuclear energy and also drawn from the reports generated from Eskom public participation meetings. The respondents were provided with these statements about nuclear energy and requested to indicate whether they agreed or disagreed with each statement, in a differentiated seven point Likert scale as follows: very strongly agree, strongly agree, agree, no opinion, disagree, strongly disagree and very strongly disagree. Results of the responses are analysed per study site and are shown in the following tables:

Table 4.2. Respondents' beliefs about aspects of nuclear energy: Thyspunt (% responses)

Belief	1	2	3	4	5	6	7
Nuclear energy is the only practical and cleaner energy source for the future	11.1	11.1	25.9	11.1	14.8	7.4	18.5
Nuclear energy is the cleanest energy option	7.4	7.4	29.6	3.7	25.9	11.1	14.8
South Africa should abandon all plans to build nuclear power plants	22.2	7.4	40.7	3.7	3.7	3.7	18.5
Nuclear energy involves hazardous waste which could affect large number of people	11.1	22.2	11.1	37	3.7	14.8	22.2
Nuclear energy provides economic benefits which are essential to society	3.7	11.1	18.5	37	18.5	11.1	3.7

1 – very strongly disagree; 2 – strongly disagree; 3 – disagree; 4 – no opinion; 5 – agree; 6 – strongly agree; 7 – very strongly agree

With regards to opinion about nuclear energy being the only practical energy source, the majority of respondents (26%) in the Thyspunt area disagree whilst a large number strongly agree (19%). Most respondents do not believe that nuclear energy is the cleanest. However, a significantly large percentage (41%) of respondents think that SA should go ahead with the construction of nuclear power plants. There was division on the beliefs about effect of hazardous waste to a large number of people with 22% of respondents strongly disagreeing and 22% strongly agreeing to the statement. Similarly, there was split opinion about whether nuclear energy is of economic benefit with equal number of people disagreeing (19%) and others agreeing (19%).

Table 4.3. Respondents' beliefs about aspects of nuclear energy: Bantamsklip (% responses)

Belief	1	2	3	4	5	6	7
Nuclear energy is the only practical and cleaner energy source for the future	41.2	0	11.8	5.9	29.4	0	11.8
Nuclear energy is the cleanest energy option	41.2	5.9	11.8	5.9	23.5	5.9	5.9
South Africa should abandon all plans to build nuclear power plants	5.9	17.6	11.8	17.6	5.9	5.9	35.3
Nuclear energy involves hazardous waste which could affect large number of people	0	0	0	17.6	23.5	0	52.9
Nuclear energy provides economic benefits which are essential to society	29.4	0	5.9	23.5	17.6	5.9	11.8

1 – very strongly disagree; 2 – strongly disagree; 3 – disagree; 4 – no opinion; 5 – agree; 6 – strongly agree; 7 – very strongly agree

A significantly large percentage of respondents at Bantamsklip believe that nuclear energy is the only practical, cleaner energy source (41%) and cleanest energy option (41%). However, the majority (35%) strongly believe that South Africa should abandon all plans to build nuclear power plants. More than 50% of respondents believe that nuclear energy involves hazardous waste that could affect a large number of people. With regards to opinions about economic benefits afforded by nuclear energy; 29% strongly disagree whilst 23% had no opinion. A similar type of assessment was carried out for responses from Duynfontein. Results are shown in table 4.4 below.

Table 4.4. Respondents' beliefs about aspects of nuclear energy: Duynefontein

Belief	1	2	3	4	5	6	7
Nuclear energy is the only practical and cleaner energy source for the future	40	15	0	5	30	10	0
Nuclear energy is the cleanest energy option	40	10	10	5	25	5	5
South Africa should abandon all plans to build nuclear power plants	15	10	20	5	5	0	40
Nuclear energy involves hazardous waste which could affect large number of people	0	0	20	20	55	0	0
Nuclear energy provides economic benefits which are essential to society	5	30	5	4	15	10	15

1 – very strongly disagree; 2 – strongly disagree; 3 – disagree; 4 – no opinion; 5 – agree; 6 – strongly agree; 7 – very strongly agree

4.4 Attitudes towards the construction of power plants

One of the objectives of the study was to determine the respondents' opinions about the construction of power plants in South Africa. Respondents' opinions were assessed for each of the power plants that people are familiar with – coal, gas, nuclear and wind. Figures 4 to 6 below show the results of this assessment.

In Thyspunt, a large percentage of respondents (56%) did not indicate any opinion about the construction of coal-fired power plants in South Africa. Of the 44% who responded, 18% strongly support the idea of constructing coal-fired power plants while the other 18% support the idea. Only 4% of the respondents are strongly opposed. A large percentage (59%) of respondents did not indicate any opinion towards construction of gas powered power plants. Of the remainder of the group that responded, only 15% showed support with 11% in strong agreement with the idea. There was no opposition for the construction of wind power plants in South Africa. However, 45% of the respondents did not indicate any opinion. Of the 55% that were in favour of construction of these plants, 37% were in very strong support, 7% strongly supporting and 11% in support of the wind-fired plant construction (Figure 5).

In both Bantamsklip and Duynefontein, an overwhelming majority of respondents support the construction wind power plants. whilst 59% of the respondents neither support nor oppose the construction of coal and coal fired power plants (Figure 6 and 7).

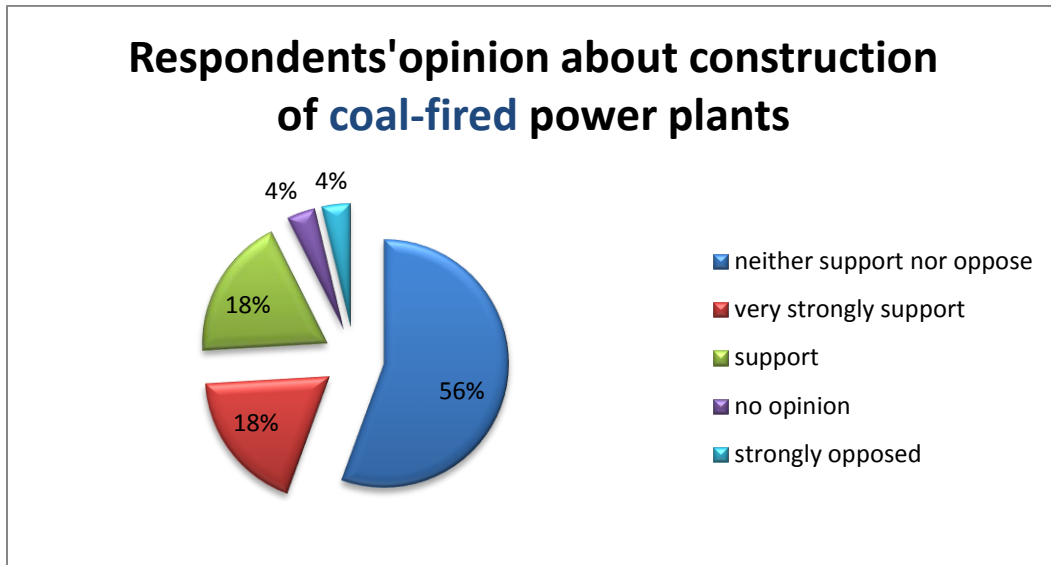


Figure 7(a)

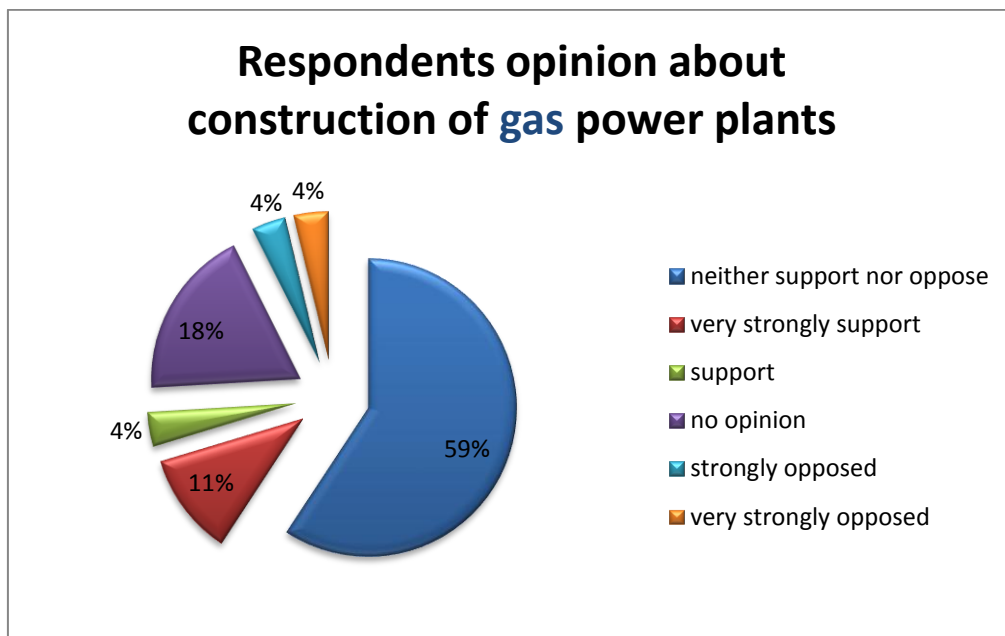


Figure 7 (b)

