A STRUCTURED APPROACH TO ENERGY RISK MANAGEMENT FOR THE SOUTH AFRICAN FINANCIAL SERVICES SECTOR

by

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Declaration

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I declare that the above thesis is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

14/07/2017

SIGNATURE DATE

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Abstract

Energy conservation, efficiency and renewable energy have become a vital part of everyday life and business. The increase in energy cost and the consequences of greenhouse gas emissions necessitates energy management and in particular energy risk management within organisations. Organisations need to manage the possible negative effect that the increased costs will have within the organisation. The present research investigated the introduction of a structured approach to energy risk management within the financial services sector of South Africa. The research followed a quantitative, non-experimental research design by using a structured questionnaire. The questionnaire was sent to managers within the financial services sector. The research investigated the criteria for the implementation of a structured approach to energy risk management such as organisational requirements (culture, corporate social responsibility, management, and finance), governance, energy strategies (energy conservation, efficiency and renewable energy), risk identification, risk management and lastly communication and review. The research found that the structured approach to energy risk management should include the context within the organisation namely organisational requirements, governance and energy strategies. Thereafter the risks within the energy strategies need to be identified, analysed and evaluated, and control measures need to be implemented. It is important to monitor the various energy strategies continuously in order to identify corrections and implement preventative actions. The strategies need to be reviewed and communicated in terms of the various strategies to all stakeholders within the organisation in order to set continual improvement plans. Risk management should form part of the energy management strategies of organisations. The research showed that energy risk management plays an important role in the overall business strategy and that the vast majority of financial services organisations have already implemented some form of energy management. There are however aspects that are still lacking within management strategies that need attention.

Key terms

Energy risk management; risk management; corporate social responsibility; management; culture; energy conservation; energy efficiency; renewable energy; energy policy; governance

TABLE OF CONTENTS

List of abbreviations

ADB	African Development Bank
CDM	Clean Development Mechanism
CEO	Chief Executive Officer
CFL	Compact Florescent Lamps
COP	Conference of the People
CSP	Concentrating Solar Power
CSR	Corporate Social Responsibility
DME	Department of Minerals and Energy
DMR	Department of Mineral Resources
DSM	Demand Side Management
EIA	Energy Information Administration
EIAs	Environmental Impact Assessment
EnMS	Energy Management System
GHG	Green House Gas
GW	Gigawatt
GWhr/m2	Gigawatt hours per square meter
IEA	International Energy Agency
IEP	Integrated Energy Plan
IPP	Independent Power Producers
IRENA	International Renewable Energy Agency
IRP	Integrated Resource Plan
ISO	International Organization for Standardization
IT	Information technology
KWEDF	Klipheuwel Wind Energy Demonstration Facility
LED	Light Emitting Diode
MW	Megawatt
NEES	National Energy Efficiency Strategy
NERSA	National Energy Regulator of South Africa
PCF	Prototype Carbon Fund
PDCA	Plan-Do-Check-Act
PEST	Political, Economic, Societal and Technological
PSEE	Private Sector Energy Efficiency
PV	Photovoltaics
REFIT	Renewable Energy Feed-in-Tariff
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RUSEFF	Russian Sustainable Energy Financing Facility
SARS	South African Revenue Service
SO	Sub-objective
SSM	Supply Side Management
SWOT	Strength, Weaknesses, Opportunities and Threats
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USA	United States of America

VaR	Value at Risk
WWF	World Wildlife Fund for Nature's

List of tables

List of figures

CHAPTER 1 INTRODUCTION

1.1 Introduction

Energy conservation, efficiency and renewable energy have become key aspects of everyday life and business. Some of the motivations for energy conservation are the fact that energy use has an effect on the environment as a whole, and that the conservation of energy could decrease the cost of living and business (Wallace 2011). According to the US Energy Information Administration (EIA) (2013), the total consumption of marketed energy worldwide is projected to increase by 56% between 2010 and 2040. The World Wide Fund for Nature's (WWF) Energy Review of 2010 (Worthington & Tyrer 2010) indicated that 50% of sustainable energy should be produced through renewable energy sources by 2030, while the 2011 report investigated the possibility of 100% renewable energy by 2050. The increase in marketed energy and the cost of energy necessitate energy management and, more importantly, energy risk management by organisations in order to manage the possible negative consequences that increased costs would have on organisations.

According to Veit (2010), 1.6 billion people do not have access to modern energy sources, and 2.6 billion still make use of traditional biomass, such as charcoal, firewood, crop residues and manure, for everyday household chores, including cooking, water heating and lighting. The African Development Bank (ADB) Group (2008) introduced a framework in September 2007, which included the following three important proposals on climate change and energy challenges:

- widening the energy access;
- creating clean energy and low carbon emissions; and
- creating and adapting climate risk management.

In June 2011, the International Organization for Standardization (ISO) published *ISO 50001, Energy management systems – Requirements with guidance for use*, with the primary purpose of creating a global and relevant international standard on a range of practices, including management systems, test methods, product specifications and assessment practices (Meffert 2010). According to ISO 50001, the main benefits of the standard will be to increase energy efficiency, to create a reduction in costs, and to enhance energy performance. The benefits of ISO 50001 also confirm what is proposed in the ADB's framework on climate change and energy challenges (African Development Bank Group 2008).

Certification in terms of a specific ISO standard is not compulsory and can be done to improve the overall sentiment of external stakeholders. The ISO does not do certification; this is done by external certification bodies (ISO 2012). Some of the benefits for an organisation of obtaining ISO 50001 certification are the potential to grow customer confidence and the potential to enhance the organisation's overall brand image (Baier 2011).

Energy management has become a focal point in today's economic and social environment, as emphasised by the greenhouse gas (GHG) emissions tax and the phenomenon of global warming. GHG emissions can be defined as the emission of various gasses, mostly carbon dioxide, into the earth's atmosphere, which contribute to the greenhouse effect (Collins English Dictionary 2014.). Davidson, Tyani and Afrane-Okesse (2002) state that global energy demand was projected to increase by 2.8% per year. According to their research, South Africa is the most industrialised country in Africa and produces the largest amount of GHG, as its energy supply is mainly coal-based. In 2014, the International Energy Agency (IEA) (2014) indicated that 69% of South Africa's energy supply was produced from coal, 15% from crude oil, 11% from renewable sources, which included biofuels and waste, 3% from gas, 2% from nuclear energy and less than 1% from hydro-electricity. The primary supply of energy in South Africa in 2014 is illustrated in Figure 1-1.

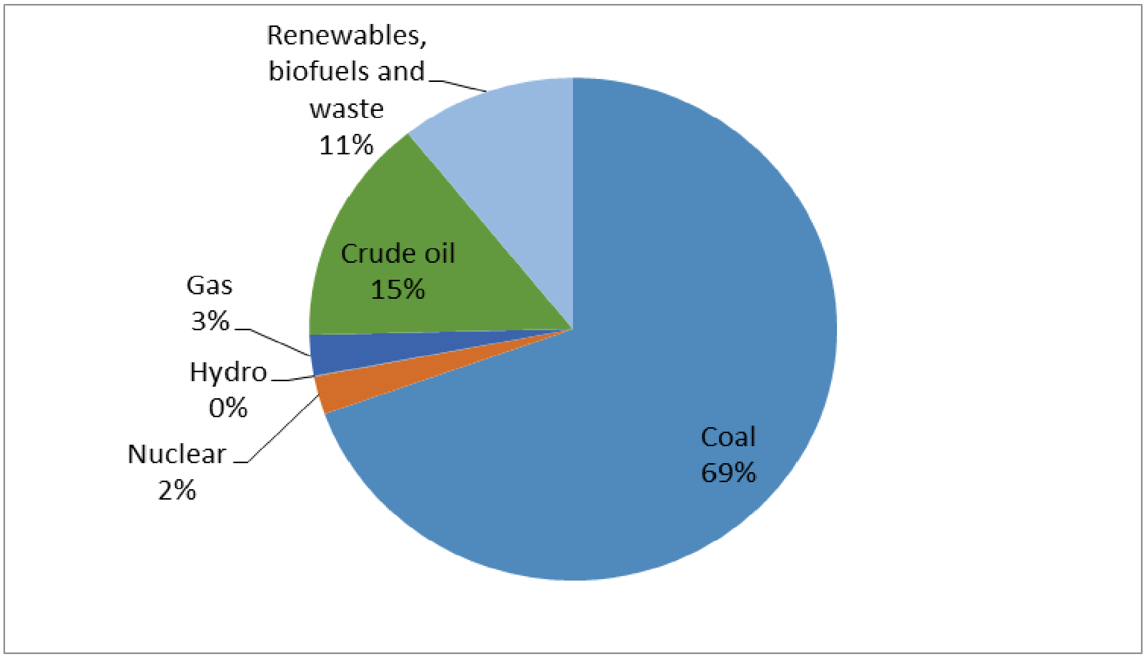


Figure 1-1 Primary supply of energy in South Africa (2014)

Source: Adapted from IEA (2014)

Figure 1-1 illustrates the final energy use per sector in South Africa, namely that the three major consumption sectors are industry (39%), residential (24%) and transport (26%), which together use almost 90% of the total energy available. Commerce (6%), agriculture (3%), fishing (less than 1%) and other sectors (2%) consume less than 12% of the energy available in South Africa. Industry, as illustrated in Figure1-2 consists of mining, iron and steel, chemicals, non-ferrous metals, non-metallic minerals, food, pulp and paper, and tobacco, and consumes around 40% of the total energy supplied in South Africa (Department of Energy 2009).

Although the energy, transport, mining and industrial sectors were prioritised for mitigation action regarding climate change and for the implementation of alternative energy sources (Department of Energy 2015b), there is still great potential for the implementation of energy management strategies and the reduction of energy costs in the commerce sector.

The Department of Energy (2015b) indicates that the envisaged contribution of solar thermal technologies will have to increase by 25% over the next 15 years.

This will require residential, commercial and industrial sectors to initiate a significant uptake in solar heating and cooling systems.

Commerce refers to financial services, information technology, tourism and government. The present study focussed on the financial services sector only due to the opportunities for improvement in energy efficiency and management within this sector.

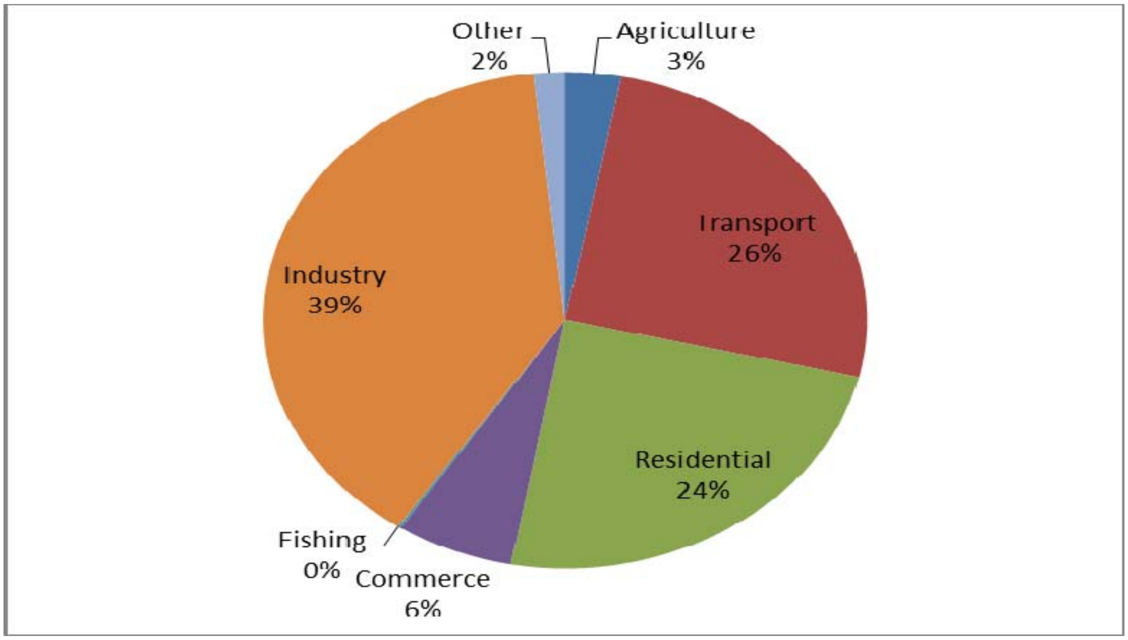


Figure 1-2 Energy usages by sector (2014)

Source: Adapted IEA (2014)

Although energy usage by the commerce sector was quite low, at below 10% in 2014, there are many opportunities for improvement in the energy usage of this sector and the inclusion of renewable energy in the energy mix. The commerce sector mainly uses energy in the form of lighting, heating and air-conditioning. It is important for organisations to manage energy in order to decrease costs, increase sustainability and lower carbon emissions. The next section comprises an overview of literature, and discusses risk management, the various risk types, the risk management process and energy risk.

1.2 Literature review

Before dealing with energy risk management, it is imperative to understand the overall concept of energy risk, the various approaches to risk management and the relevant factors which could influence the efficiency of an organisation. A detailed focus on the underlying literature of risk management will clarify risk management concepts that form part of energy risk management. Therefore, the objective of the literature review is first, to deal with the concept of risk management, then to examine the various risk categories and risk types in the market, and then to provide an overview of the risk management process. In Chapter 3, different risk categories will be investigated, indicating how energy risk fits within these categories and how a structured approach to energy risk management improves the analysis of it.

1.2.1 Risk management

Risk management has become an increasingly critical function in all organisational environments. Organisations need to focus on the management of the financial and operational consequences that a financial crisis might have on their organisations, and on the increasing cost consequences of natural disasters around the world. Risk management is defined by various authors in different ways. Valsamakis, Vivian and Du Toit (2010:2) define it as "the art and science of managing risk". Chance (2003) defines it as a process where the desired and actual level of risk is identified, and these risks are then monitored and managed to keep them aligned. Sadeghi and Shavvalpour (2006) define risk management as the processes and tools used by an organisation to evaluate, measure and manage the various risks. Furthermore. Maginn, Tuttle, Pinto and McLeavey (2007:580) define it as a process to identify the exposure to risk, to establish a range of acceptable exposures, and to measure and adjust these exposures continuously.

Based on the definitions of risk management above, it can be concluded that risk management is a process of identifying, evaluating, measuring and managing risks on a continuous basis. The present research firstly investigated how various authors categorise risk, in order to establish a definition for energy risk management and to provide a foundation for the implementation of a structured approach to energy risk management. An analysis of the risk management process will follow (see section 3.4). The discussion of the risk management process will be presented in Chapter 3 and will incorporate the energy management process.

1.2.2 Risk categories

Risk management divides risks broadly into financial and non-financial risks. This section will consider how various authors sub-categorise risks, such as operational, market and credit risk within these two fields.

Ghosh (2012) defines financial risk as market risk, credit risk and operational risk, and non-financial risk as reputational, legal, technology, strategic, operational, environmental and control risk, as well as money laundering. Although not all risk types are included in these definitions, the main areas of risk management are identified. Figure1-3 graphically illustrates how Ghosh (2012) divided risk management into financial and non-financial risks.

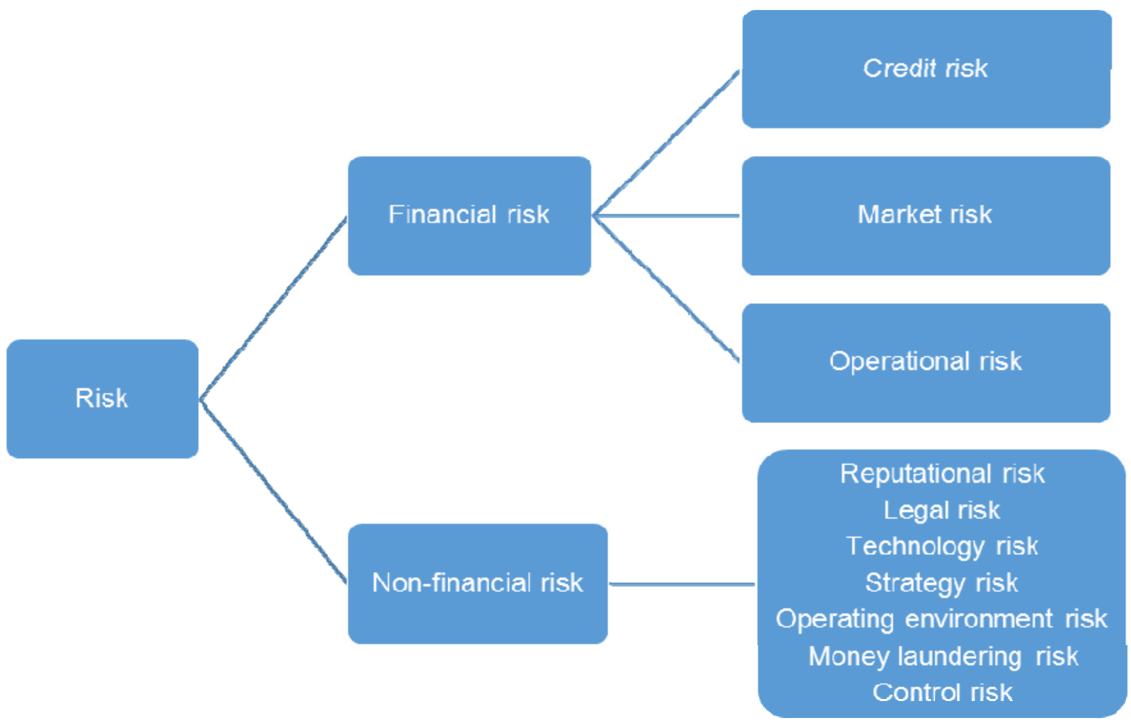


Figure 1-3 Risk management categories

Source: Adapted from Ghosh (2012:5)

Chance (2003) and Maginn *et al.* (2007) also divide the risks of an organisation into financial and non-financial risks. To them, **financial** risks include liquidity, credit and market risks, which in turn include commodity, equity, exchange rate and interest rate risks, while **non-financial** risks include accounting, taxes, model, operations, regulations, settlement and legal risks. These are graphically illustrated in Figure 1-4

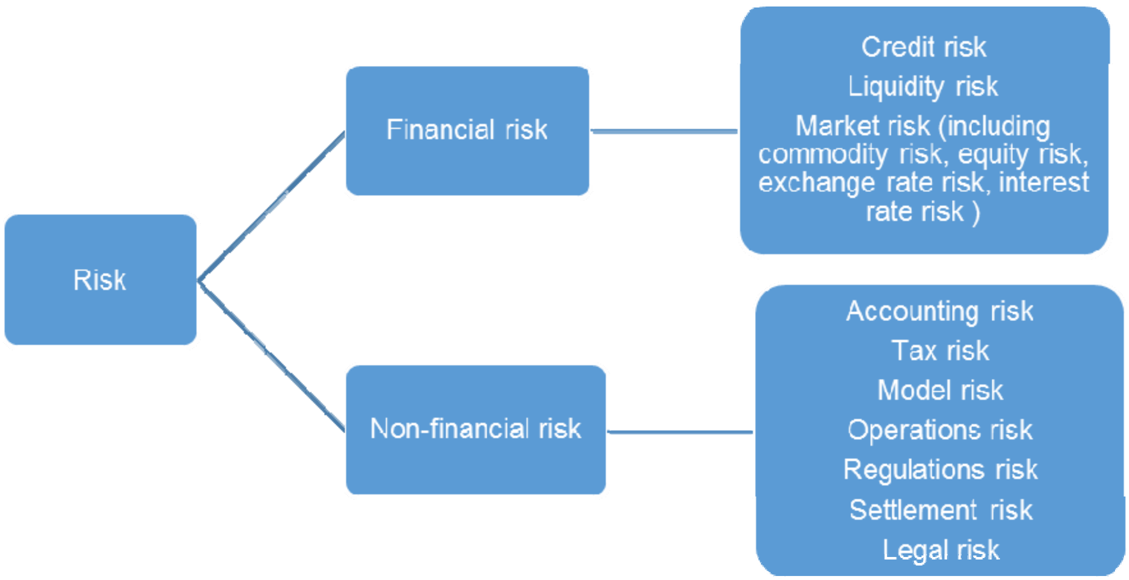


Figure 1-4 Risk management categories

Source: Adapted from Chance (2003:570)

Chapman (2011) does not draw a distinction between financial and non-financial risks but lists them all separately as financial, operational, technology, project, ethical and health and safety risks. He further sub-classifies financial and operational risks. Financial risks are credit, liquidity, interest rate, inflation, currency, funding, foreign investment, and derivative risk. Operational risks are system, business, crime, regulatory, reputational, disaster, information technology, legal and outsourcing risk, as can be seen in the graphic illustration in Figure1-5.

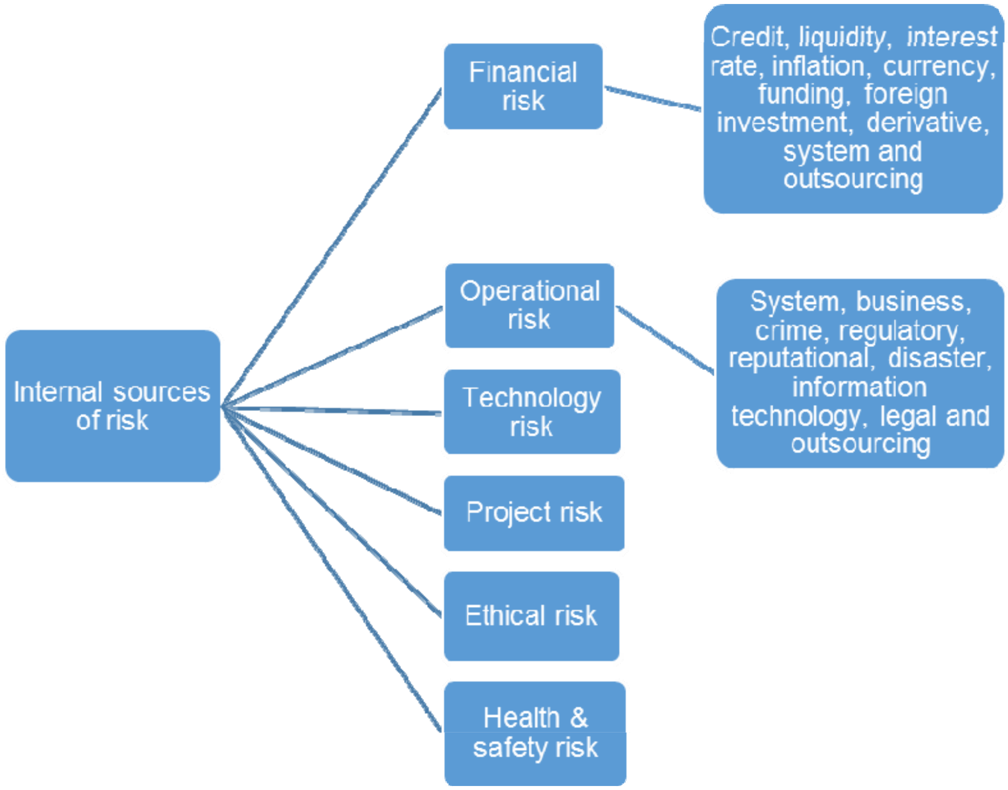


Figure 1-5 Internal sources of risk

Source: Adapted from Chapman (2011:247)

Most of the risks identified by previous authors are relevant to energy projects. Through continuous investment in energy projects and sustainable energy sources, the management of the risks associated with these projects has become an important consideration in organisations. Some of the factors that drive these investments are striving to reach carbon emission targets, decreasing the dependency on fossil fuels, and increasing the supply of long-term sustainable energy (Watts 2011).

Energy efficiency projects include operational risk, financial risk, exchange rate risk, regulatory and contract risk, credit risk and liquidity risk (Kleindorfer 2011). Renewable energy risks include operational risk, regulatory risk, product market risk, input risk and financial risk (Cleijne & Ruijgrok 2004). Rivža and Rivža (2012) further indicate that the dominant risks in renewable energy production are technology, environmental, legislative, financial and investment risk, with less common risks being reputational, operational, resource, social and macroeconomic risks. Therefore, energy risk can be defined as the risks associated with energy projects (both energy efficiency and renewable energy projects) and investments. Based on the literature, this study defined some risks that form part of energy projects. These are financial (i.e. market, credit, and liquidity risk) and non-financial risk (i.e. operational risk, reputational, disaster [weather/environmental], strategic or business and regulatory risks) (Figure1-6).

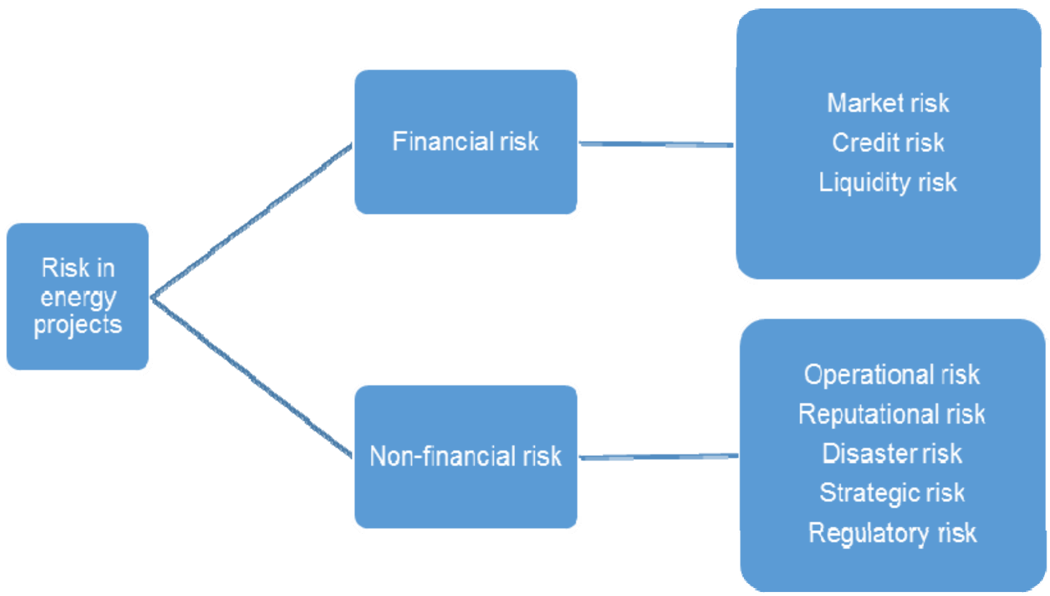


Figure 1-6 Risks in energy projects

Source: Author

Financial risks can be defined as a decrease in profitability or the total collapse of an organisation due to adverse events (Chapman 2011). Banks (2010) defines financial risk as the risk of loss due to financial activities, such as a change in interest and exchange rates that negatively affect the payments involved in energy projects. Watts (2011) further shows that financial risk is the risk of having insufficient access to capital in order to manage the energy project.

Market risk is the risk of loss due to a change in the market value of the underlying instruments (bonds, shares, loans and commodities). Watts (2011) indicates that for renewable energy projects, market risk is the risk that commodity prices and other inputs will increase or the price of energy for sale will decrease. Credit risk, also known as default risk, is the risk that the counterparty will not be able to make the necessary payments or will default on the contract; therefore, creating a financial loss to the organisation. Liquidity risk is the risk that the underlying instrument cannot be bought or sold without incurring significant costs or risk that the organisation will not be able to obtain enough funds to settle its financial obligations (Banks 2010; Chance 2003; Chapman 2011; Maginn *et al.* 2007).

The Basel Committee on Banking Supervision (BCBS) (2004) defines operational risk as a risk of loss due to insufficient or failed internal processes, people or systems or due to external events. This is currently the most accepted definition of operational risk and is confirmed by Banks (2010), who says that operational risk is the risk of loss when the processes and procedures of an organisation fail or are inadequate. For energy projects, these may include outdated technologies or inadequate systems or, in the case of renewable energy plants, unplanned closures (Watts 2011).