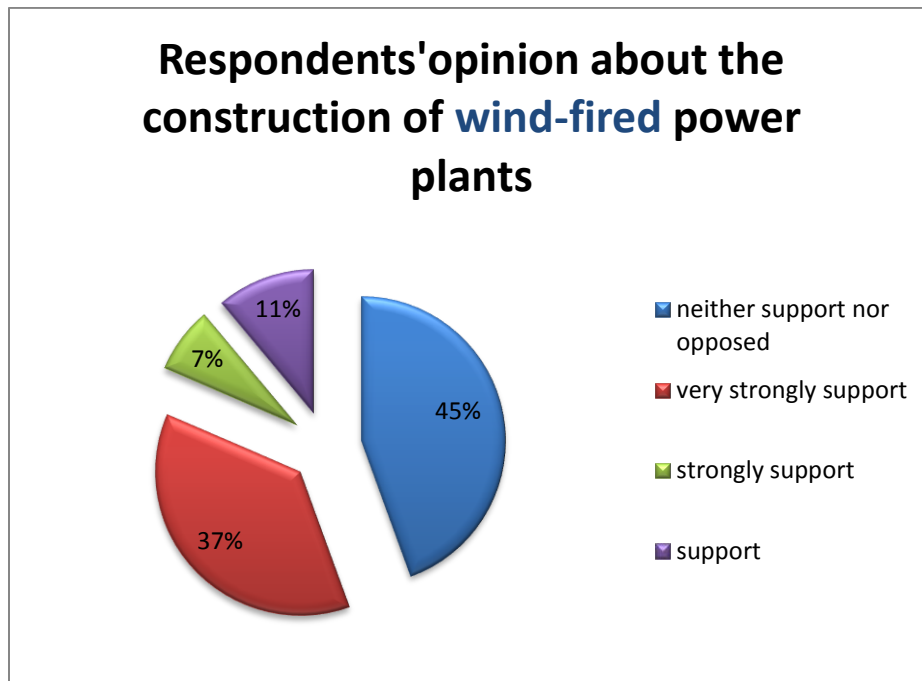


Figure 7 (c)

Figure 7. Thyspunt respondents' opinions about the construction of coal, gas and wind-fired power plants in South Africa

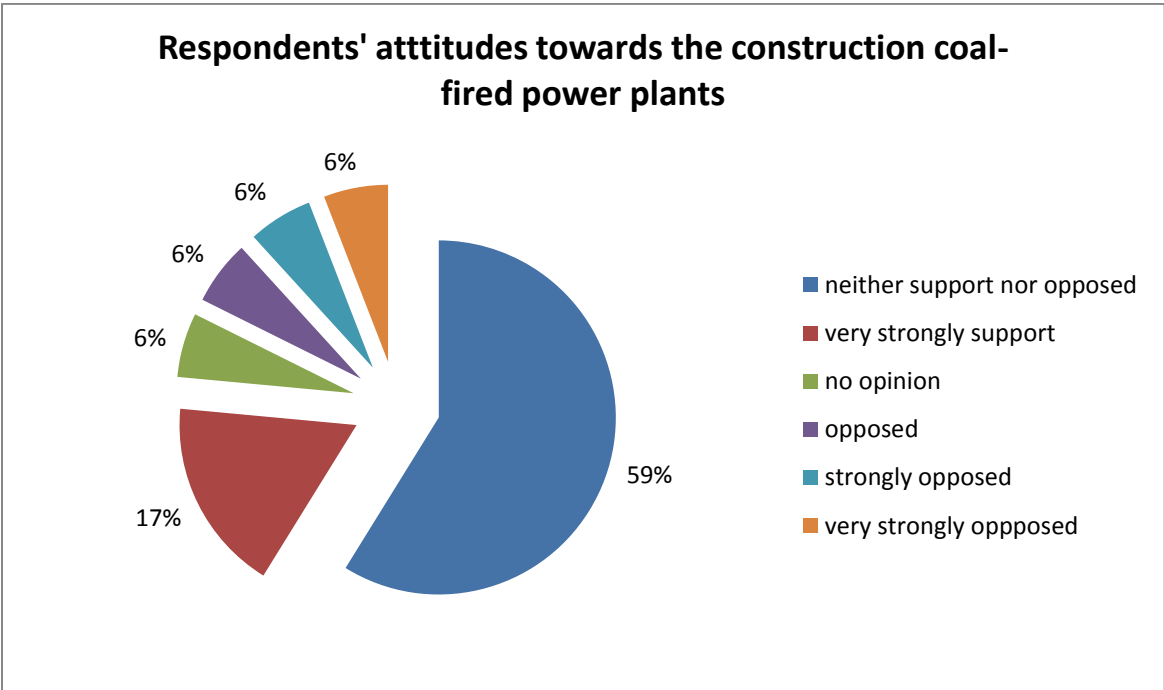


Figure 8 (a)

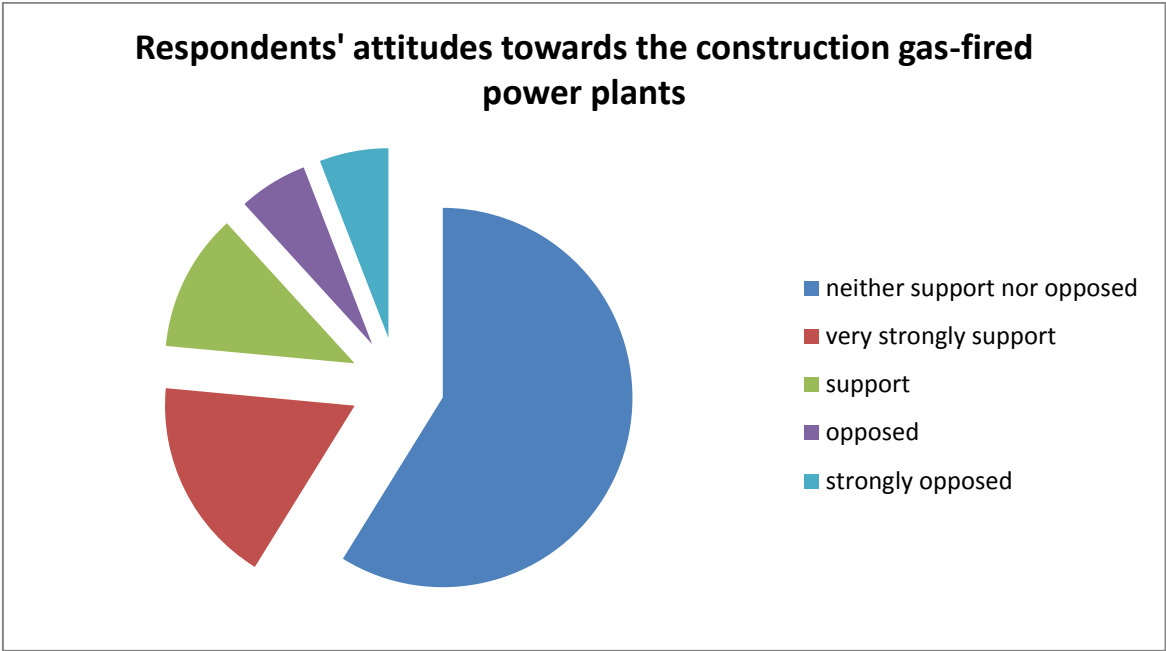


Figure 8 (b)

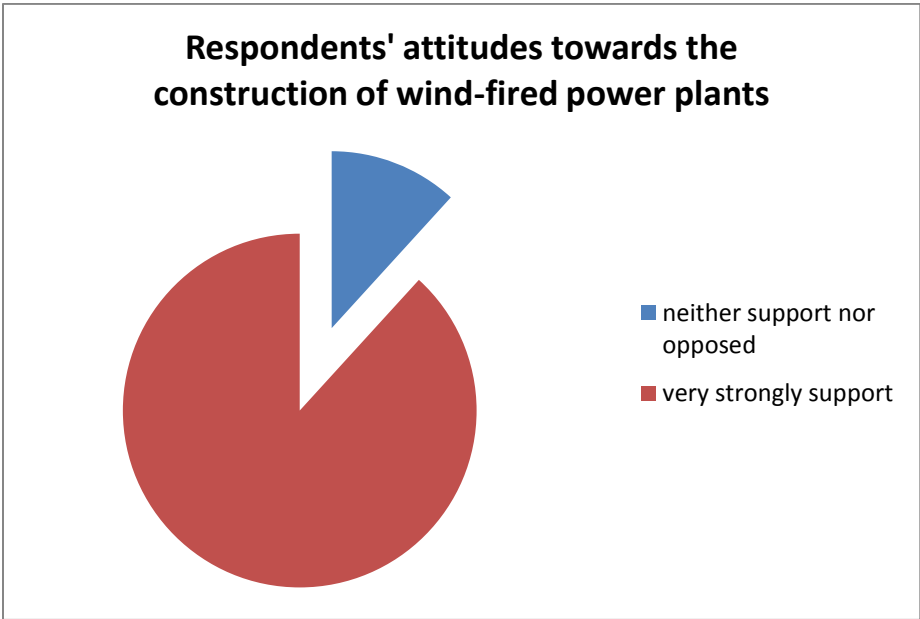


Figure 8 (c)