As seen in Figure 1-6, reputational risk, disaster risk, strategy risk and regulatory risk fall under operational risk. This section will define these risks briefly. First, reputational risk can be defined as the risk of loss due to damaging publicity and public image (Banks 2010; Ghosh 2012). Chapman (2011) further indicates that negative reputation could decrease sales, harm the recruitment of high-level staff and business partners and could make debt more expensive, which also relates to energy projects within the financial services sector. Second, disaster risk incorporates weather and environmental factors, and is defined by Banks (2010) as the risk of loss when the physical infrastructure is damaged, leading to a cessation of all business operations. Chapman (2011) elaborates on this definition of disaster risk, stating that it is the risk of loss due to fire, natural disasters, floods and terrorist attacks, which negatively affect business operations. Watts (2011) states that disaster risk can be seen as the risk of damage caused by the environment and the subsequent liability arising from such damage. Third, strategic risk affects the viability of the organisation. This can be attributed to obsolete technologies (Watts 2011). Lastly, there is regulatory risk, defined by Maginn *et al.* (2007) as an uncertainty regarding the regulation of various transactions or a change in the regulatory environment. Watts (2011) further indicates that regulatory risk is risk which arises from changes in policy that could affect the profitability of the energy project.

Section 1.2.2 defined the different risk types within organisations. These risk types are also contained in energy projects, which all need to be managed in order for the organisation to have a sound risk management process.

Section 1.2.3 focusses on the overall risk management process and the various components that form part of this process. The views of various researchers on the risk management processes are evaluated. The section also includes a discussion on the development and selection of methods to manage risk, including implementation and continuous monitoring of performance. A more detailed analysis of the process is reflected in Chapter 3, in order to establish the risk management process most suitable for energy projects.

1.2.3 Risk management process

Risk management is seen as a continuous process that needs to be managed and monitored throughout the organisation's operations (Maginn *et al.* 2007). The risk management process is regarded by Valsamakis *et al.* (2010) as constituting risk identification, risk evaluation and risk control and financing. Harrington and Niehaus (2003) identify the same three components for risk management as Valsamakis *et al.* (2010), but elaborate on the risk control and financing section. The International Organization for Standardization (ISO) (2009) states that organisations have to manage risk by identifying, analysing and evaluating the different risks within the organisation. A decision on the treatment that needs to be implemented can then be made. This treatment must be monitored, reviewed and communicated constantly to the organisation's stakeholders.

Chapman (2011) has a similar definition of risk management, stating that it requires establishing the context, identifying and analysing the risks. After the analysis, risks have to be evaluated and a decision taken on appropriate risk treatment, which will be monitored and reviewed and ultimately followed by communication and consultation with all stakeholders. The last two stages happen on a continuous basis in all the risk management processes.

The different stages in the risk management process will be discussed in detail. The implementation of a structured and consistent process of risk management helps organisations to manage risk effectively, efficiently and coherently (ISO 2009).

According to the ISO31000 (ISO 2009), the risk management process must be a fundamental part of the management function of an organisation. It is important for management to tailor risk management to the requirements of the organisation and to root the risk management in the practices and culture of the organisation. In order to manage risks within an organisation, management needs to monitor the risk management process continuously, and communicate and consult with stakeholders. It is the responsibility of management to establish the context of the risks within the organisation, to identify, analyse and evaluate the risks, and lastly, to find a treatment in order to manage the risks effectively. These stages are discussed in more detail:

- *Communication and consultation*

Communication and consultation are continuous activities that form part of all stages of the risk management process, as can be seen in Figure1-7. Internal and external stakeholders need to be consulted on the causes and consequences of risks and the best way to measure and treat these risks within the organisation. For this reason, it is important that communication form part of the early stages of the risk management process (ISO31000). During this stage, it is necessary to communicate all relevant decisions and processes of the various risk management stages to all stakeholders in the organisation. Chapman (2011) indicates that the communication and consultation stage is a process of gathering relevant information regarding the key risks identified, the opportunities that exist and the decisions of the business. In order for risk-related decisions and communication to be effective, organisations first have to establish the context within which they operate.

- *Establish the context*

Establishing the context requires the manager to review the business background in its entirety, as well as the specific activities related to the organisation (Figure1-7). This includes understanding the overall environment within which the organisation operates as well as the internal environment and culture of the organisation (Berg 2010). The aim of this stage is to gather as much timely and accurate data as possible in order to establish a relevant and accurate risk management process (Chapman 2011). This will include the development of risk criteria by means of a SWOT (strength, weaknesses, opportunities and threats) analysis or a PEST (political, economic, societal and technological) analysis. The risk criteria should be relevant to the type and level of risks within the organisation and should be related to the weaknesses and opportunities of the organisation (Berg 2010).

The next stage in the risk management process is risk assessment, as indicated in Figure 1-7. This comprises the identification, analysis and evaluation of the overall process (Chapman 2011; Edmead 2007; ISO 2009).

- *Risk identification*

Risk identification requires a holistic view of the business, which comprises economic, legal and regulatory information. Valsamakis *et al.* (2010) and Berg (2010) suggest that this is the most important stage in the risk management process. During this stage, all sources of risk are categorised, the consequences for the achievement of the goals and activities of the organisation are evaluated, and the available opportunities are identified (Berg 2010; Chapman 2011; Edmead 2007; ISO 2009). Valsamakis *et al.* (2010) refer to these as macro and micro risks. Macro risks are the major risks within an organisation that could result in large financial loss if not properly managed, whereas micro risks are sub-sections of the macro risks which could be prevented through proper risk control measures.

- *Risk analysis*

The purpose of the risk analysis stage is to decide on the likelihood of the risk occurring, as well as to establish the opportunities available to manage the adverse effects if the event does occur (Berg 2010; Chapman 2011; Edmead 2007; ISO 2009). By developing a proper understanding of the various risks within the organisation, management could use the analysis as an input to evaluate whether the risks should be accepted or whether they should be treated (ISO 2009).

- *Risk evaluation*

Risk evaluation assists management in decision-making, and is based on the outcomes of the risk analysis. In the risk evaluation stage, the level of risk identified is compared to established, pre-set risk criteria within the organisation (Berg 2010; ISO 2009). Valsamakis *et al.* (2010) define risk evaluation as assigning a numerical value to the risks identified. The purpose of this is to get an overall view of the size of the different risks and their possible financial effect on the organisation. Chapman (2011) points out that at this stage, management evaluates the results that were established during the analysis stage of the process. During risk evaluation, the relationship between potential risks and opportunities is evaluated in order to establish the net effect, should the event occur. Managers then need to make a decision on whether the risk will be accepted or if further treatment is required to manage the risk. If accepted, the risk should be constantly monitored and reviewed.

- *Risk treatment*

Chapman (2011) indicates that in the risk treatment stage, the context and risk assessment is used in order to establish a proper response and plan to manage the unacceptable risks and the opportunities that exist, in order to achieve the organisational objectives. This stage requires the development of a cost-effective plan to treat risk by either avoiding, reducing, transferring or retaining the identified risks (Berg 2010; ISO 2009). The selection of a suitable treatment plan should incorporate the benefits and costs associated with implementation.

- *Monitoring and review*

The risk management of an organisation is a continuous process, with monitoring and reviewing the risks at various stages forming a vital part of the organisational function, as seen in Figure 1-7. This is confirmed by Chapman (2011), who indicates that monitoring and review form a key stage within the overall risk management process. As the process is not isolated, it is necessary to refer back to previous stages constantly in order to obtain additional information, particularly where business circumstances might have changed. The purpose of this stage is to:

- ensure that all controls are effective and efficient;
- gather information to enhance the risk assessment;

- analyse the implementation to improve on previous decisions;
- identify changes in the risk criteria (internal and external environment); and
- identify new and emerging risks (ISO 2009).

It is important to remember that risk management is a continuous process that should be monitored and reviewed on a regular basis and communicated to the relevant stakeholders within the organisation.

From the above explanation, the risk management process can be graphically represented as in Figure 1-7.

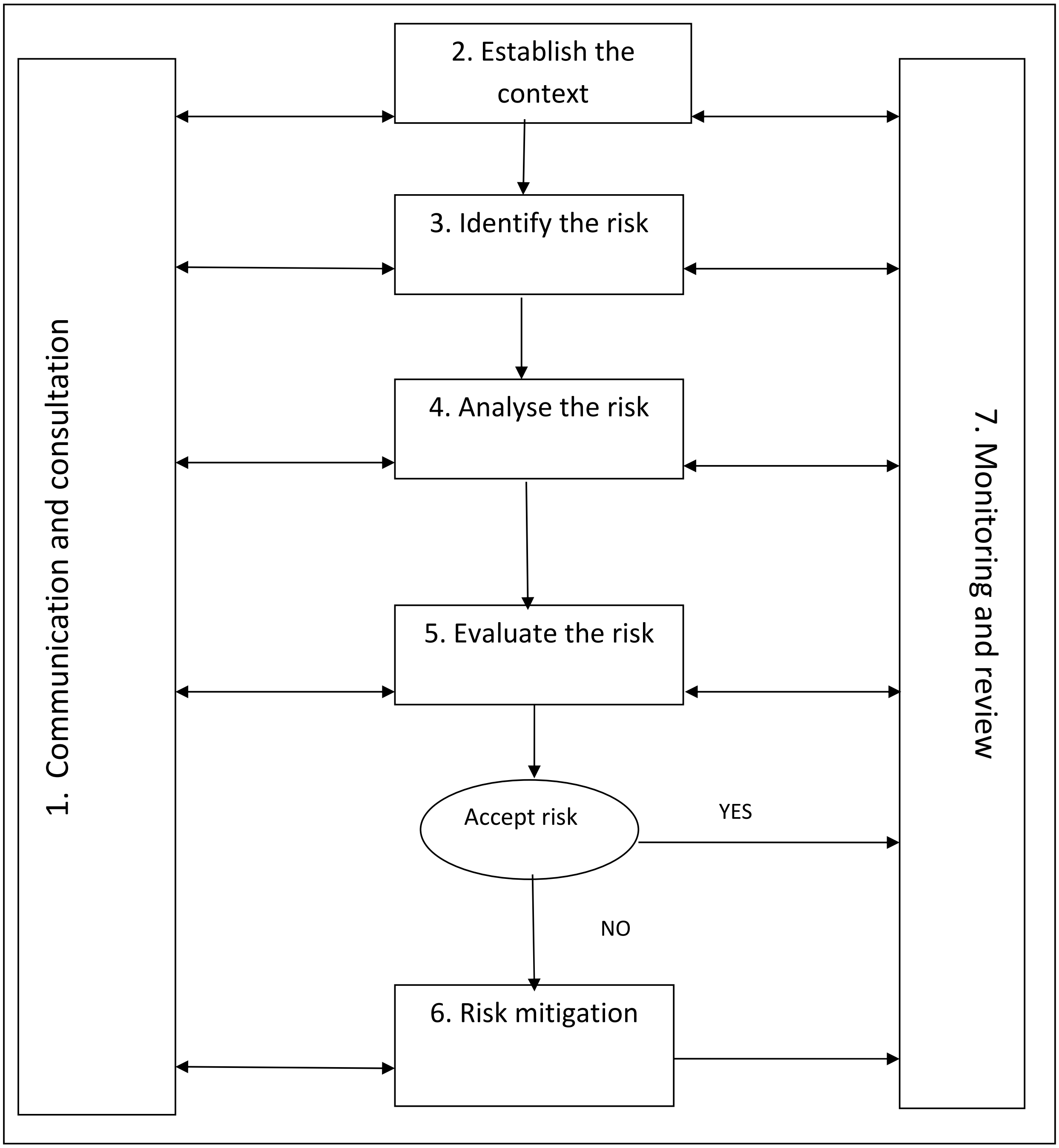


Figure 1-7 Risk management process

Source: Adapted from ISO (2009) and Chapman (2011:138)

1.3 Problem statement

Based on the above literature review, it is apparent that risk management is an important part of organisational functioning and assists in managing the important risks of an organisation. With the increased focus on energy management within organisations due to the scarcity of energy sources and the concomitant increase in price and the continuous investment in energy projects, it is imperative for organisations to incorporate energy management within their risk management processes. Previous research (Sadeghi and Shavvalpour 2006; Huisman 2009; Weron 2000) focussed on risk management within the energy markets. The energy user perspective has not yet been considered in previous research.

The purpose of the present research was therefore to establish a structured approach to the management of energy risks from the user's perspective, and to ensure the maximum efficiency of organisational processes and their ultimate contribution to the environment.

1.4 Objective of the study

The primary objective of this study was to provide a structured energy risk management approach for organisations in developing countries, to contribute to the effective management of energy projects and to add value to a sustainable environment.

In order to achieve this objective, the research had the following sub-objectives:

- SO1: Evaluate the current definitions of energy risk within organisations.
- SO2: Determine the various energy risk management processes.
- SO3: Determine the criteria to be considered for effective energy risk management.
- SO4: Determine the perceived success of energy strategies within organisations.
- SO5: Evaluate the perceived success of energy conservation, energy efficiency and renewable energy methods within organisations.
- SO6: Determine the management criteria for effective energy risk management.
- SO7: Determine the influence of finance on the implementation of energy strategies.
- SO8: Identify the effect of energy strategies on organisations.
- SO9: Develop a structure approach for the implementation of energy risk management.

1.5 Methods of research

The present study focussed first on an extensive literature review of risk management, energy management and the energy risk management process. Thereafter, international and domestic approaches and trends in energy management were researched to identify the most important criteria necessary for effective energy risk management. The second part of the research concentrated on empirical research through primary data analysis in order to identify the most important criteria for an effective energy risk management approach.

The research thus comprised two phases: the literature review and empirical research.

1.5.1. Literature review

The primary objective of the research was to identify the criteria for effective energy management for sound and sustainable energy risk management in South Africa. A literature review on risk management, energy risk management and international and domestic trends and approaches used in energy risk management was conducted in order to identify criteria. These criteria were then tested by means of a questionnaire in order to rank the criteria and evaluate the importance of implementing a structured approach to energy risk management within organisations.

1.5.2 Empirical research

The empirical research was based on a quantitative non-experimental research design in order to achieve the research objectives. Research data was gathered by means of a questionnaire, which evaluated current energy risk management criteria for the financial services sector in order to implement a sound and sustainable energy risk management approach.

The questionnaire consisted of closed-ended questions in order to gather the information needed for the research. The closed-ended questions mostly made use of a five-point Likert-type scale, and was sent to the respondents in electronic format.