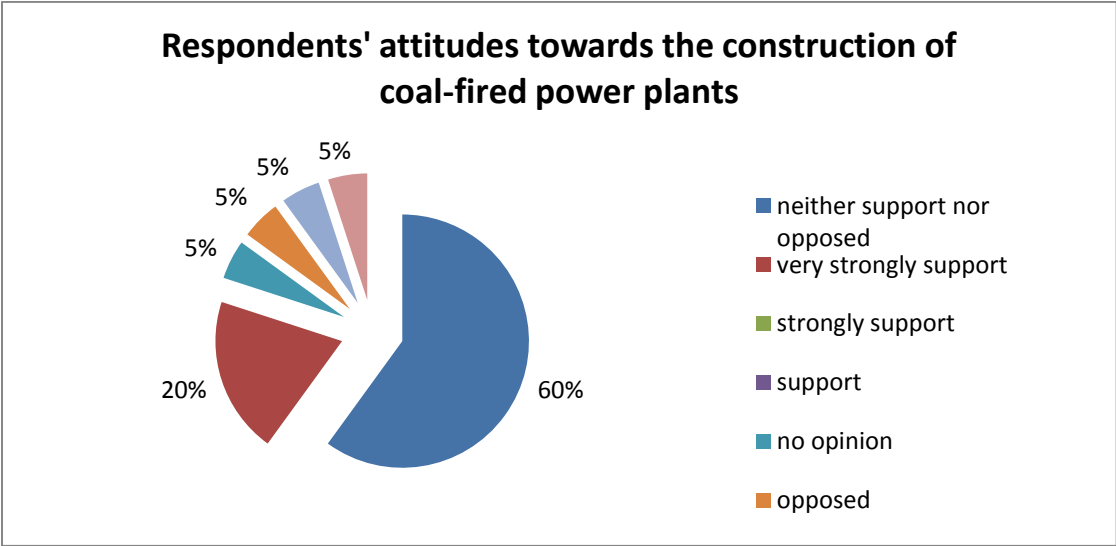


Figure 9(a)

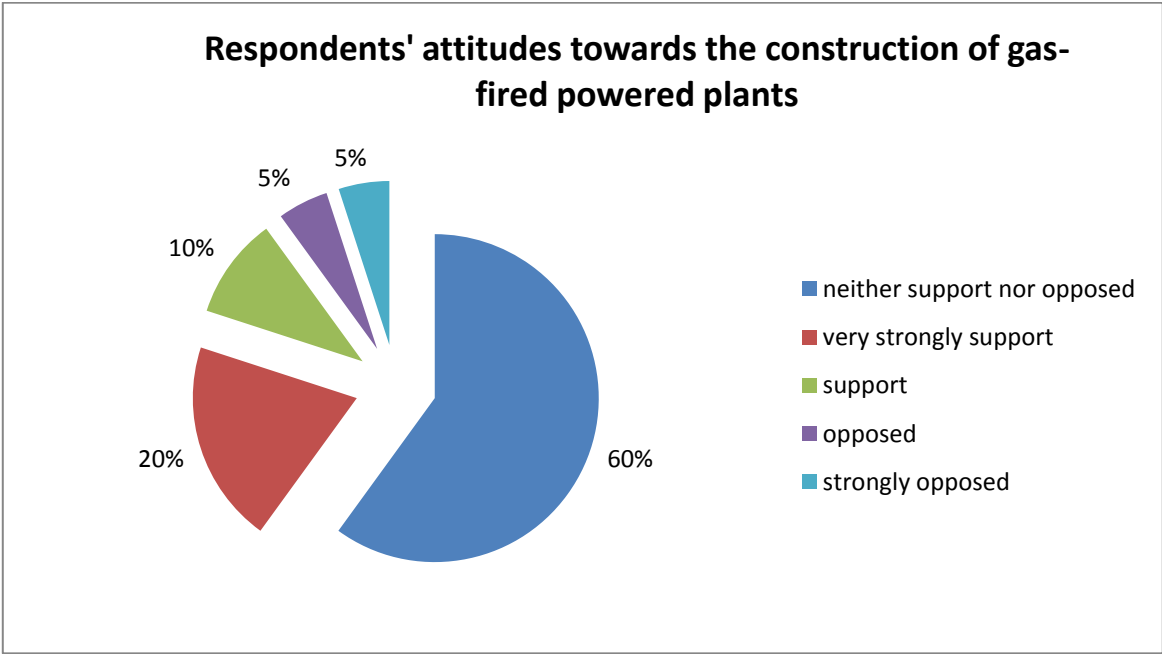


Figure 9 (b)

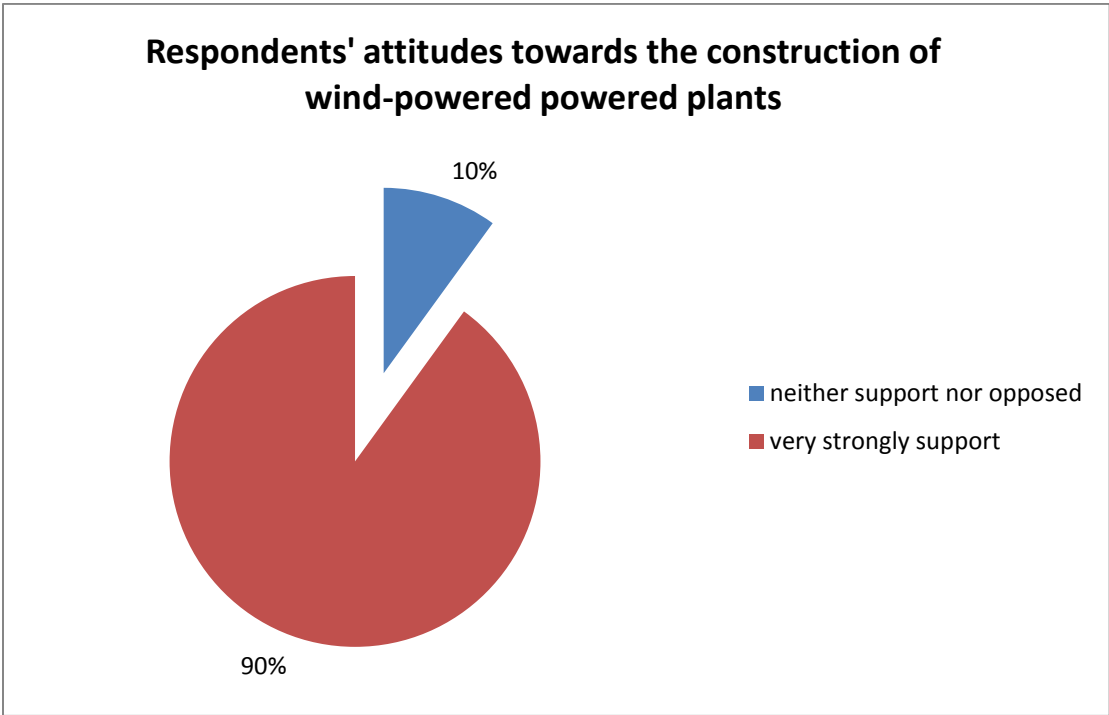


Figure 9 (c)

4.5 Attitudes towards the construction of nuclear power plants

Attitudes towards the construction of nuclear power plants were established from respondents from each of the construction sites. The attitudes were tested towards nuclear power plants in general and also towards construction in one's locality.

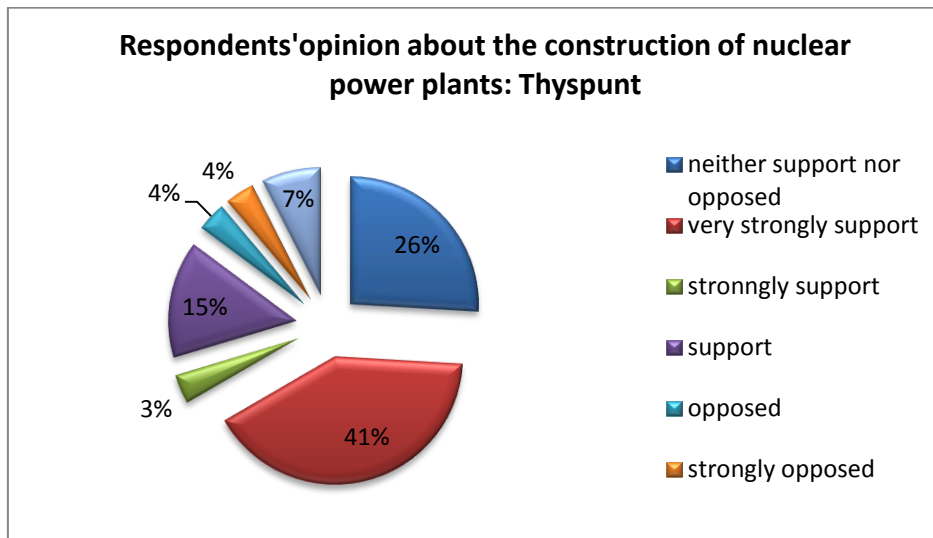


Figure 10 (a)

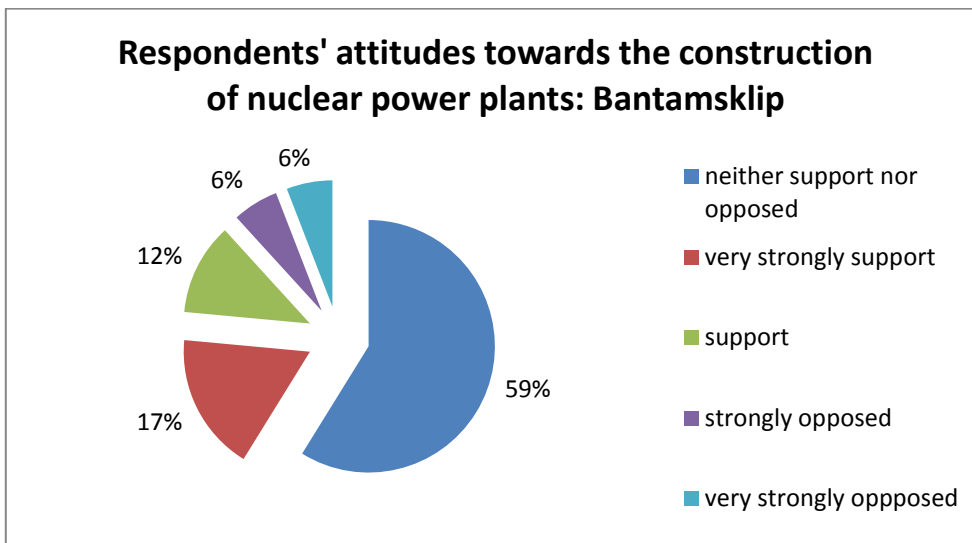


Figure 10 (b)