1.5.3 Validity and reliability

Research design has both internal and external validity. Internal validity refers to whether the research design chosen is a good test for the stated objectives, and external validity refers to how the design can be generalised to other populations (DuPlooy-Cilliers et al. 2014). The present research used content validity in order to test whether the questionnaire measured what it was intended to measure. Content validity was conducted by giving the questionnaire (measuring instrument) to experts and other stakeholders in order to check whether all areas for the research study had been covered.

Reliability indicates whether the measuring instrument (the questionnaire) measures the concepts consistently (Kumar 2011; Cresswell 2009). The most widely used measure of reliability is known as Cronbach's alpha, which tests for internal consistency of the scale. It is imperative to report on Cronbach's alpha when using a Likert-type scale questionnaire in order to determine reliability. Cronbach's alpha indicates the consistency of the test for any of the scales and also gives an unbiased estimate of the generalisability of the information to the general population.

1.5.4 Research sample

For the purpose of this study, the target population was selected from respondents in the commerce sector of South Africa. The study focussed on the financial services industry, including banks, investment companies, insurance companies, and asset management companies. The financial services industry spends billions of rand on energy project financing and insurance, and has leading practices in order to decrease their own energy consumption and increase environmental sustainability within the industry. The sample consisted of managers within the financial services sector. Managers were chosen because they are the people most involved in operations and strategic decisions within their organisations. It was believed that they would have information and insight into the energy strategies that were being implemented, the outcome of these strategies for the organisation, and the various forms of risk management that were implemented at the time of this research to manage energy risk.

The research aimed to get a representative sample of the financial services sector in South Africa, after which the data gathered would be analysed and interpreted to establish the most important criteria necessary for implementing a strategic and sustainable energy risk management approach. This would assist the commerce industry to manage their energy risk as part of their overall risk management strategy.

1.6 Structure

The thesis is structured as follows**:**

Chapter 1 focussed on the background and introduction of the study on energy risk.

Chapter 2 deals with the approaches and trends in energy risk management, both domestically and internationally, and summarises the criteria needed for a sound and sustainable energy risk management approach.

Chapter 3 continues with the literature review on risk management. It also presents an evaluation of the risk management and energy management processes in order to identify the criteria needed to implement energy management within an overall risk management plan.

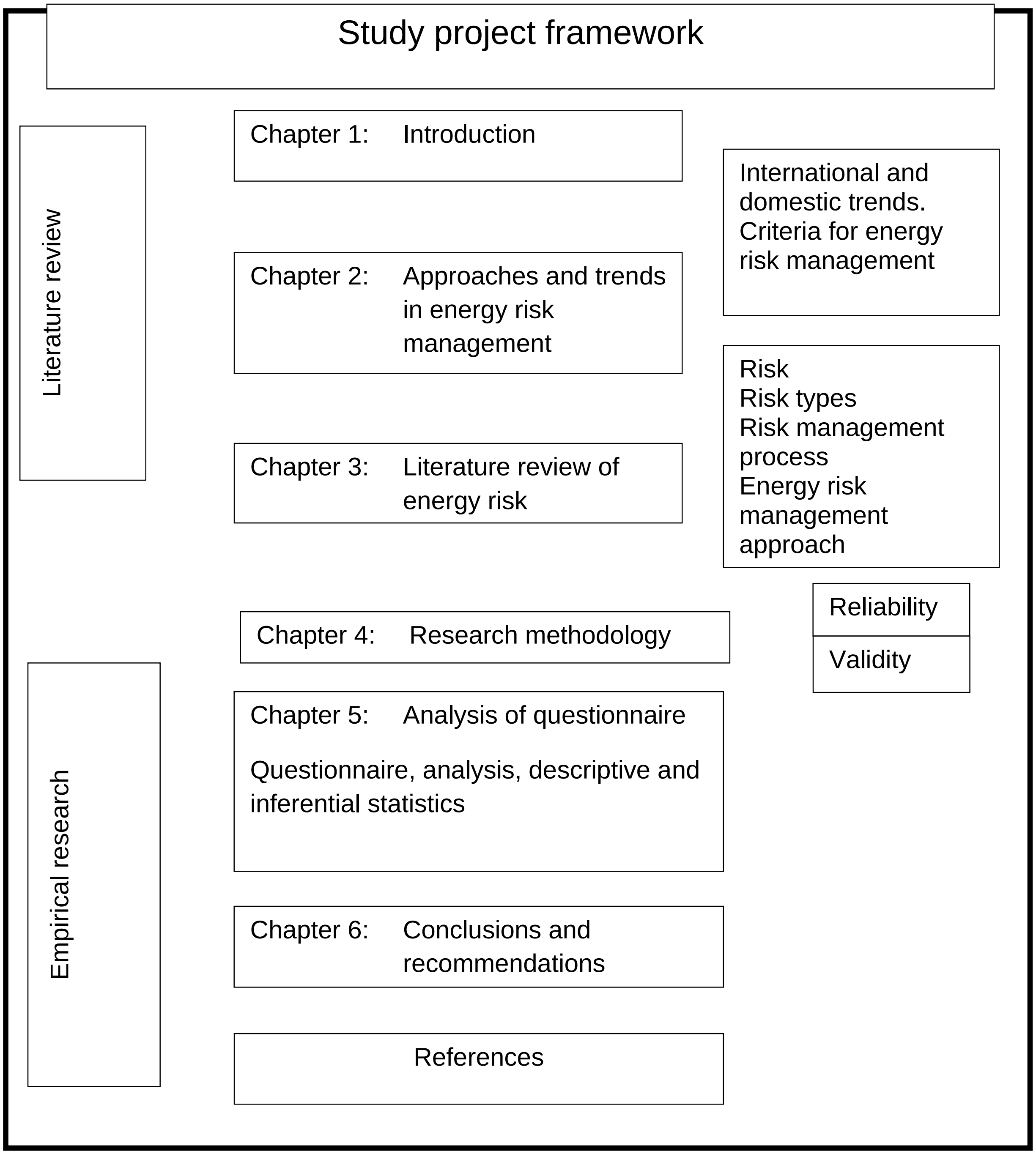
Chapter 4 entails a review of the research methodology, including the design of the research method, the structure and process of the questionnaire design as well as the confirmation of the validity and reliability of the research instrument. This section also elaborates on the selection criteria for the respondents in the study.

Chapter 5 provides the findings and analysis of the empirical research by means of descriptive and inferential statistics.

Chapter 6 presents the conclusions and recommendations regarding a structured approach for the implementation of energy risk management by the financial services sector.

Below is a graphic representation of the research framework used in this study:

Figure 1-8 Study project framework



CHAPTER 2 ENERGY MANAGEMENT STRATEGIES

2.1 Introduction

According to Esty and Simmons (2011), the interest that organisations have in green business has increased drastically, and top management in most large organisations realises that sustainable environmental issues need to be part of the strategy of the organisation. It is therefore important for organisations to set energy policies, targets and objectives in order to enhance their organisational processes and procedures, and to establish holistic risk management processes.

This chapter reports on energy management, including energy conservation, energy efficiency and renewable energy. It also presents the benefits of energy management and the advantages and disadvantages of various energy management strategies. Furthermore, a summary of international, domestic and organisational policies and requirements regarding energy management is presented, in order to establish the policy and regulation criteria necessary for energy risk management within organisations.

2.2 Energy management

Energy management is defined as a systematic tool to improve the energy performance of an organisation by means of management and technology (Private Sector Energy Efficiency Programme (PSEE) n.d.). According to the Energy Lens (2014) and the PSEE (n.d.), energy management could help an organisation to reduce costs and risks, increase the reputation of the organisation, and enhance compliance with relevant legislation. Energy is therefore a critical factor in both the economic and social development of South Africa and South African (SA) organisations (Winkler 2005). Energy is broadly divided into three aspects: energy conservation (energy saving), energy efficiency, and renewable energy (Lund 2007). All three aspects need to be implemented in order to constitute a holistic energy management strategy. According to Clark and Eisenberg (2008, cited by Fox 2009), there are two primary functions of energy: First, energy provides a comfortable work and living environment through the regulation of temperature, and second, it provides electricity for lighting and the operation of infrastructure necessary to create a productive work and living environment. As indicated in section 1.1, energy management has become a vital part of modern economy, due to an increase in energy prices and carbon emission targets, as well as the legislative and regulatory requirements of different countries. The three aspects of energy mentioned above can be graphically illustrated by means of an energy pyramid, as indicated in Figure2-1. Lund (2007) states that to implement a sustainable development strategy, there needs to be energy savings on the demand side, energy efficiency and improvements on the supply side and the replacement of fossil fuels with renewable energy. The energy pyramid includes all three of these sustainable development strategies and is a widely accepted concept in the energy community. From the energy pyramid in Figure2-1 it can be seen that in order to manage energy efficiently, organisations first have to look at the lowest cost option of energy conservation, thereafter, at energy efficiency and lastly, at renewable energy.

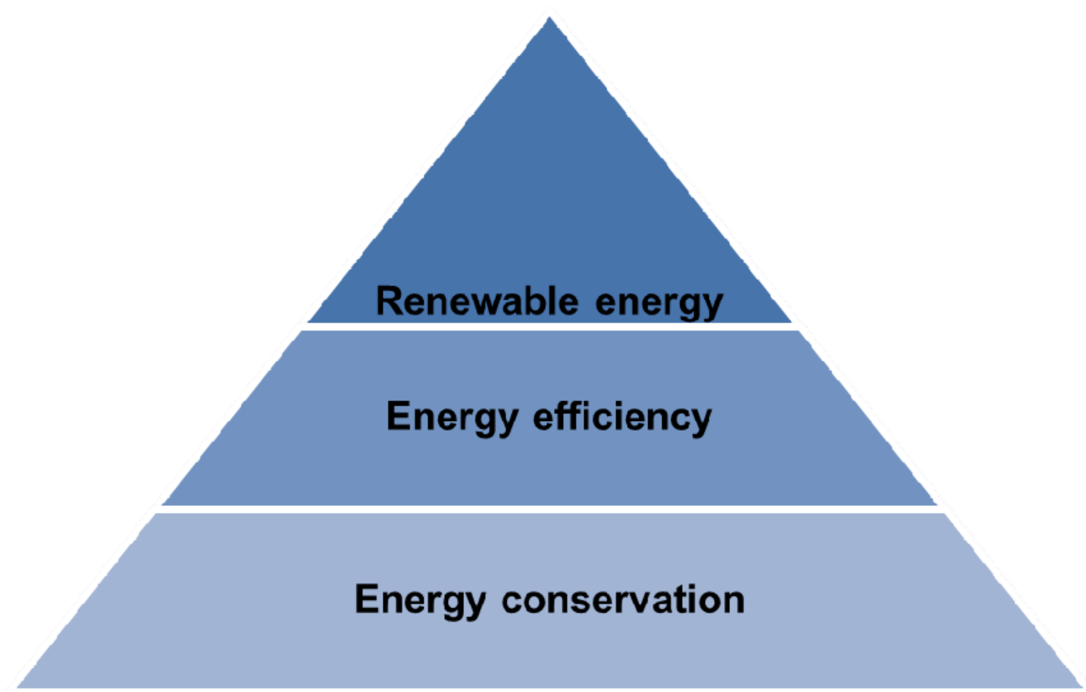


Figure 2-1 Energy management pyramid

Source: Giurata (n.d.)

As indicated by the pyramid in Figure 2-1, energy conservation is the first and largest stage in the energy management process for organisations. This stage comprises the preservation of current energy sources available, for example, basic activities such as switching off lights when not in use, making use of gas for heating and cooking, and saving water.

The second stage in the pyramid is energy efficiency. Energy efficiency can be defined as the ratio of energy input to energy output. The higher the energy efficiency, the lower the energy consumption (Patterson 1996, as cited by Hsu, Chang & Hsiung 2011). Energy efficiency can either use demand-side management (DSM) or supply-side management (SSM). With DSM, users are encouraged to use less electricity in peak periods, which does not necessarily decrease the consumption but alleviates the stress on the national grid during peak periods. SSM involves the energy that is supplied to the organisation. Energy efficiency is seen as a low-cost solution to reducing energy costs within the organisation (TWN Wind Power 2013). According to Winkler and Van Es (2007:32), ways to achieve energy efficiency include:

- efficient lighting systems, including compact fluorescent lamps (CFLs) and light emitting diode (LED) lights;
- light retrofits, including motion sensors;
- solar tubes;
- smart metering, which tracks energy consumption;
- unplugging and switching off electronics when not in use;
- programmable control systems, which monitor consumption within organisations; and
- computer-intelligent software programs to assist with management of computer systems when not in use.

The Department of Minerals and Energy (DME) (2005, as cited by Winkler and Van Es 2007) identified key barriers to the implementation of energy efficiency strategies. These are:

- energy pricing (low energy prices create the perception that energy efficiency has no financial benefit);
- lack of knowledge and understanding of the energy efficiency methods;

- institutional barriers and resistance to change;
- low investment confidence (the perception that return on investment might not be realised); and
- imperfect or incomplete information when making decisions.

Further barriers as indicated by the Department of Energy (2016) are:

- the economic downturn and decreases in commodity prices;
- market failures;
- the high cost of energy-efficient appliances; and
- the negative incentive of high borrowing costs.

All these barriers decrease the likelihood of organisations implementing energy efficiency strategies. Winkler and Van Es (2007), however, indicate that energy efficiency measures can also have a positive effect on financial returns, the reduction of GHG emissions and an overall national economic benefit. This was confirmed by the Department of Energy (2016), which indicated benefits such as the reduction of GHG emissions, a decrease in energy expansion costs, improving the trade balance and employment creation. Energy efficiency also has a direct effect on the competitiveness, productivity and product quality of the organisation.

Figure 2-1 shows that the last aspect of efficient energy management within an organisation is renewable energy sources. Renewable energy is the most costly stage in the energy management pyramid, after energy conservation and energy efficiency.

Fossil fuels are currently used to produce most of the supply of energy to the world. These have deleterious consequences for the environment, but there may well be sufficient supplies to continue to sustain the next generation (Dresselhaus & Thomas 2001). Fossil fuels are energy sources that are produced from animal and plant remains over a very long period and include coal, oil, gas and turf (Quaschning 2009). In producing energy through fossil fuel, carbon dioxide and other harmful toxins are released into the atmosphere (Dresselhaus & Thomas 2001). This, in turn, increases the amount of GHG emissions, which have negative consequences for the environment.