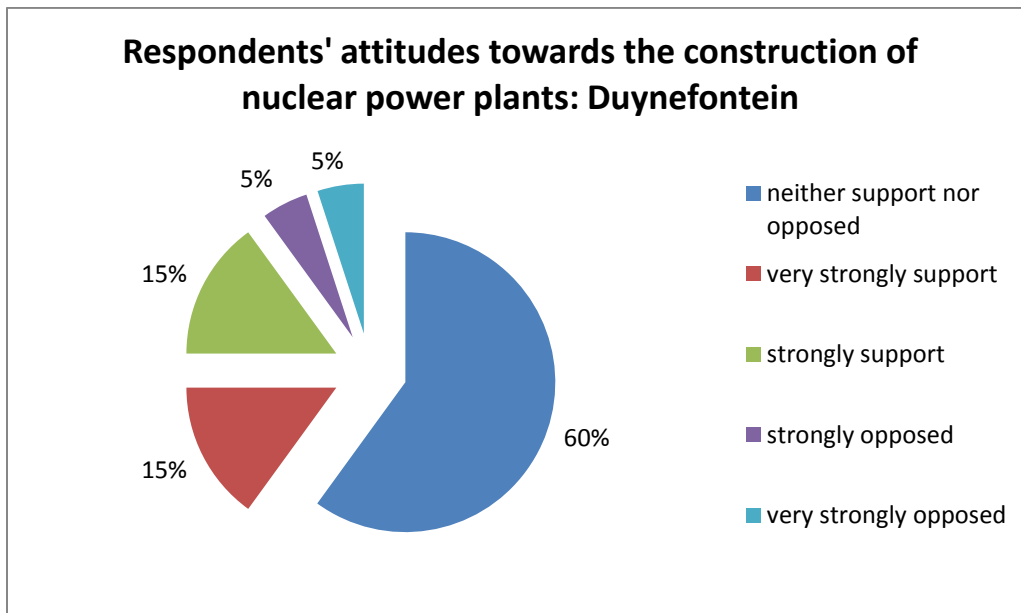


Figure 10 (c)

Figure 10. Assessment of attitudes towards the construction of nuclear power plants

In Thyspunt, 26% of respondents did not respond to this statement. A large percentage (59%) of the respondents support the construction of new nuclear plants in South Africa; 41% very strongly in support, 3% in strong support and 15% supporting the construction of nuclear plants (Figure 8a).

A large percentage of respondents from both Bantamsklip and Dunefonteyn neither support nor oppose the construction of new nuclear power plants; although there is some support for nuclear plant construction.

The attitude of respondents towards the construction of power plants near their locality was determined. In a scale of five choices, respondents were required to indicate their attitude towards such construction and were provided an option of strongly oppose, somewhat oppose, support, strongly support and no opinion. The respondents' attitudes were also correlated with the residential status in order to determine which group of

participants were either opposed or in support of nuclear plant construction. This was done for all three sites separately and results are presented in the figures below.

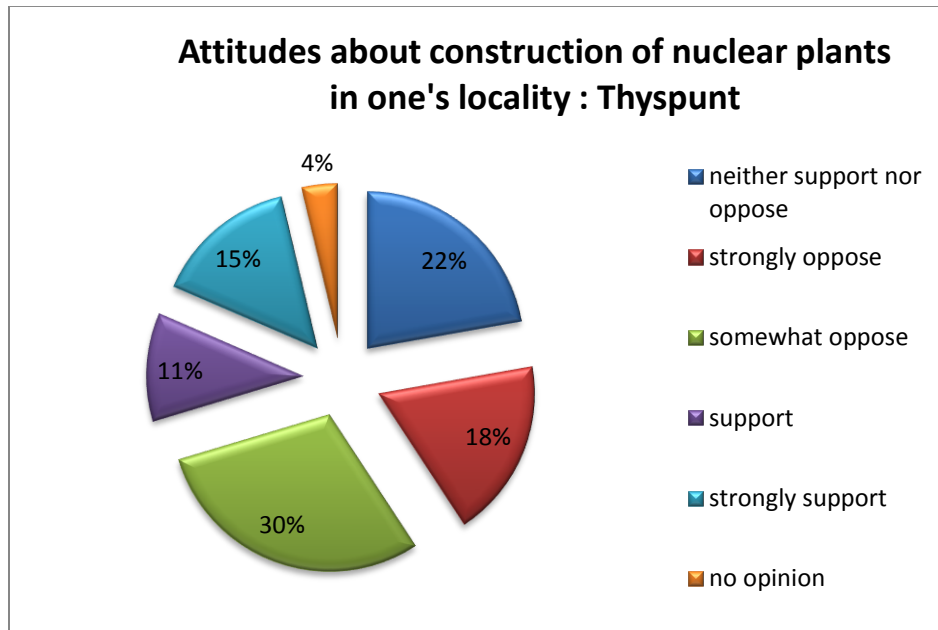


Figure 11 (a)

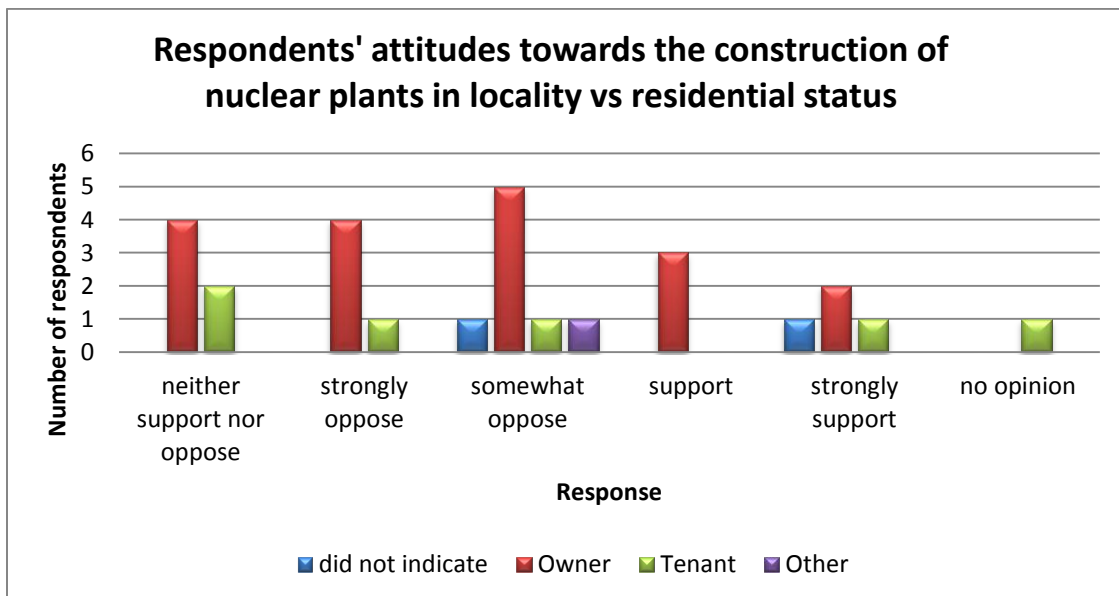


Figure 11(b)

Figure 9. Residential status and attitudes of respondents towards the construction of nuclear power plants near their locality: Thyspunt

From Thyspunt, 22% of respondents neither support nor oppose the construction near their locality. Of those who responded, 30% somewhat opposed the construction and 18% strongly opposed. 26% supported the construction of nuclear power plants near their locality, whereas 48% were in opposition (Figure 9). Those who were opposed to the construction near locality were largely property owners in the area (Fig 11b) and their attitude ranged from strongly opposed to somewhat opposed (30%). The ones in support of the construction are a mixed group of property owners and tenants in the area and constituted 26% of the respondents. Figure 12 below shows the analysis of Bantamsklip residents' attitudes.

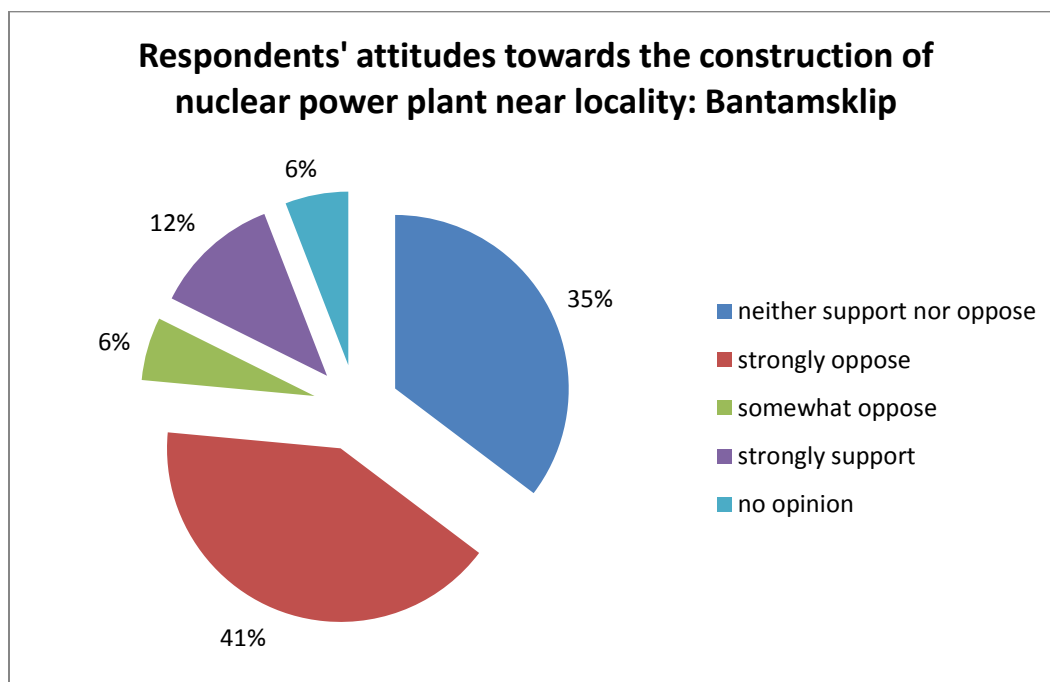


Figure 12(a)

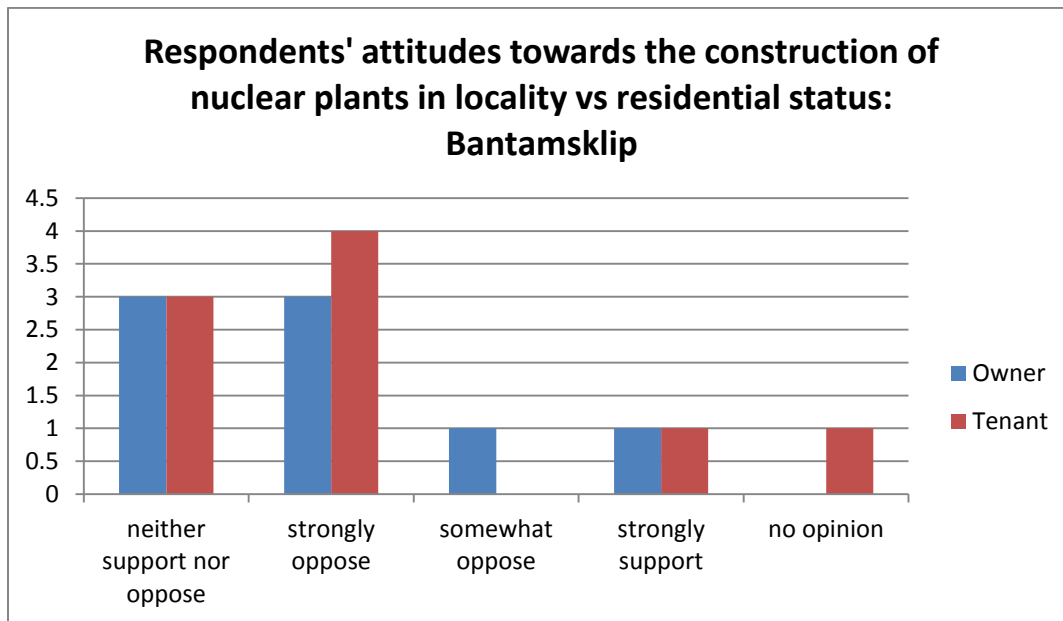


Figure 12(b)

Figure 12. Residential status and attitudes of respondents towards the construction of nuclear power plants near their locality: Bantamsklip.

About 35% of respondents are neither in support nor in opposition of the construction of nuclear plants close to their locality and 6% did not declare their opinion. Of the remaining 49% who stated their attitudes towards the issue, a large percentage (41%) strongly opposed the idea and only 6% somewhat opposed. Only 12% of the respondents strongly support the construction (Fig 10a). Further analysis and correlation of these attitudes with the residential status of respondents shows that the majority of people who are opposed to this are property owners although, also a large percentage of tenants in the area show opposition (Fig 12b). The attitudes analysis for Duynefontein respondents is shown in Figure 13 below.

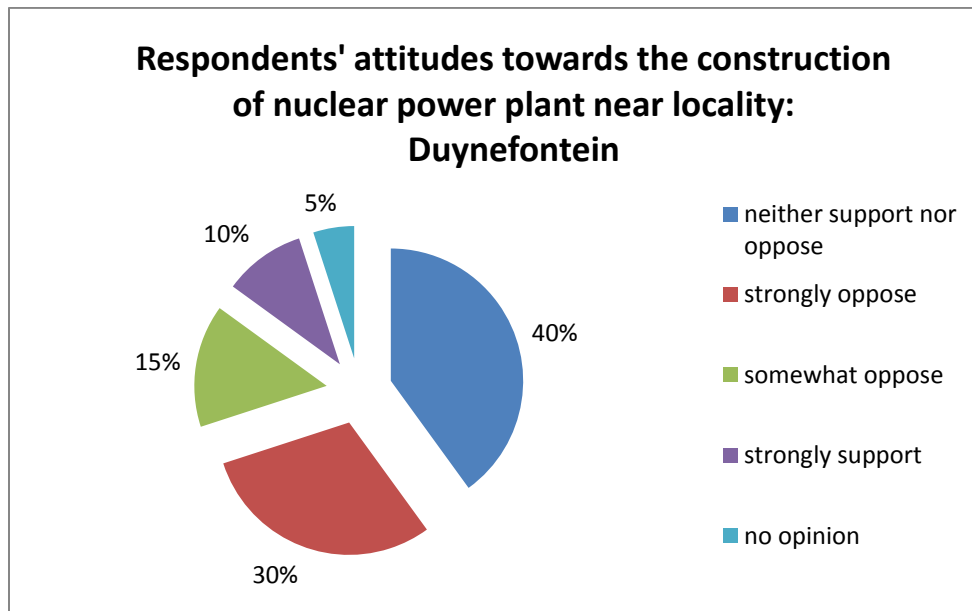


Figure 13(a)

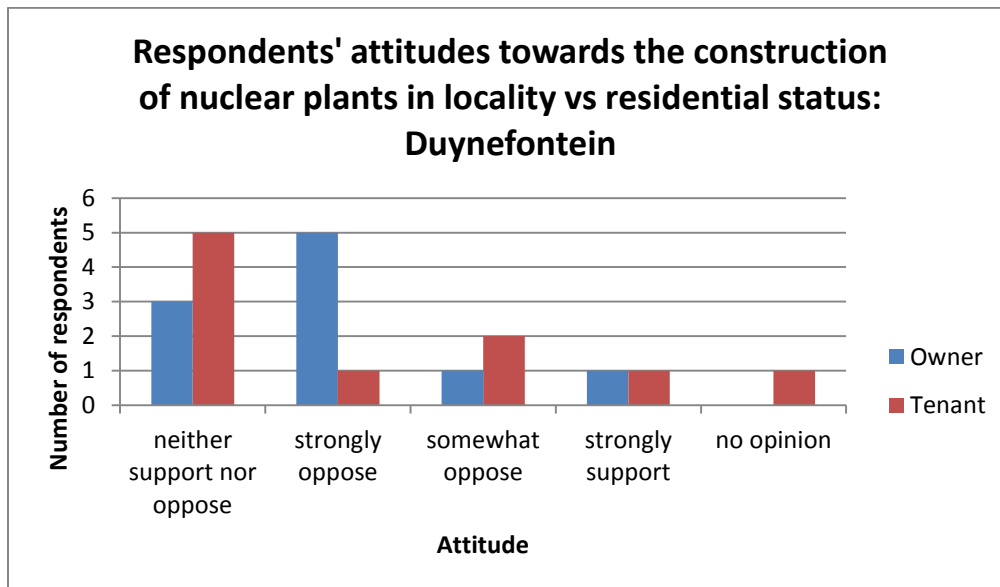


Figure 13(b)

Figure 13. Residential status and attitudes of respondents towards the construction of nuclear power plants near their locality: Duynefontein

About 40% of respondents are neither in support nor in opposition of the construction of nuclear plants close to their locality and 5% did not declare their opinion. Of the remaining 55% who stated their attitudes towards the issue, 30% strongly opposed the idea and only 15% somewhat opposed. Only 10% of the respondents strongly support the construction (Fig 13a). Further analysis correlating these attitudes with the residential status of respondents shows that the majority of people who are strongly opposed to this are property owners whereas a large percentage of tenants in the area neither support nor oppose (Fig 13b).

4.6 Perceptions about the effects of nuclear power plant construction

The perceptions of people about various short term effects of nuclear power plant construction were assessed. The perceived effects were drawn from Eskom's draft scoping report which was compiled after the public participation meetings. The report is a summary of people's concerns about the construction. The perceptions were then grouped into short and long term perceived effects for the purpose of this study. Respondents were requested to rank these concerns, on a five point scale, in order of importance from least important to extremely important. In Thuyspunt, environmental concerns were the most highlighted with the majority of respondents considering pollution as an extremely important concern during construction with 33% of respondents concerned about air pollution and 37% concerned about noise and visual pollution. Congestion both in terms of traffic in the area and influx of workers was also the most important concern with 33% of respondents stating these as extremely important. Amongst the highest ranked concerns in order of importance, were, security/crime during construction (48%); housing of construction workers (41%); spread of HIV/AIDS (37%), amenities for additional population (22%); conversion of land from current use (22%) and housing of construction workers. Only 4% of the respondents cited other important concerns (Table 4.5).