In order to meet the ever-increasing demand for energy production and to allow for the depletion of fossil fuel sources, the world has to look at producing more alternative clean energy (Dresselhaus & Thomas 2001). Lund (2007) concurs with this point by indicating that there is a need to replace fossil fuels with alternative energy sources in order to improve the sustainability of energy sources. Further reasons to investigate the use of additional renewable energy sources are the harmful effect of carbon emissions and the increased price of fossil fuels (Fox 2009). Organisations can assist in decreasing the GHG emissions from fossil fuels by implementing energy management strategies, and by not only looking at renewable energy sources, but also considering energy conservation and energy efficiency within their organisations.

Renewable energy sources are those energy sources that are replaced as they are used, such as solar, wind, wave, tidal, biomass, hydropower as well as geothermal energy (Beugeling, Vijge & Witherden 2002). Bugaje (2006:604) indicates that the major sources of renewable energy in Africa are solar power, wind energy, wood and biomass, as well as biogas production. Lund (2007) also mentions solar, wind, water and biomass as renewable energy sources. Hsu *et al.* (2011) are more focussed on the energy industry and include solar energy, wind power, biofuel, hydrogen power and fuel cells, hybrid power automobiles, and multi-fuel gasification-based power generation. Quaschning (2009) showed that all the renewable energy sources combined (solar, wind, hydropower, biomass, geothermal heat and tidal energy) would exceed the total fossil and nuclear fuels available on earth. Small (2012) further adds that renewable energy is captured through natural processes, such as photosynthesis, geothermal heat flows, solar radiation, wind and water.

Based on the above, renewable energy can be defined as a collection of any usable, sustainable energy source, such as solar, wind, waves and tides, hydropower and biomass to replace fossil fuels in the production of energy, with no or very low carbon emissions. These sources can be replaced after they had been used (Beugeling *et al.* 2002) and are implemented to reduce dependency on the fossil fuel supply and the costs associated with this form of energy (Fox 2009). Winkler (2005) also indicates that renewable energy assists in reducing a dependency on fossil fuels, but adds that it could furthermore assist in increasing access to clean energy, diversifying the supply of energy and reducing pollution. There is still some debate on whether nuclear energy should form part of renewable energy sources. Kenny (2014) indicates that nuclear energy is one of the cleanest forms of energy, and it has the lowest amount of waste products compared to other renewable energy sources. However, the world still sees this as a dangerous and expensive source of energy, especially after the Fukushima Daiichi disaster in 2011. Fukushima Daiichi is situated on the coast of Japan, which was hit by a devastating tsunami in 2011. This caused the disabling of the power supply and the cooling systems of three of the nuclear reactors, which leaked nuclear material into the surrounding environment (World Nuclear Association 2012). After this disaster, Germany, which was the forerunner in nuclear energy, decided to decommission all its nuclear reactors by 2022 (Turner *et al.* 2013; The Guardian 2011).

According to Fox (2009), renewable energy sources are used to replace or supplement the current fossil fuel that is used in most energy production. Most countries are increasing the use of renewable energy sources. Morocco, Egypt, Tunisia, Algeria and Nigeria are all planning to increase their renewable energy sources by between 2% and 40% by 2030 (Cassell 2013). South Africa's 2030 target for renewable energy sources is between 15% and 29% (Edkins, Marquard & Winkler 2010). In December 2015, the SA government approved for the Department of Energy to call for proposals for the implementation of nuclear power for the country (LeCordeur 2016). This has, however, elicited widely differing views from stakeholders regarding the feasibility of nuclear when compared to other renewable energy sources for the SA energy mix.

According to Worthington and Tyrer (2010), Southern Africa has a quarter of the world's best solar areas and ample wind near the coastal regions. They further indicate that solar and wind energies are the most promising technologies for South Africa. This is supported by Bugaje (2006:605), who indicates that South Africa is a solar-rich country with an average 24 GWhr/m^2 per year. By June 2014, South Africa had already established 1.9 GW of renewable energy capacity in the country's energy mix (Department of Energy 2015b). This is an increase of 1.4 GW since 2010, in both utility-scale and small-scale installations, which shows a significant change in the energy landscape of South Africa.

According to Lund (2007), energy conservation is the first step in energy management within an organisation, and includes the preservation of current energy sources. This is followed by energy efficiency initiatives that could assist organisations to decrease their energy costs. The last state of energy management, as indicated in Figure 2-1 is the implementation of renewable energy sources. This is the most costly stage in the energy pyramid and refers to solar, wind, waves and tides, hydropower and biomass being used to replace fossil fuels in the production of energy.

The next section will evaluate solar power and wind power as renewable energy sources, giving a brief background of these energy sources as well as the advantages and disadvantages that these energy sources could have for organisations.

2.2.1 Solar power as renewable energy source

Due to the SA climate, solar power is a great source of renewable electricity production. According to the Department of Energy (2015a), solar power is the most readily available renewable energy source in South Africa and can be used for electricity as well as for powered heating. Solar power is either produced by concentrating solar power (CSP), where the sun is used to heat fluids, which turn into steam and are converted to electricity by means of a conventional turbine, or by PV (PV), where solar radiation is converted directly to electricity (Bartels, Pate & Olson 2010). CSP is seen as a fairly new commercial technology, which contains significant risks and uncertainty, but which will be ideal for South Africa as a result of the SA climate (Edkins *et al.* 2010). Edkins *et al.* (2010) also indicate that there is great potential for growth in this technology worldwide. Bartels *et al.* (2010), however, indicate that the cost of wind and other alternative energy sources is less than that of solar energy. They indicate that, for solar power to be cost-effective there needs to be improvements in the technology or lower costs for solar panels, enabling solar power to be feasible for the future. In South Africa, PV systems are mostly installed in areas that are far from the current electricity grid. These include schools, healthcare centres and rural households (Edkins *et al.* 2010). Edkins *et al.*

(2010) further state that the cost of producing renewable energy through PV systems is still higher than that produced through CSP and wind energy.

The advantages of solar energy are the following:

- It is infinite, whereas coal and oil reserves will last for 30 to 40 more years.
- It can be used in remote areas that cannot easily access the national grid.
- It does not pollute or emit GHG.
- The energy is free, except for the installation and maintenance costs.
- The energy projects could assist in job creation.
- It could avoid political and price volatility (Ryan 2009; Whitburn 2013.)

According to Dresselhaus and Thomas (2001), the principal disadvantage of using solar energy is the unreliability of the climate, as sunlight varies with the time of day and season, often resulting in low sunlight-to-electricity conversion. Ryan (2009) further indicates that solar collection panels are expensive, and large areas of land are required to capture sun energy. Whitburn (2013) adds that solar panels and batteries are bulky and need storage space. The biggest disadvantage is still the current cost of installation.

Dresselhaus and Thomas (2001) indicate that to get the maximum efficiency out of alternative energy sources there need to be improvements in the storage of energy and energy transmission. They conclude that there need to be improvements in the materials used in order to increase the efficiency of not only the generation of energy but also the conversion, transmission and use of energy sources.

From the above, it is clear that the primary disadvantages of solar energy are the unreliability of sunlight, causing insufficiency in its conversion to electricity, the high installation costs and the large land requirements for solar plants. The advantages and disadvantages of solar energy are summarised in Table 2-1.

Table 2-1 Advantages and disadvantages of solar energy

Advantages	**Disadvantages**
Unlimited and free	High cost of hardware and installation
Use in remote areas	Insufficient energy conversion/storage
Low GHG emission	Unreliable climate
Increase job creation	Large land requirements

South Africa not only has ample sunlight but also a great wind energy source, especially in the coastal regions. Although the cost of solar power installations is still relatively high, it could assist organisations to decrease their carbon footprint and to create jobs in South Africa.

2.2.2 Wind power as renewable energy source

Wind energy may be regarded as one of the most mature technologies in renewable energy production, although this technology is still growing, especially in developing countries (Edkins *et al.* 2010). The wind market comprises both wind farm operators as well as manufacturers of wind turbines (Edkins *et al.* 2010). On the operating side, the market is dominated by established utilities as well as large independent power producers (IPPs), and on the manufacturing side, this market includes mostly large, established manufacturing companies (Edkins *et al.* 2010). South Africa introduced two pilot wind turbine projects, the Eskom Klipheuwel Wind Energy Demonstration Facility (KWEDF) and the Darling Wind Farm, which started producing electricity in 2006 and 2008 respectively (Edkins *et al.* 2010). The latest addition to the wind farms is the Jeffreys Bay wind farm, which is currently the biggest wind farm in South Africa, with 60 turbines. This wind farm was one of the projects that was approved in the first bid window of the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) by the SA government in 2012 (Brown 2014; Yeld 2014). There are several more wind farm projects currently being built or approved for construction, mostly in the coastal areas of South Africa. Some of these are Amakhlala Emoyeni Phase 1, Sere Wind Farm Project, and Cookhouse Wind Farm Development.

Edkins *et al.* (2010) indicate that some of the advantages of wind energy are that the cost of wind energy is known, it has a high degree of certainty and there is an additional margin for environmental outcome assessments (EIAs). They further indicate that SA wind energy programmes are well understood, have low risk, and use mature technology, which is subject to skills and infrastructure development. However, one crucial disadvantage is the increased lead time on manufacturing, which creates a shortage in supply (Edkins *et al.* 2010).

After evaluating the advantages and disadvantages of the various energy management strategies, the next section will summarise the benefits and barriers that exist in the implementation of these.

2.2.3 Benefits and barriers to energy management strategies

The main benefits of renewable energy sources and energy-saving activities are the enhancement of energy security, the protection of the environment and the reduction in GHG emissions (Russian Sustainable Energy Financing Facility [RUSEFF] 2011; Small 2012). The development of renewable energy sources furthermore assists in job creation, rural development and technology improvement (Small 2012). Some of the other benefits are the possibility of tax rebates, a decrease in operating costs as well as an increase in the corporate social responsibility (CSR) of an organisation. The barriers to these energy strategies are the high implementation costs, limited knowledge, education and awareness, inadequate incentives and finance, the weak service market and weak technology support. These benefits and barriers are discussed in detail in 2.2.3.1 and 2.2.3.2.

2.2.3.1 Benefits of energy management strategies

In 2.2.3, the benefits of energy management strategies were identified, such as the possibility of tax rebates and various other policy incentives, a decrease in GHG emissions, a decrease in operating costs and an overall increase in CSR. This section discusses these benefits for organisations in detail.

- *Possible tax rebates and policy incentives*

According to Turner *et al.* (2013), governments have introduced various policies in order to increase investments in energy efficiency and renewable energy strategies. Some of these are tax credits, feed-in tariffs, capital subsidies and tradable green certificates. This was supported by Ghoorah (2010) who indicates that governments need to implement more effective policies, including tax rebates, in order to promote the implementation of energy projects. Ghoorah (2010) further indicates that some developed countries, such as the United States have already implemented tax-based incentives, where tax credits are received for investment in renewable energy projects.

- *Decrease in GHG emissions*

As was indicated by Winkler and Van Es (2007), the implementation of energy efficiency strategies could assist in the reduction of GHG emissions. Bergmann, Hanley and Wright (2006) further found that renewable energy offers partial solutions to reducing GHG emissions and could help meet energy needs in the future. This was supported by the Department of Energy (2013), which indicated that the implementation of energy projects could assist in the reduction of GHG emissions.

- *Decrease in operating costs*

According to a study by Bartels *et al.* (2010) on the economic outcome of fossil fuels versus alternative energy sources, the operating costs of fossil fuel facilities are increasing while the costs of alternative energy are decreasing. This view is supported by Fakir (2010), who indicates that 50% of the costs of coal-fired power stations are related to upfront capital and 50% to operating costs. Renewable energy projects, on the other hand, make use of 80–90% upfront capital, with the remainder being operating costs. Energy Star (2005a) notes that the implementation of energy management will reduce operating costs within organisations. From this it can be seen that, with the implementation of energy strategies, organisations have the opportunity to decrease their overall operating costs by decreasing energy costs.

- *Increase in corporate social responsibility*

Prindle and De Fontaine (2009) present three motives for energy management strategies to be implemented: to decrease GHG emissions, to decrease operating or energy costs, and to demonstrate the organisation’s commitment to CSR. In this context, CSR is the commitment of organisations to contribute positively to environmental conservation (Davidson *et al.* 2006). Altan (2010) further indicates that CSR accounts for economic, social and environmental outcome, and aims to address sustainable development challenges. The implementation of energy strategies will therefore have a positive influence on the CSR of organisations as well as on the reputation of organisations.

This section considered the benefits of implementing energy strategies, such as reduction of GHG emissions, a positive influence on the financial returns of the organisation, increased CSR and the ensuing enhanced reputation of the organisation. These energy strategies, however, also have barriers, such as the costs of implementation, limited knowledge and awareness of the different strategies, inadequate incentives and finance, and weak service and technology support. These barriers are discussed in detail in 2.2.3.2.

2.2.3.2 Barriers to energy management strategies

In 2.2.3, the barriers of energy management strategies were identified, such as the cost to implement, limited knowledge and awareness, inadequate incentives and finance and weak service market and technical support. This section discusses these benefits for organisations in detail.

- *Cost to implement*

Fox (2009) indicates that the cost implications of energy projects are the most important barrier to their implementation. Although renewable energy projects are more capital-intensive than other energy strategies, there is an opportunity to manufacture renewable energy equipment locally and then export it to the international community, which could assist in covering the cost of the implementation of these strategies (Bergmann *et al.* 2006). High initial investment and long payback periods were listed by the Department of Minerals and Energy (2002) as financial barriers to the implementation of energy strategies. This is also indicated by Winkler and Van Es (2007), who argue that there is low investment confidence in energy projects, as investors are not convinced that returns on investments will be realised.

- *Limited knowledge and awareness*

Harnisch (2009) and Pegels (2010) refer to some of the barriers to effective energy management as a lack of education, knowledge, culture and awareness. This view is supported by Dahle and Neumayer (2001) and the Department of Minerals and Energy (2002), which indicates that environmental education, awareness and culture are lacking with regard to energy projects within organisations.

- *Inadequate incentives and finance*

Dahle and Neumayer (2001) remark that another barrier to energy management is the lack of financial resources. This is supported by Harnisch (2009) who says there are inadequate incentives and access to finance related to energy projects.