Table 4.5. Perceptions about various short term effects of construction and perceived importance: Thyspunt

Short term effects of construction (N = 27)	Importance				
	Least important	Slightly important	Important	Very important	Extremely important
Air pollution	18.5	7.4	25.9	11.1	33.3
Noise and visual pollution	14.8	11.1	11.1	22.2	37
Traffic congestion	18.5	14.8	22.2	11.1	33.3
Influx of workers into the area	18.5	25.9	14.8	7.4	33.3
Security/crime concerns during construction	11.1	11.1	25.9	3.7	48.1
Amenities for additional population	7.4	18.5	29.6	7.4	29.6
Conversion of land from current use	11.1	22.2	25.9	11.1	22.2
Housing of construction workers	7.4	14.8	40.7	11.1	22.1
Spread of HIV/AIDS	22.2	11.1	22.2	7.4	37.0
Other**			3.7		

Table 4.6. Perceptions about various short term effects of construction and perceived importance: Bantamsklip

Importance					
Short term effects of (N = 17) construction					
	Least important	Slightly important	Important	Very important	Extremely important
Air pollution	11.8	35.3	41.2	0	41.2
Noise and visual pollution	23.5	0	17.6	11.8	35.3
Traffic congestion	17.6	5.9	23.5	11.8	29.4
Influx of workers into the area	0	0	11.8	5.9	64.7
Security/crime concerns during construction	0	0	23.5	11.8	47.1
Amenities for additional population	11.8	0	11.8	11.8	47.1
Conversion of land from current use	11.8	5.9	23.5	0	41.2
Housing of construction workers	5.9	0	23.5	0	52.9
Spread of HIV/AIDS	5.9	0	11.8	5.9	58.8
Other**					

Table 4.7. Perceptions about various short term effects of construction and perceived importance: Duynfontein

	Importance				
	Least important	Slightly important	Important	Very important	Extremely important
Short term effects of construction (N = 20)					
Air pollution	10.0	0	40.0	0	40.00
Noise and visual pollution	25.0	0	20.0	10.0	35.00
Traffic congestion	20.0	5.00	20.0	15.0	30.0
Influx of workers into the area	0	0	15.0	5.0	65.0
Security/crime concerns during construction	0	0	15.0	10.0	50.0
Amenities for additional population	10.0	0	15.0	10.0	50.0
Conversion of land from current use	10.0	5.0	25.0	0	45.0
Housing of construction workers	5.0	0	25.0	0	55.0
Spread of HIV/AIDS	5.0	0	15.0	5.0	60.0
Other**	-	-	-	-	-

4.7 Drivers behind public preferences for nuclear energy

The survey asked questions to gauge how people perceived the cost and benefits associated with the construction of nuclear power plants in their area. Before asking respondents to rank the individual harm and benefit factors, in order of importance; they were first required to indicate their perception about the likelihood of nuclear energy improving or worsening the situation in their locality. This was done in order to ascertain their attitude towards nuclear energy. There was variation between the three sites on the perceptions of the effects of construction to the local environment and communities.

In Thyspunt it is clear that the majority of respondents are optimistic mainly about the improvement in employment opportunities and standard of shopping facilities that the construction will bring to the area. Although not in the majority, people expressed concern about the effects on wildlife and harm to the marine environment (Figure 14a). These perceptions are in contrast to what the residents from Bantamsklip and Duynefontein have expressed; where the majority of people were concerned mainly about the marine environment, wildlife and farming. In terms of improvement in conditions, the majority of people thought that the construction will result in improved standards of shopping facilities, cheaper electricity; improvement in standard of local transport and increased employment opportunities (Figure 14b and c).

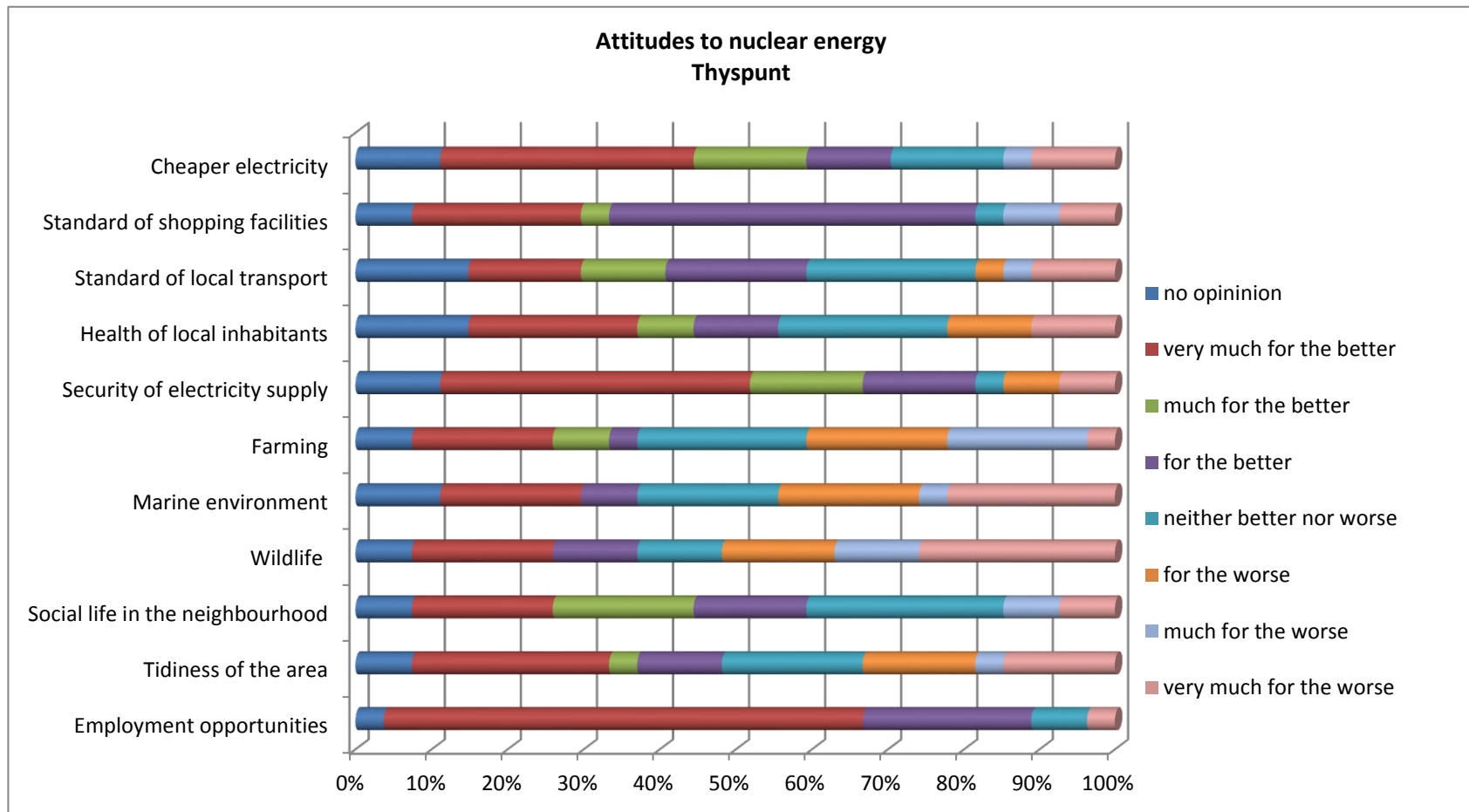


Figure 14 (a) An assessment of people’s opinions on the impact of nuclear energy: Thyspunt

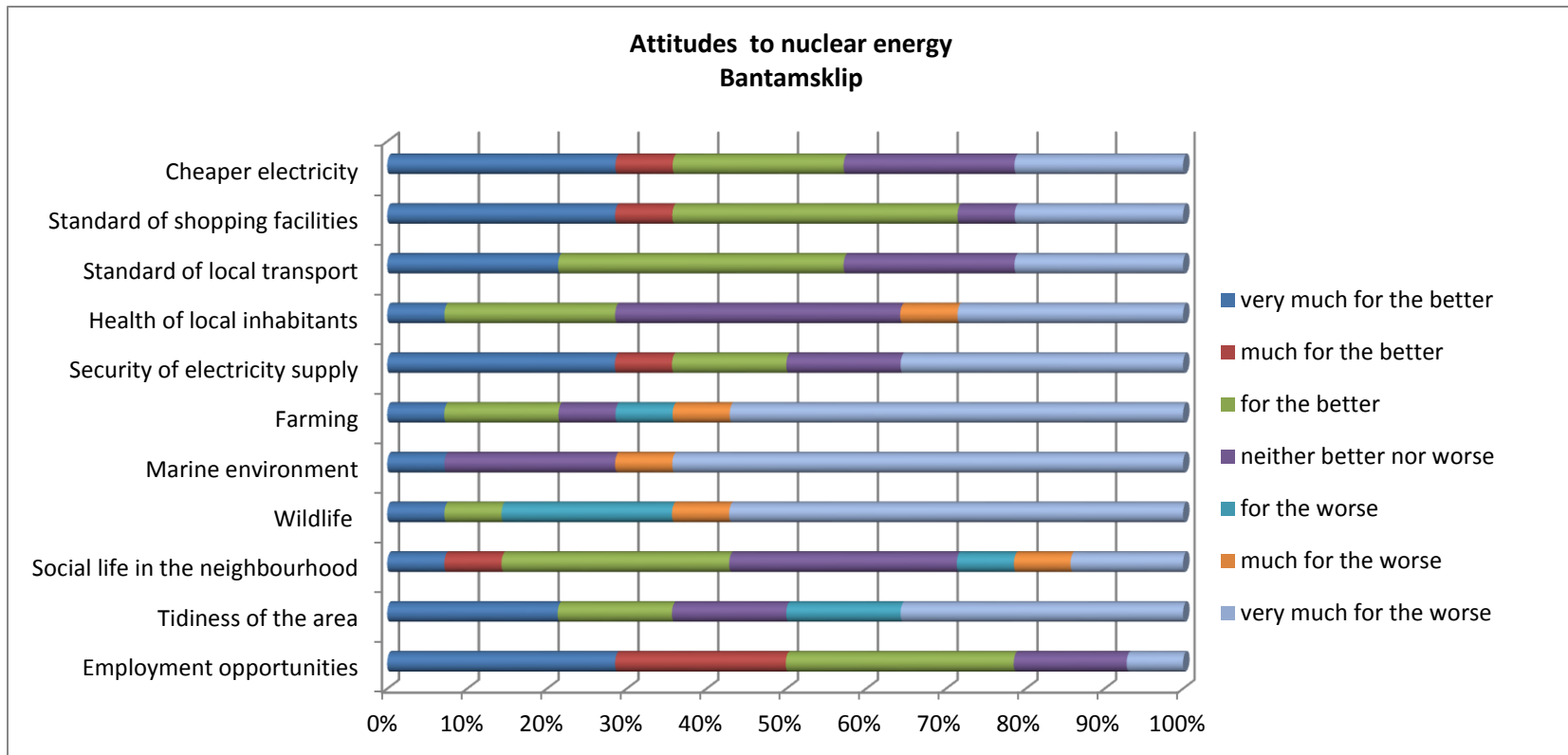


Figure 14 (b) An assessment of people’s opinions on the impact of nuclear energy: Bantamsklip

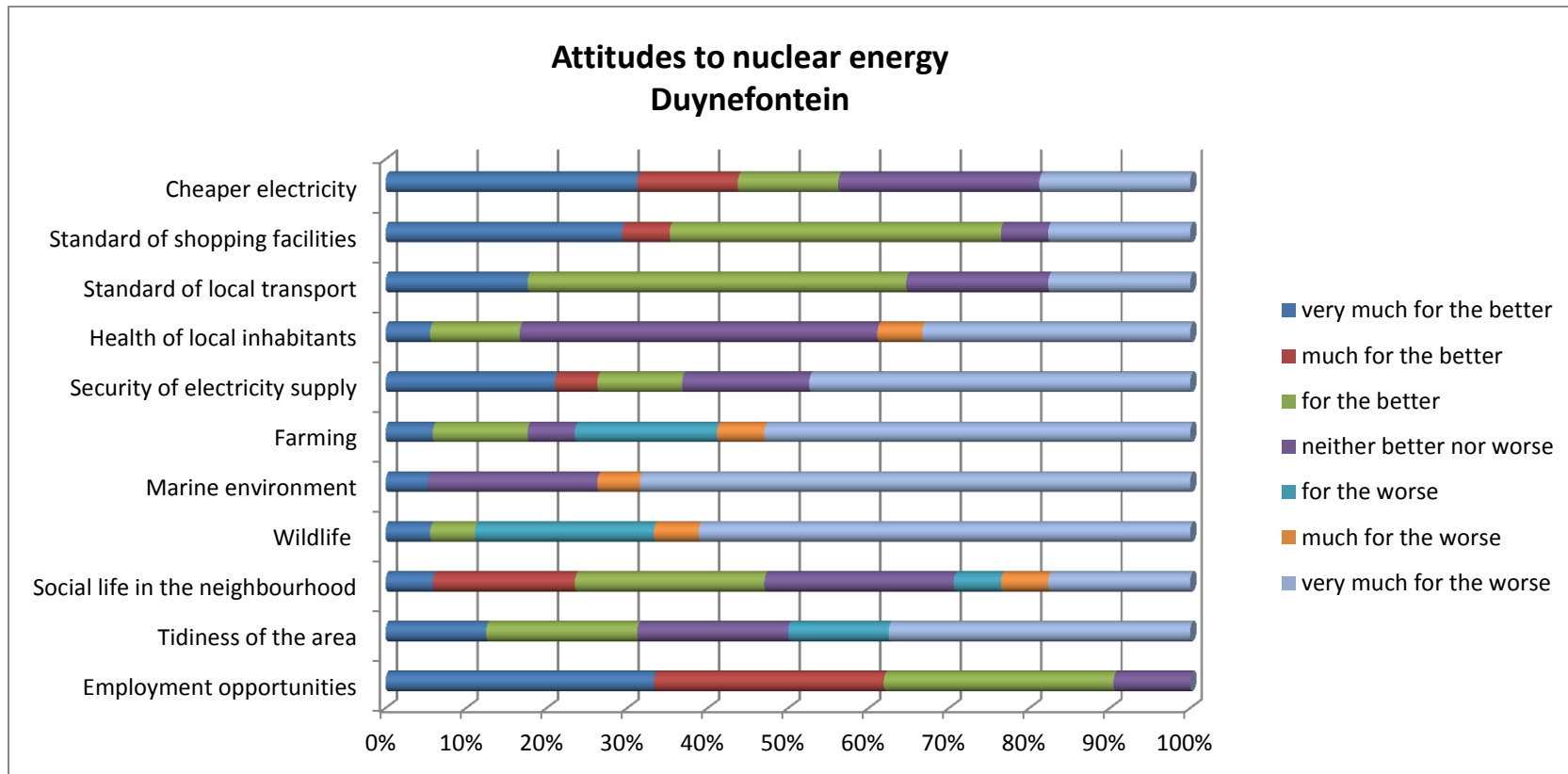


Figure 14 (c). An assessment of people’s opinions on the impact of nuclear energy: Duynfontein

CHAPTER FIVE: DISCUSSION

It is widely recognized that public opinion is important not only during the construction phase of new nuclear plants but also it must be taken into account when evaluating any country's national overall energy demands and ways and means to meet them. The importance of political and social issues in determining policies and methods for nuclear power has long been recognized. In as far back as the 1970's, scientific discussions and studies emphasized the importance of collective engagement of nuclear scientists and technologists alongside various interest groups involved in the construction of nuclear power systems (International Conference on nuclear power and its fuel cycle, 1977). It is now common practice in many countries to regularly conduct opinion and attitude assessment studies in order to determine public attitudes to nuclear. These studies are either small or large scale country specific and/ worldwide polls, surveys and outlook studies conducted by specialized institutes such as the Nuclear Energy Institute, Energy Information Agency (EIA) in the US, and organizations specializing in survey studies (Ipsos MORI, UK).

Public attitudes to nuclear are not static and are influenced by events and catastrophes associated with nuclear hazards. Consequently large scale studies are usually carried out to provide baseline data afterwhich monitoring of the attitudes to nuclear power over time is done, which can be as frequent as month to month attitude assessment surveys (Nuclear Energy Update Polls, UK, etc). For example, following the Fukushima disaster in 2010; in the US, surveys were conducted between October 2010 and March 2011. These surveys showed that public opinion shifted against the increased use of nuclear energy. Such shifts in public opinion are not necessarily against nuclear power, but rather vary from country to country and community to community - such as the results shown in Britain where public opinion to nuclear power after Fukushima has seen peaking levels, rising three points higher than pre-Fukushima levels (Wallard, Dufy and Cornick, 2012). This study provided an opportunity to assess peoples' opinions about nuclear energy, in particular, to assess attitudes towards the construction of new

nuclear plants in South Africa, as it was carried out soon after the Fukushima incident. Four main issues were established from the population:

- Background variables such as the socio-demographic status of the population;
- knowledge of, and preferences for energy generation;
- opinions and perceptions about nuclear energy and lastly,
- Perceptions about the effects of construction.

5.1. Background variables

One of the factors known to influence people's openness to nuclear energy is trust. Increased trust in organizations responsible for assessing and communicating about the risks associated with nuclear energy e.g. agencies, government and nuclear industry partners, is related to increased support for nuclear energy (Greenberg 2009a; Greenberg et. al, 2007; Tanaka 2004; Whitfield et al, 2009). Of specific inference to this study, high levels of trust in Eskom were expected amongst the affected communities due to prior engagements between Eskom and the communities during the pre-environmental assessment surveys and focus groups discussions which had taken place already.

In addition to the trust factor, many public polls globally have shown that people's attitude to nuclear power is largely influenced by socioeconomic factors. In the US, for example, there has been a noticed gender gap in support for nuclear energy with more men being more supportive than women (Bisconti 200b; Greenberg 2009a; Greenberg and Truelove 2011). In addition, people who reside near nuclear waste facilities have been shown to be more supportive of nuclear energy than members of the general public (Greenberg 2009b). With regards to education level mixed results have been found, with no correlation between support for nuclear energy and the level of education of the respondents. In this study, from all three sites, it is clear that the majority of respondents are female. Most of the respondents are residents and property owners in

the areas. Of particular note, is that the majority of people support the construction of new plants in South Africa, but there was split opinion on the construction near their residential localities. There was no significant relationship between education status and support for the construction of new nuclear plants ($p \geq 0.05$).

5.2. Knowledge and preferences for energy generation

The majority of the respondents do know that energy in South Africa is largely generated from coal. However, in Thyspunt and Bantamsklip, respondents show neither support nor opposition to the construction of wind, gas or coal power plants. In Duynefontein, a large majority (90%), strongly support the construction of wind power plants. Although not tested, this distinct preference for wind power plants in Duynefontein may be attributed to perceptions about geographical location and weather conditions in the Western Cape. The Western Cape is characterized by strong wind conditions throughout the year.