- *Weak service market and technical support*

Harnisch (2009) points out that there are gaps in knowledge and technical expertise, which prevent organisations from implementing energy strategies. The Department of Minerals and Energy (2002) arrived at a similar conclusion and states that the lack of access to key energy infrastructure and a lack of market power in utilities are key barriers to the implementation of energy strategies.

All these barriers have to be accommodated and accounted for within the energy management risk strategy of an organisation in order for the organisation to make sound management decisions. Based on the research, Table 2-2 summarises the benefits and barriers to energy management strategies:

Table 2-2 Benefits and barriers to energy management strategies

Benefits	**Barriers**
Possible tax rebates	Costly to implement
Decrease in GHG emission	Limited knowledge and awareness
Decrease in operating costs	Inadequate incentives and finance
Increased CSR	Weak service market and technical support

From the preceding discussion, it can be concluded that energy management comprises energy conservation, energy efficiency and renewable energy. It is important that all three these aspects form part of the energy strategy of an organisation. The main benefits of energy management strategies were highlighted as possible tax rebates, policy incentives, the reduction of GHG emissions, the reduction of operating costs and an increase in CSR for organisations. The barriers, however, result from high implementation costs, limited knowledge, education and awareness, inadequate incentives and finance as well as the weak service market and technological support.

Taking into consideration both benefits and barriers, the energy management strategies of organisations are influenced by government interventions and policies, organisational requirements and responsibilities, and the finance and risk management associated with energy projects.

Section 2.3 will look at the requirements by both international and domestic governments for energy, and organisational responsibilities and requirements that need to be taken into account in terms of effective, sustainable energy management.

2.3 International requirements for energy

Policy incentives are the greatest drivers for new investments in energy projects and technologies (Turner *et al.* 2013:6). Turner *et al.* (2013:6) indicate that governments have assisted the renewable energy sector through feed-in tariffs (France and Australia), tax credits (United States), capital subsidies (China) and tradable green electricity certificates (United Kingdom). In order to regulate and manage energy efficiency and renewable energy projects, organisations need to adhere to certain policies and procedures as set out by governments. The Conference of the Parties (COP) is a decision-making body of the United Nations (UN) Framework Convention on Climate Change (UNFCCC), which meets annually, enabling nations around the world to discuss energy issues and climate change (UNFCCC 2014). The UNFCCC (2014) sets up targets and standards regarding carbon emissions and energy challenges, the first of which was the Kyoto Protocol, which has been adjusted over the years in order to adhere to the changing climate environment.

2.3.1 The UNFCCC and the Kyoto Protocol

In 1992, 180 nations joined the UNFCCC in recognising that there was a worldwide problem with the concentration of GHG emissions. It was agreed to adopt specific actions in order to stabilise GHG emissions and manage climate change. These actions came into effect on 21 March 1994, when the convention agreed to embark on specific actions in order to stabilise GHG emissions. Although no specific concentration levels were set, it was indicated that the GHG emission concentration should not reach dangerous levels (Bhattacharyya 2011). In 1995, the nations realised that the emission reduction provisions as set out by the convention were inadequate. Re-negotiations were initiated to strengthen the global response to climate change by setting internationally binding emission reduction targets. This lead to the Kyoto Protocol two years later (UNFCCC 2014). The Kyoto Protocol legally binds signatory nations to reduce carbon emissions. Under the Kyoto Protocol, the clean development mechanism (CDM) was developed. This gave developed countries the opportunity to invest in CDM projects in developing countries in order to receive carbon credits and to meet their set reduction targets (Winkler & Van Es 2007:29). The first commitment period to reduce emissions was from 2008 to 2012, and the second was from 2013 to 2020 (UNFCCC 2014). Developed countries collectively agreed to reduce their emissions by 5.2% during the first period and by 18% during the second period. Although South Africa agreed to the Kyoto Protocol, developing countries did not have any quantifiable targets for the first period (DME 2002). In 2001, the detailed rules for the implementation of the Kyoto Protocol were adopted in Marrakesh, Morocco, at the Seventh Session of the Conference of the Parties (COP7). These rules are known as the Marrakesh Accord (UNFCCC 2014). In 2012, the Doha Amendments to the Kyoto Protocol were introduced (UNFCCC 2014). These included new commitments by nations in the second commitment period (2013–2020), a revised list of GHGs on which nations needed to report, and amendments to articles referring to the first commitment period (UNFCCC 2014).

Organisations do not only have to adhere to international requirements but also to domestic requirements of their particular governments. South Africa has the following energy-related policies and regulatory requirements that organisations need to incorporate into their day-to-day activities:

- White Paper on Energy Policy (1998);
- White Paper on Renewable Energy Policy (2003);
- National Energy Act (No. 34 of 2008);
- Integrated Energy Plan (IEP) (2003); and
- National Energy Efficiency Strategy (NEES) (2005).

These policies and regulatory requirements will be explained in more detail in the next section.

2.4 Domestic requirements for energy

South Africa has various policy and regulatory requirements that are related to the energy sector. These are:

- the White Paper on Energy Policy;
- the White Papers on Renewable Energy Policy;
- the National Energy Act No. 34 of 2008;
- the Integrated Energy Plan (IEP); and
- the National Energy Efficiency Strategy (NEES).

The SA government has also introduced various government projects that are aimed at boosting energy projects within the nation.

2.4.1 White Paper on Energy Policy (1998)

The White Paper on Energy Policy states that the SA energy policy should create a balance between the supply and demand of the country, including short-, medium- and long-term goals that make use of the natural resources in South Africa, while taking environmental considerations into account (DME 1998). The major objectives of the energy policy are to:

- increase access to affordable energy sources;
- improve governance of the energy sector;
- stimulate economic development;
- manage energy-related health and environmental influences; and
- secure a supply of energy through diversification (Davidson & Winkler 2003; DME 1998; Winkler 2005:28).

This White Paper highlights the need to improve the ability of government to address the country's long-term energy issues. Renewable energy resources are required to create a more sustainable energy mix within the country and to provide affordable energy solutions (Department of Energy 2015b). According to the Department of Energy (2013), these five objectives are still relevant and they form the foundation of all energy policies and procedures within South Africa. The Energy Policy White Paper of 1998 was significant in terms of the growth that renewable energy technologies were expected to have due to the competitiveness of implementation and the numerous opportunities that they would yield for the future of South Africa (Department of Energy 2015b). Table 2-3 lists the five objectives as set out by the Department of Energy as part of the 1998 White Paper on Energy Policy and indicates what will be required from government in order to meet these objectives.

Table 2-3 Energy policy objectives and requirements by government

Objective	Requirement by government
Access to affordable energy source	• Promote access to affordable energy services for disadvantaged households and businesses.
Governance of the energy sector	• Improve governance in the energy sector. • Consult stakeholders. • Co-ordinate between government departments and policies. • Strengthen government capacity for better implementation of policies.
Economic development	• Encourage competition in the energy market. • Government has to intervene in market failures to ensure effective delivery. • Government policy has to encourage cost-effective energy prices. • There needs to be transparency within subsidies. • Energy taxation will remain an option for fiscal policy. • Government to create an investor-friendly energy market.
Energy-related environmental impacts	• Promote access to basic energy services. • Establish national targets for the reduction of GHG. • Balance the exploitation of fossil fuel and acceptable environmental requirements.
Security of supply through diversity	• Encourage a diversity of energy supply sources and energy carriers.

Source: Department of Energy (2013)

Government has introduced various policies, programmes and initiatives since 1998 in order to address the objectives, as set out in Table 2-3. Some of these will be discussed later in the chapter, such as –

- the White Paper on Renewable Energy Policy (see 2.4.2);
- the National Energy Act, No. 34 of 2008 (see 2.4.3);
- the Integrated Energy Plan (IEP) (see 2.4.4);
- the Integrated Resource Plan (IRP) (see 2.4.5); and

Certain government projects such as the Renewable Energy Fee-in Tariff (REFIT) and REIPPPP programmes will also be discussed (see 2.4.6.1 and 2.4.6.2).

The White Paper on Energy Policy of 1998 was supplemented by the White Paper on Renewable Energy Policy in 2003, which recognised the significance of renewable energy for the medium- and long-term goals of the country. This White Paper is discussed in the next section.

2.4.2 White Paper on Renewable Energy Policy (2003)

The former Department of Minerals and Energy (DME) implemented the White Paper on Renewable Energy Policy in November 2003. This White Paper supplements the White Paper on Energy Policy of 1998, in which government recognised the significance of the medium- and long-term potential of renewable energy. South Africa is largely reliant on coal for energy production, but the Department of Mineral and Energy realised that, due to GHG emissions, energy produced from this source has a negative effect on climate and the environment. Therefore, the purpose of the 2003 White Paper was to establish a framework in which renewable energy could be developed with a concomitant positive effect on the SA economy and the global environment (DME 2002).

One of the key goals of the 1998 White Paper on Energy Policy was energy security through diversification. Winkler (2005:28) confirms this by indicating that securing energy supply through diversification is closely related to the use of renewable energy, as the use of renewable energy could create a more diverse energy supply. The DME, however, indicated that they would have to develop an action plan in order to facilitate the implementation of renewable energy sources within the SA economy (DME 2002).

One of the key requirements for renewable energy is funding. The SA government has budgeted for the implementation of renewable energy projects and has also endorsed the UNFCCC and the Kyoto Protocol, which give renewable energy producers access to international funding in order to reduce GHG (DME 2002). International funding includes the Prototype Carbon Fund (PCF), bi-lateral assistance and private sector investments (DME 2002). The PCF is a partnership between seventeen companies and six governments with the aim of providing funding for the reduction of carbon emissions and the promotion of sustainable development. This fund was established in April 2010, and is managed by the World Bank (World Bank n.d.).

The main aim of the Renewable Energy Policy of 2003 is to set the goals and objectives for the development and implementation of renewable energy technologies within South Africa. There are four strategic goals with supporting objectives set out in the White Paper on Renewable Energy Policy, namely the financial instruments, legal instruments, technology development and training and education through raising awareness and capacity building (DME 2002). It is imperative to look in more detail at the supporting objectives that form part of these four goals.

- *Goal 1: Financial instruments*

The first goal is related to finance within the renewable energy sector. This goal aims to implement sustainable financial instruments within renewable energy projects, and the objectives are:

- o to ensure that a reasonable amount of national resources be invested in renewable projects;
- o to set targets for the spending of public resources on renewable energy technology;
- o to introduce suitable fiscal incentives;
- o to extend government and institutional financial support and establish a sustainable structure and mechanism for financing; and
- o to assist in the creation of an investment climate towards a renewable energy sector.

The DME was restructured in 2009 to form the Department of Energy and the Department of Mineral Resources (DMR). Although the original overall responsibility of the renewable energy policy in South Africa resided with the DME before 2009, it is now the responsibility of the Department of Energy, which is tasked with creating an enabling environment for the implementation of the activities and objectives within the policy. The main strategic objective of the Department of Energy is to promote energy security by supplying affordable, reliable and clean energy sources, to give universal access to energy and to transform the energy sector in order to strengthen the operations and management of the department (Department of Energy 2015b).

- *Goal 2: Legal instruments*

The second goal looks at the legal instruments for renewable energy projects. This goal aims to develop, implement, maintain and improve the legal instruments in order to promote the development of renewable energy. The objectives of this goal are to develop a legal and regulatory framework to address:

  - the pricing and tariffs that will ensure the incorporation of renewable energy into the economy;
  - the incorporation of IPPs into the electricity system; and
  - the integration of local producers into the electricity system.

In 2009, government introduced the Renewable Energy Feed-in Tariff (REFIT) system, which was replaced in 2011 by the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP). These systems created fixed pricing and tariffs for the support of the integration of renewable energy. The tariff systems will be discussed in detail later in the chapter (see 2.4.6.1). Independent power producers were able to bid for renewable energy projects within the country. To date there have been five bid windows, contributing 6 327 MW in total from 92 renewable energy projects (Department of Energy 2015a).

- *Goal 3: Technology development*

The third goal is based on technology development within the country. This goal aims to encourage, improve and develop technologies in order to implement sustainable renewable energy. The objectives of this goal are to promote:

  - the development and implementation of standards, guidelines and a code of conduct relating to renewable energy; and
  - research and development, in order to strengthen renewable energy technologies.

- *Goal 4: Education, training and capacity building*

The last goal is based on education, training and capacity building. This goal aims to develop public awareness of the benefits and opportunities available in renewable energy. The objectives of this goal are:

- to promote education of renewable energy and energy efficiency in order to stimulate its implementation;
- to promote the renewable energy market by disseminating information on the economy, the environment and the social and trade benefits of renewable energy;
- to develop renewable energy training programmes through government and government-funded institutions;
- to involve women in decision-making and planning, and to promote empowerment in renewable energy programmes; and
- to improve communication between all stakeholders in the economy on renewable energy policy.

Although the White Paper on Renewable Energy Policy outlined the long-term vision of government for the implementation of sustainable and completely non-subsidised alternative energy, it did not quantify targets for the country. The White Paper on Renewable Energy Policy (2003) continues to provide government with the basis for investment and implementation, and for developing a sustainable market share for clean energy, as was foreseen by the DME (Department of Energy 2015a).

The four goals discussed above remain the basis of South Africa's renewable energy policy and should be incorporated by organisations within their day-to-day activities. In 2008, South Africa introduced the National Energy Act (No. 34 of 2008) to ensure diversification of energy sources and the use of sustainable energy in South Africa.

2.4.3 National Energy Act (No. 34 of 2008)

The National Energy Act was promulgated in 2008. The aim of this act is:

- to provide a variety of energy resources to the SA economy in order to ensure sustainable quantities and affordable prices. This is required in order to support economic growth and poverty alleviation. It involves incorporating environmental management requirements and promoting interaction amongst economic sectors in order to create a viable energy sector;
- to provide energy planning and supply through adequate investment in order to monitor energy demand, supply and data generation; and

- to create an institution that is responsible for the promotion of efficient energy generation and consumption and energy-related research (Department of Energy 2008).

The Act requires the Minister of Energy to develop an IEP which needs to be reviewed annually and published in the Government Gazette (National Energy Act, No. 34 of 2008). The IEP provides a roadmap for the development of the energy sector and is discussed in the next section.