5.3. Knowledge and perceptions about nuclear energy

The knowledge about certain aspects of nuclear energy varied between the three localities. In Thyspunt, whilst the majority of respondents disagree that nuclear provides the cleanest energy option, they believe that South Africa should go ahead with the planned construction of new nuclear plants. There was no clear demonstration of the stance and knowledge regarding the economic benefits of nuclear energy and knowledge about hazardous waste from nuclear. In Bantamsklip and Duynefontein on the other hand, the majority of participants strongly agree that nuclear contains hazardous wastes that could be dangerous to society, but, nonetheless, strongly support South Africa's plans to construct additional nuclear power plants. These people do not believe that nuclear energy is the cleanest option, and strongly disagree that it provides economic benefits. Taken together, these results regarding knowledge about nuclear energy show a variation in opinions and suggest a knowledge gap amongst residents regarding nuclear energy, its risks and benefits.

The attitudes towards the construction of new nuclear plants between the three study sites were not similar. A large percentage of respondents from Thusypunt very strongly support the construction of new nuclear plants. However, these people are somewhat opposed to the construction near residential localities. Whilst the majority of people from both Bantamsklip and Duynefontein neither support nor oppose construction of new nuclear plants in general, they strongly oppose the construction of nuclear plants near residential localities. Taking these results collectively, this study shows that the majority of people, mostly property owners in the areas, support the construction of new nuclear plants, but these should be away from their residential sites. Due to lack of comparative data, it is not clear whether and to what extent is this opinion influenced by the Fukushima tragedy which occurred during the time of this study. Therefore the data gathered here will provide a baseline for monitoring changes in perceptions about nuclear energy over time.

5.4. Perceptions about the effects of construction

The results obtained from this study regarding the attitude to construction near residential localities are comparable to those shown around the world where the NIMBY phenomena had been reported. These results clearly demonstrate that the major concerns regarding the actual construction are short-term, ranging from concerns about influx of workers into the areas, spread of HIV/AIDS, security in the area, amenities for the additional population and conversion of land from current use.

5.5. Conclusions and Recommendations

The participants from this study are mainly residents and mostly property owners and females, in the age groups 20 – 45 years. A large percentage of the respondents are aware that energy in South Africa is largely generated from coal and showed an understanding of the other alternative sources such as wind power plants. However, with regards to general knowledge about nuclear energy, the study shows that between the three sites there is split opinion with regards to knowledge about the value of nuclear energy and knowledge about the hazardous wastes from nuclear.

In terms of attitudes, the participants are open to new nuclear plants in South Africa, but these should preferably not be located near the places of residence. The perceived benefits associated with new nuclear plants appear to be those of improved socioeconomic conditions such as security of electricity supply, cheaper electricity and improved health of the local dwellers. The perceived concerns to the communities are associated with harm to the environment. The major concerns are harm to marine life, wildlife and farming. These trends are similar to what has been observed in many countries around world with communities affected by construction ear places of residence. The perceptions on the most important short terms impacts of the actual construction are varied between the three localities. The top five and most common concerns in the areas are: - influx of workers into the areas, spread of HIV/AIDS, security in the area, amenities for the additional population and conversion of land from current use. The perceived benefits in the long term appear to be those of improved social conditions such as improved shopping facilities, standard of transport and increased employment opportunities.

5.6. Recommendations for further study

Since the 1970's, public opinion on nuclear energy issues has been changing. In the 1970's the increased opposition to nuclear energy coincided with the growth of the environmental movements. Since then, the environmentalists became more organised and broadened their membership throughout the world whilst also gaining political and scientific significance. At the same time, media interest in environmental and climate change issues increased. The periods of increasing public concern on the issue of nuclear energy were marked by several developments. For example, some countries held national referenda on the subject (Austria, Switzerland and Sweden); whilst others organised national discussion and information campaigns (Austria, 1976 – 77); the Netherlands, 1982 – 83) in an attempt to promote public debate. The increasing and consistent public opinion polls measuring public attitudes to nuclear energy reflect the acknowledgement of the importance of public opinion on this issue.

In countries in which nuclear energy has been used for a long time, the limiting factors for support are mainly related to safety, the disposal of nuclear waste and trust. This study, although small scale has provided a basis for monitoring public attitudes over time. This study can also be expanded to determine national attitudes and perceptions about the issue of nuclear energy, given the constraints in energy sources in South Africa.

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APPENDIX 1

CONSENT FORM

The Cape Peninsula University of Technology supports the practice of protecting participants' rights. Accordingly, this project was reviewed and approved by the CPUT Research Committee. The information in this consent form is provided so that you can decide whether you wish to participate in our study. It is important that you understand that your participation is considered voluntary. This means that even if you agree to participate you are free to withdraw from the survey at any time, without penalty.

This study is an investigation into attitudes and perceptions of stakeholders towards the construction of new nuclear power plants. For this study, you will complete a questionnaire. Should you be willing to be interviewed, an appointment will be setup with you in order carry out the interview at your earliest convenient time.

Participation in this survey poses no risks or threats to you, and your name will not be associated with the findings. Also, upon completion of your participation in this study you will be provided with a brief explanation of the question this study addresses. If you have any questions not addressed by this consent form, please do not hesitate to ask. You will receive a copy of this form, which you are free to keep for your records.

We thank you for your time.

Researcher's Signature

M Mbusi

mbusim@eskom.co.za

CONSENT STATEMENT:

I have read the above comments and agree to participate in this survey. I understand that if I have any questions or concerns regarding this project I can contact the

investigator at the above location or the Cape Peninsula University of Technology Research Ethics Committee, c/o Professor N Bechan at 021 460 3673.

(Participant's signature)

(date)

APPENDIX 2
Name and Surname of respondent (optional):

Please circle the most appropriate response from the options provided:

Section 1: Personal Information						
Age (in years)	Less than 20	20 - 35	36 - 45	46 - 55	Above 55	
Race	African	White	Coloured	Indian	other	
Gender	Male		Female			
Residential status	Owner	Tenant	Day visitor	Tourist	Other	(please specify)
				
Number of years in the area	Less than two years	2 - 5 years	6 - 10 years	11 - 20 years	More than 20 years	
Level of education	Matric less	or Diploma /degree	Postgraduate level			
Contact details						
e-mail address and/or telephone (optional):						

Section 2: Knowledge about energy generation							
How do you think electricity is generated in South Africa	Largely from Coal	Largely from Wind	Largely Hydro (water)	Largely from Nuclear	Do not know	Gas	Solar
In this area, how is electricity generated?	Coal	Wind	Hydro	Nuclear	Do not know	Gas	Solar

Section 2.1: General beliefs about nuclear energy

	Very strongly disagree	Strongly disagree	Disagree	No opinion	Agree	strongly agree	Very strongly agree
Nuclear energy is the only practical and cleaner energy source for the future							
Nuclear energy is the cleanest energy option							
South Africa							

should abandon all plans to build nuclear power plants							
Nuclear energy involves harzadous waste which could affect a large number of people							
Nuclear energy provides economic benefits which are essential to society							
Any other?							

Section 3: Construction of new power plants in South Africa

Section 3: Construction of new power plants in South Africa						
	Coal-fired power plants	Natural gas-fired plants	Nuclear power plants	Wind power facilities	Solar power plants	
Very strongly support						

Strongly support					
Support					
No opinion					
Opposed					
Strongly opposed					
Very strongly opposed					

Section 4: Construction of new nuclear power plants in your locality

In order to diversify the energy mix and to expand the existing capacity for energy, the SA government has proposed the construction of new nuclear power plants in your area. How would you feel if the proposed power plant were to be built 15km from your home?

Strongly oppose	Somewhat oppose	Support	Strongly support	No opinion
	Yes	No		
Have you attended any public meetings / or hearings on the proposed development in your area (please				

select yes or no)				

Section 5: Construction phase

Which of the following issues are of serious concern to you during the period of construction of the new nuclear power plant?

	Very much for the better	Much for the better	For the better	Neither better no worse	for the worse	Much for the worse	Very much for the worse
Air pollution							
Noise and visual pollution							
Traffic congestion							
Influx of workers into the area							
Security concerns during construction							

Amenities for additional population							
Conversion of land from current use							
Housing of construction workers							
Spread of HIV/AIDS							
Other (please specify)							

Section 5.1: Construction phase

Please rank these concerns in order of importance to you (1 – least important to 5 – extremely important)

	1	2	3	4	5
	Least important	Slightly Important	Important	Very important	Extremely important

Air pollution					
Noise and visual lpollution					
Traffic congestion					
Influx of workers into the area					
Security concerns during construction					
Amenities for additional population					
Conversion of land from current use					
Housing of construction workers					
Spread of HIV/AIDS					
Other (please specify)					

Section 6: Potential consequences

	Very much for the better	Much for the better	For the better	Neither better nor worse	For the worse	Much for the worse	Very much for the worse
Employment opportunities							
Tidiness of the area							
Social life in the neighbourhood							
Wildlife							
Marine environment							
Farming							
Security of electricity supply							
Health of local inhabitants							
Standard of local transport							

Standard of shopping facilities							
Cheaper electricity							
Other							

Section 6.1: Potential consequences

Please rank these concerns in order of importance to you (1 – least important to 5 – extremely important)

	1 Least important	2 Slightly Important	3 Important	4 Very important	5 Extremely important
Employment opportunities					
Tidiness of the area					
Social life in the neighbourhood					
Wildlife					
Marine environment					

Farming					
Security of electricity supply					
Health of local inhabitants					
Standard of local transport					
Standard of shopping facilities					
Cheaper electricity					
Other (please specify)					

Section 7: Importance of impact of plant construction

If there were to be a public inquiry into the building of a nuclear power station in your neighbourhood, how much importance do you think should be attached to each one of these? Please rank these in order of importance (0 – not important to 7 –extremely important)

	0	1	2	3	5	7
	not important at all	Least important	Somewhat important	important	Very important	Extremely important

Local environmental impact						
Political implications						
Economic impact and arguments						
Risks of nuclear accidents						
Any other (please specify)						