2.4.4 Integrated Energy Plan (IEP) and Integrated Resource Plan (IRP)

The Integrated Energy Plan (IEP) and the Integrated Resource Plan (IRP) are two of the most important documents used in the shaping of the energy sector in South Africa. The National Energy Act (No. 34 of 2008) states that the main purpose and benefit of the Integrated Energy Plan (IEP) is to regulate the supply of energy in the most cost-effective and socially responsible way, now and in the future. The main purpose of the IEP is to provide a roadmap for the development of an energy structure for South Africa, which will guide and manage energy investments and policies (Department of Energy 2013). The IRP 2010,[1] which falls under the Electricity Regulation Act No. 4 of 2006, is secondary to the IEP and consists of the national electricity sector plan. The plan expresses the country's electricity policy and provides an overall planning framework for electricity demand in South Africa, by indicating the preferred energy mix required (Department of Energy 2015b).

The IEP is a long-term framework for the management of energy, and is updated annually by the Minister of Energy. The IEP has five objectives: creating guidelines for the implementation of policies, selecting appropriate technologies, finding investment, developing an energy infrastructure, and recommending alternative energy sources (Department of Energy 2013). The IEP is a strategic pathway where the benefits and shortcomings of various energy sources are analysed in order to find integrated relationships and to optimise the energy system (Department of Energy 2013).

[1] The updated IRP 2010 was circulated by the Department of Energy for public consultation in 2013 but has not been promulgated to date (November 2017).

The IEP evaluates the three key drivers of energy demand, namely economic growth, population growth and energy prices (Department of Energy 2013). The Department of Energy (2013) estimated the potential energy demand of the country by sector, as indicated in Table 2-4.

Table 2-4 Estimated potential energy demand by economic sector

Sector	**2010**	**2030**	**2050**	**Change**
Industry (excluding mining)	37%	33%	34%	Decrease
Mining	8%	7%	4%	Decrease
Agriculture	3%	2%	3%	No change
Commerce	7%	7%	7%	No change
Residential	11%	9%	8%	Decrease
Transport	34%	43%	44%	Increase
Total	**100%**	**100%**	**100%**	**---**

Source: (Department of Energy 2013)

Eight key objectives were identified for the IEP:

- the security of energy supply;
- the minimisation of energy costs;
- increased access to energy;
- diversifying the supply sources and primary energy carriers;,
- minimising emissions from the energy sector;
- improving energy efficiency;
- promoting localisation, technology transfer and job creation; and
- ensuring water conservation (Department of Energy 2013).

The IEP and IRP are energy-planning frameworks that are used to create supply-side capacity development, and they are used by government as the primary tool to determine the future action of electricity supply in South Africa (WWF International 2014).

2.4.5 National Energy Efficiency Strategy (NEES) (2005)

The Department of Energy introduced the first National Energy Efficiency Strategy (NEES) in 2005. The aim of the strategy was to respond to the demand for energy and to increase commitment to reducing the national environmental footprint

(Department of Energy 2016). NEES set an overall energy intensity reduction target of 12% by 2015, indicating different targets for each sector in South Africa. In 2014, the Energy Efficiency Target Monitoring System (EETMS) was established, which evaluated results from 2000 to 2012. In Table 2-5 it is clear that there was a substantial improvement in energy intensity in most sectors due to technology advancements and deliberate interventions to improve efficiency.

Table 2-5 Reduction in energy intensity targets for SA (2000–2012)

Sector	2015 targets (based on 2000 baseline)	Performance to 2012
Economy-wide	12%	23.7%
Industry and mining	15%	34.3%
Power generation	10%	26% (estimated by Eskom)
Transport	9%	14.1%
Commercial and public buildings	15%	0.3% (electricity only, from 2003 to 2013)
Residential	15%	28.2%

Source: Department of Energy (2016)

After 2015, NEES aimed to improve the achievements that were as set out in Table 2-5, by way of a combination of financial and fiscal incentives, as well as a strong legal and regulatory framework. Through NEES, the government aims to support organisations to take advantage of energy efficiency opportunities by:

- facilitating increased availability, affordability and quality of technologies;
- supporting job creation;
- supporting energy efficiency investments;
- promoting knowledge sharing and best practice; and
- developing a vibrant and professional energy services sector.

The Department of Energy has set additional targets per sector for 2030. For the commercial sector, the goal is to accelerate the current rate of improvement in energy consumption per square meter and to achieve an overall 37% reduction target, relative to the 2015 baseline. In 2.4.6, some government projects that were implemented in order to assist in the achievement of the energy targets are discussed.

2.4.6 Government projects

One of government's main roles in energy efficiency and renewable energy production is to set realistic targets (Winkler 2005:29). As indicated in 2.4.5, government set an energy reduction target for the commercial sector of 37% to be reached by 2030. Together with this reduction target, South Africa also has a renewable energy target of between 15% and 29% for 2030 (Edkins *et al.* 2010). In 2006, South Africa's total energy use was 75% reliant on coal (Banks & Schaffler 2006). In order to meet the reduction and renewable energy targets, government could set policy incentives either for costs or for quantity of renewable energy used. Some of these policy incentives are feed-in tariffs, portfolio standards or renewable obligations (Winkler 2005:31–32). These are discussed in detail in Chapter 3, where financial requirements are discussed. In 2009, government introduced the Renewable Energy Feed-in Tariff (REFIT), which was replaced by the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) in 2011. The next section reports on the background related to the introduction of the REFIT and REIPPPP incentives.

2.4.6.1 Renewable Energy Feed-in Tariff (REFIT) (2009)

In 2009, the National Energy Regulator of South Africa (NERSA) implemented the Renewable Energy Feed-in Tariff (REFIT) scheme in order to increase the implementation and development of renewable energy projects (Edkins *et al.* 2010). Phase I of REFIT focussed on solar power, wind, small hydro and landfill gas. In 2010, NERSA estimated the tariffs for these energy sources at R2.10 per unit for CSP, R1.25 per unit for wind, R0.94 per unit for small hydro and R0.90 for landfill gas, rates which, at that stage, were lower than some European countries. Phase II of REFIT focussed on CSPs, PVs, biomass and biogas, as shown in Table 2-6.

Table 2-6 NERSA REFIT tariffs (2010)

REFIT PHASE	Renewable energy source	R/kWh
Phase I	CSP	2.10
	Wind	1.25
	Small hydro	0.94
	Landfill gas	0.90
Phase II	CSP trough without storage	3.14
	Large-scale, grid-connected PV systems	3.94
	Biomass, solid	1.18
	Biogas	0.96
	CSP tower with six hours per day storage	2.31

Source: Edkins et al. (2010)

The purpose of REFIT was to enable independent renewable energy power producers to sell excess energy back into the national energy grid. The main reason for establishing REFIT was the apparent success that feed-in policy instruments had had in other countries, such as Germany and Spain (Edkins *et al.* 2010).

The National Treasury and the Department of Energy investigated various problems related to the legality of REFIT under the country's procurement framework and the willingness of Eskom to support the programme. They found that REFIT contravened public finance and procurement regulations (Department of Energy 2015b). For this reason, REFIT was replaced in 2011 by the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), which is a competitive bidding process with greater transparency.

2.4.6.2 Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), 2011)

The REIPPPP programme was introduced in 2011 to replace the REFIT scheme. According to Winkler (2005:33), the major disadvantage of feed-in tariffs is the budget constraints of developing countries for paying high tariffs. A renewable obligation strategy, such as REIPPPP, has the advantage of promoting competition in the renewable energy sector by means of a tendering process (Winkler 2005:33). The REIPPPP programme was implemented in order to enhance socio-economic and environmentally sustainable growth, and to promote a sustainable renewable energy industry within South Africa (Department of Environmental Affairs 2012). The REIPPPP programme was the primary vehicle used to secure private-sector funding and investments in order to increase electricity generation, and it gave effect to the policy decisions that were set out in the White Paper on Energy Policy of 1998 (Department of Energy 2015b).

According to FIN24 (2014), the REIPPPP programme has attracted around R120 billion of foreign direct investment and is considered a benchmark programme by policymakers. This was supported by the Department of Energy (2015b), which indicated that the regulatory framework is suitably robust and flexible enough to support emerging markets due to the rapid development of the REIPPPP programme.

Since 2011, there have been five successful bid windows completed under the REIPPPP, with a total of 92 IPPs participating in the market (Department of Energy 2015b). The REIPPPP has been the primary force in the growth of the renewable energy market since 2011 (Department of Energy 2015b).

The success of this programme may be seen to be the result of its transparent selection process, and the fact that some of the best legal, technical and project finance advisors contributed to it. It has since been launched around the world. The transparent selection process involving competitive bidding ensures that the power supply is cost-effective, affordable and sustainable. The REIPPPP assists in delivering clean energy to the energy network of South Africa at competitive prices, and has contributes to improved energy supply, economic stability, development and job creation. This programme had tremendous success and is the fastest-growing energy programme in the world and one of the largest in the current infrastructure development portfolio of South Africa (Department of Energy 2015b).

Government's main role in this regard is to implement realistic targets in terms of energy efficiency and renewable energy. It implemented incentives from 2009 in order to increase the use of various renewable energy resources in SA energy mix. These included REFIT in 2009, which was replaced with the REIPPPP programme in 2011. Furthermore, the Department of Energy undertook to support energy efficiency investments through various fiscal and financial incentives. One of these included the 12L tax rebate. Details of the various incentive programmes are discussed in Chapter 3. The next section will look at the requirements that are necessary for organisations in order to implement energy efficiency and use renewable energy resources.

2.5 Organisational requirements for energy

Organisations do not have to adhere only to the international and domestic requirements of energy management but also to various requirements within each organisation. The ISO is an independent, non-governmental membership organisation that creates voluntary international standards for organisations.

Two standards are used to assess energy and risk management within organisations respectively: ISO50001 and ISO31000. These standards provide basic guidelines for the implementation of sustainable energy and risk within the organisation. The standards establish the most important risk criteria that need to be implemented within an organisation in order to ensure a sustainable energy risk structure. Each of the international standards will be dealt with in the sections below in order to elucidate and evaluate the requirements as set out in each respective ISO regarding organisational implementation.

2.5.1 ISO50001 – Energy management systems: Requirements with guidance for use

Piñero (2009) states that the need to decrease GHG emissions and the promotion of energy efficiency as well as the increased use of renewable energy sources provided a strong impetus for the development of an energy management standard. He indicates that the goal of this standard was to provide organisations and managers with strategies to decrease their energy costs, increase their energy efficiency and improve the environmental performance of their organisations. The need was further substantiated by the large number of organisations around the world that indicated they had been the first to implement the ISO50001 energy management system within their country or field when it was first introduced (Chiu, Lo & Tsai 2012). ISO50001 was introduced in 2011 with the aim of developing systems and processes for the improvement of organisations' energy performance, use and consumption. The standard aims to reduce GHG emissions, environmental impacts and the costs of implementing systematic energy management systems (ISO 2011). ISO50001 supplies organisations and companies with an international, unified framework in order to manage energy, and it includes all the processes required in the energy management system (Chiu *et al.* 2012; Gopalakrishnan & Ramamoorthy 2014). The standard applies only to activities under the control of an organisation, so that they will be able to meet their targets, control energy performance, and effect appropriate plans if targets are not met.

Energy savings and targets to decrease GHG emissions have been a challenge for organisations since the start of the 21st century (Rizzon & Clivillé 2015). Organisations are faced with economic costs relating to energy, as well as environmental and social costs, as a result of the depletion of resources and the increasing contribution to climate change. Organisations are unable to control energy costs, government policies or the global economy, but they can implement energy management strategies to improve the management of energy within their respective organisations (ISO 2011). ISO50001 was introduced to assist public and private organisations to implement management strategies in order to decrease their energy costs, increase energy efficiency and improve their overall energy performance (Chiu *et al.* 2012). The energy management system (EnMS) is a documented framework that not only defines the goals, procedures and policies but also the processes that need to be implemented in order to maintain and improve energy management within organisations (Gopalakrishnan & Ramamoorthy 2014). The ISO50001 is based on a ‘Plan-Do-Check-Act’ (PDCA) continuous improvement framework, which incorporates energy management into the day-to-day activities of the organisation. This standard can be used on its own or in conjunction with other systems within the organisation. Figure 2-2 reflects a graphic representation of the energy management system for organisations according to ISO50001. This process comprises energy policy and planning, implementation, monitoring, reviewing and the continuous improvement of this process within an organisation.

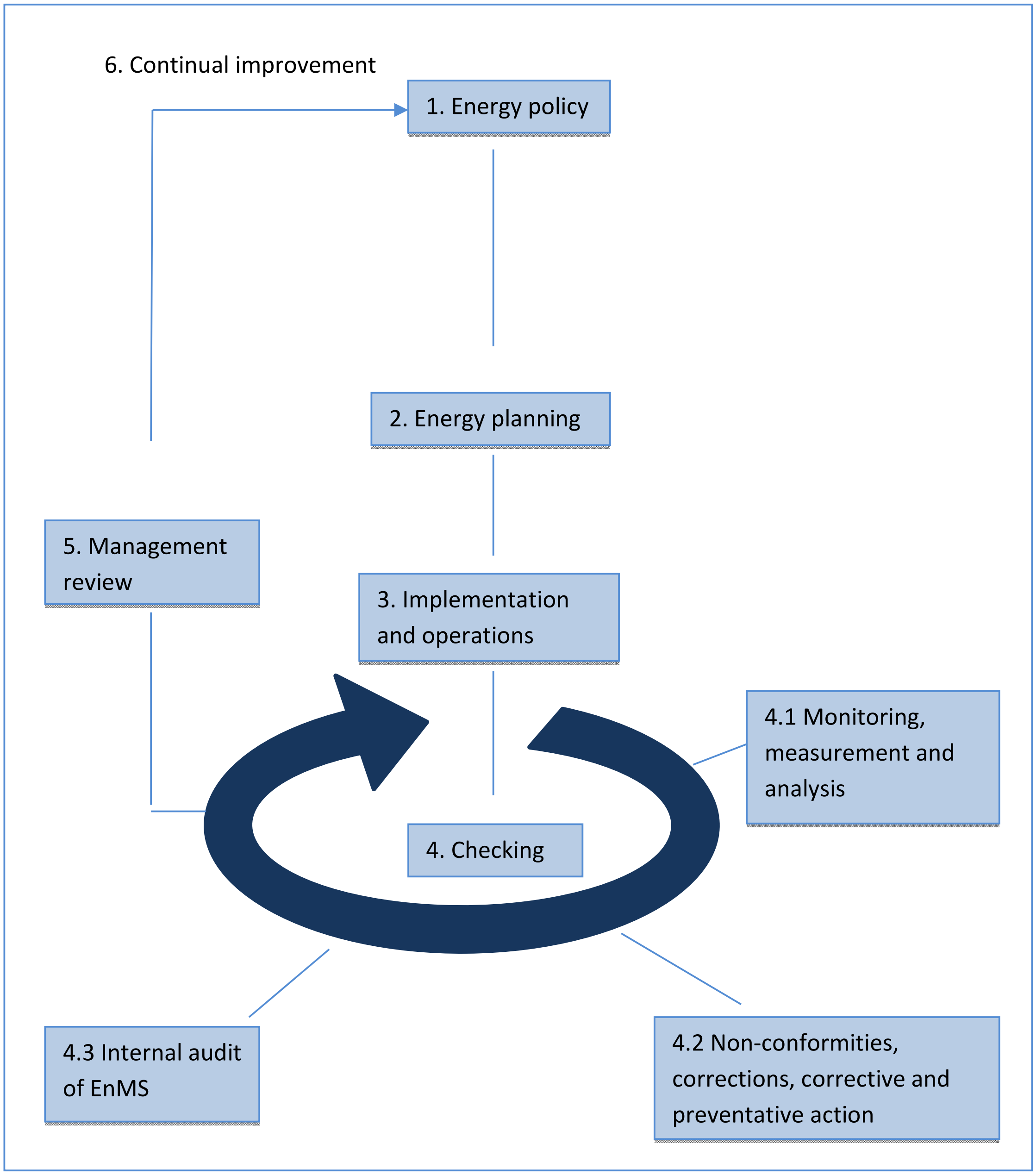


Figure 2-2 Energy management system for ISO50001

Source: ISO (2011)

Figure 2-3 graphically illustrates the PDCA continual improvement structure of ISO50001.

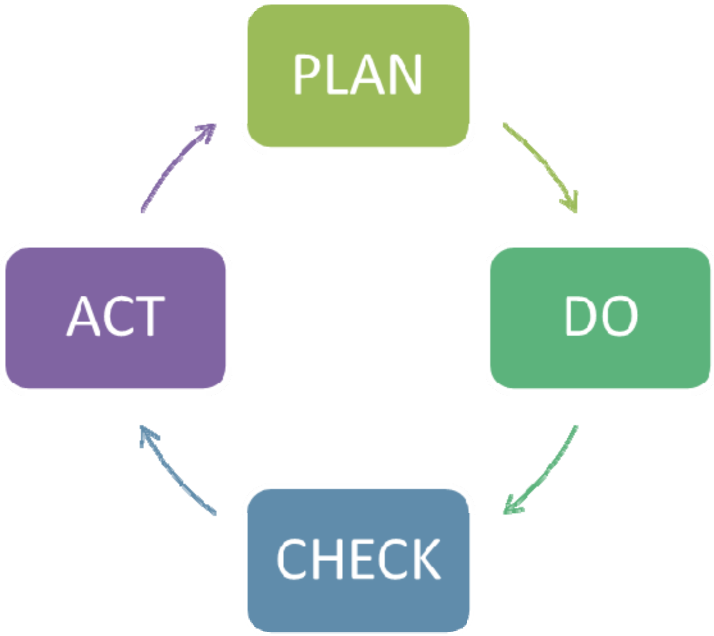


Figure 2-3 Plan-Do-Check-Act structure of the ISO50001 EnMS

The paragraphs below present a discussion of the steps in the EnMS and how they relate to the PDCA structure.

The first step in the EnMS is to establish an **energy policy** within the organisation. This is a key step for a successful system and needs to include all the stakeholders within the organisation (Gopalakrishnan & Ramamoorthy 2014). The energy policy is a formal statement by top management, which indicates the commitment of the organisation to improve energy performance, and should be appropriate in nature for the scale of the energy use by the organisation (Gopalakrishnan & Ramamoorthy 2014). It is the responsibility of top management to develop and implement an energy management statement and to communicate that energy strategy to all stakeholders. This energy strategy will set the framework for action and assist the organisation to set targets and objectives.

The next step in the EnMS is energy planning, which is related to the **plan** part of the PDCA. The process reflected in Figure 2-3 starts with planning. In this step, the organisation has to:

- look at all the legal and regulatory requirements;

- review their energy data and identify opportunities for significant improvement;
- set a baseline year for comparison;
- develop energy performance indicators to measure their energy performance;
- set the objectives and targets for the organisation; and
- set out the action plans for the organisation.

This plan includes the actions that need to be taken as well as the responsibilities and methods that will be implemented to achieve these objectives (Georgia Tech Research Corporation and US Department of Energy 2011). Organisations need to establish their energy baseline in order to quantify energy savings after implementation of the plan. This baseline year will depend on the availability of relevant information, and can be established through conducting an energy review (Chiu *et al.* 2012; Gopalakrishnan & Ramamoorthy 2014). The energy review includes an analysis of energy use and consumption, the identification of areas of significant use, and the identification of opportunities for improving energy performance (Gopalakrishnan & Ramamoorthy 2014).

Planning in the PDCA structure also indicates what organisations intend to do in order to achieve the targets and objectives that were identified in the overall plan. This includes plans for –

- communication with all stakeholders within the organisation;
- the maintenance and management of the documents;
- the design, procurement and implementation of operational controls; and
- the education and awareness-raising of employees (Georgia Tech Research Corporation and US Department of Energy 2011).

The third step in the EnMS (Figure 2-2) is implementation; the **do** part of the process, where the organisation is required to implement the plans made.

The third part in the PDCA structure (Figure 2-3) is to check whether the EnMS is working. This corresponds to the fourth step in the EnMS, and includes monitoring, measuring and analysing the different activities within the energy plan, evaluating compliance with all the requirements, conducting internal audits, identifying noncompliance, corrections and preventative action that need to be implemented and controlling the information and records of the results of the process (Georgia Tech Research Corporation and US Department of Energy 2011). The EnMS requires organisations to monitor, measure and analyse their energy performance regularly and to record, investigate and respond to deviations within the performance (Gopalakrishnan & Ramamoorthy 2014). According to Gopalakrishnan and Ramamoorthy (2014), organisations are also required to conduct internal audits of the EnMS process in order to ensure that the organisation –

- has adapted to the requirements that were set out by the standard;
- has achieved the energy targets and objectives; and
- has effectively implemented and maintained the plan.

The audit assists the organisation to improve its energy performance.

The last step of the EnMS comprises identifying current and future non-conformities. These non-conformities are areas where the requirements of the standard are not currently met or have the potential not to be met in the future. The organisation is then required to identify corrective and preventative actions in order to rectify the non-conformities (Gopalakrishnan & Ramamoorthy 2014).

The last part in the PDCA structure is to establish how management will implement continual improvement through reviewing the process. This accords with step five of the EnMS process, **management review**. Management will review all the results of the activities of the EnMS and take appropriate action to enhance the process and improve the energy performance within the organisation (Georgia Tech Research Corporation and US Department of Energy 2011). Antunes, Carreira and Da Silva (2014) indicate that review of the system is necessary in order to change the energy policy, objectives and targets if required, and to evaluate the allocation of resources used in the energy management system.

The underlying foundation of the PDCA consists of three sections: management responsibility; roles, responsibilities and authority; and energy policy.

2.5.1.1 Management responsibility

Management responsibility includes the commitment of top management towards the EnMS and the continuous improvement of their energy management strategies.

Top management needs to recognise that energy management forms a core part of their organisational strategy (Energy Star 2005b).

2.5.1.2 Roles, responsibility and authority

Management is responsible for appointing an energy manager and energy team. This team establishes the energy targets and expectations for the organisation, monitors energy performance and strives to improve the system and behaviours of energy use within the organisation. Energy Star (2005b) estimated that the appointment of an energy team is an important part of the first step of energy management. The tasks of the team are setting energy goals, planning energy projects, developing cost estimates, implementing and benchmarking energy projects, and tracking energy savings through monitoring and evaluating. All of these tasks require training of and communication with staff in the organisation. The energy team represents various sections of the organisation, as set out in Table 2-7, which shows the integration of the energy team's activities.

Table 2-7 Energy management activities within the energy team

Integration of energy management activities	Establish energy goals	Plan energy projects	Develop cost estimates for the projects	Implement energy projects	Track energy savings
Energy management team	√	√	√	√	√
Engineering department		√	√	√	
Financial management department			√		
Building, design and maintenance department		√	√	√	

Source: Energy Star (2005b)

2.5.1.3 Energy policy

Management is responsible for developing and implementing an energy management policy and for communicating the policy to the organisation and all its stakeholders. This will assist in improving the overall management strategy of the organisation.

Energy management has become a focal point in organisational strategy and policy, in order to decrease energy costs and GHG emissions. ISO50001 assists organisations in setting up their energy management process, which comprises establishing an energy policy and targets, and planning, implementing, monitoring, and reviewing it for continuous improvement. It is the responsibility of top management to show a commitment towards energy management and to establish an energy team in the organisation to manage the various tasks necessary for a sound energy system.

Risk management should form part of the energy strategy of the organisation in order to identify and evaluate the various risks that affect energy strategies. The final task is to communicate the strategy through training and awareness campaigns.

Section 2.5.2 considers ISO31000, which focusses on risk management standards, with principles and guidelines for implementation.

2.5.2 ISO31000 – risk management: principles and guidelines

Risk management forms an important part of the overall activities of organisations, especially after the financial crisis of recent years (Bodnar, Giambona, Graham, Harvey & Marston 2011). Gjerdrum and Peter (2011) also highlight the importance of risk management by stating that it forms an essential part of the success and continuity of organisations. Bodnar *et al.* (2011) further substantiate the global importance of risk management in their study on best practices in risk management policy and behaviour.

ISO31000 was published in November 2009 in order to establish a risk management standard that could be used by all organisations in any type of business or country (Gjerdrum & Peter 2011). ISO31000 lays out eleven principles for effective risk management, namely risk management should:

- create and protect value;
- form an integral part of organisational processes;
- be part of all decision-making;
- clearly address uncertainty;
- be systematic, timely and structured;

- be founded on the best available information;
- be tailor-made for the organisation;
- take human and cultural factors into account;
- be transparent and inclusive;
- be dynamic and responsive to change; and
- facilitate continual improvement of the organisation (Ernawati & Nugroho 2012; ISO 2009:18–19; Purdy 2010).

When risk management is carried out effectively and holistically, it raises awareness of the need to identify and treat risks within an organisation. It also assists in improving the identification of both threats and opportunities of current and potential emerging risks within an organisation (Gjerdrum & Peter 2011) .

The risk management structure and process is explained in more detail in Chapter 3, where the process of implementation for energy risk management is evaluated (see section 3.4).

2.6 Conclusion

This chapter presented a discussion of energy management, namely energy conservation, energy efficiency and the incorporation of renewable energy with an overall energy plan. From the literature, it was clear that organisations need to incorporate a holistic energy strategy in order to reduce costs, improve energy performance, enhance reputation, and increase compliance with legislative and regulatory requirements. According to the literature review, it seems that energy conservation is the first and most cost-effective step in the energy management process, followed by energy efficiency and the implementation of renewable energy. The benefits that a renewable energy strategy could have for organisations are the enhancement of CSR, a decrease in operating costs and GHG emissions, and possible tax benefits and savings.

Based on the benefits and barriers to energy management that were discussed, it is evident that energy management is shaped at many levels: by government interventions and policies, organisational requirements and the financial and risk management associated with energy projects.

The literature review presented international, domestic and organisational policies and regulations relating to energy and risk management within organisations. SA organisations also need to develop an energy policy that reflects the goals and objectives set out in the White Paper on Renewable Energy of 2003, a policy that should include financial instruments, legislative instruments, technology development, training, education and communication.

Energy management to reduce costs and GHG emissions has become a vital part of organisational structure. Organisations could set energy objectives and targets and work out detailed action plans by implementing an energy management system as outlined above. These plans need to be monitored and measured in order to improve continuously. It is imperative that management shows commitment to the energy policy and plans within the organisation and that these be communicated effectively to staff to assist management in improving the action plan. If risk management is carried out correctly within the organisation, it assists in increasing the awareness of the need to identify, treat and manage risks.

The next chapter will look at the financial and cost implications of energy plans and the risks involved for an organisation. The chapter will focus on the risk management process and the way energy management, as set out in ISO50001, could be incorporated into energy risk management.

CHAPTER 3 FINANCE AND RISK RELATED TO ENERGY MANAGEMENT

3.1 Introduction

Chapter 2 dealt with the concept of energy management, the potential advantages and disadvantages of energy efficiency and conservation, renewable energy and energy management as a whole. The chapter further covered international, domestic and organisational energy regulations and policies, and risk management within organisations. From the discussion in Chapter 2, it was evident that organisations need to develop an energy policy in accordance with regulations and policies and that the management of energy assists in reducing energy costs and GHG emissions.

Energy management is an important part of energy conservation, energy efficiency and the use of renewable energy sources. Energy management is important for managing costs and also for managing the risks associated with energy projects. This chapter focusses on the financial and risk-related factors that form part of the energy strategy of organisations. The financial requirements of energy-related strategies will be discussed first (see 3.2), followed by the risk management process (see 3.3). The focus of this chapter is the risk management process, with the aim of evaluating a structured approach to energy risk management within organisations.

3.2 Financial aspects and costs of energy projects

Financial aspects form an important part of the implementation of energy strategies. After 2015, national energy efficiency strategies suggest that additional incentives are required by organisations in order to implement more challenging saving methods, as investors currently see the payback period on investments as too long (Department of Energy 2016). Various finance sources are available for energy efficiency projects, such as commercial banks, suppliers of energy-efficiency equipment, cash grants and tax incentives.

The commonest financing method for energy efficiency projects is loans, either through banks or suppliers of energy-efficiency equipment (PSEE 2015). Funding may also be obtained through cash grants that are offered by various government departments to cover the costs of energy efficiency projects (PSEE 2015). The last method is tax rebates. The SA government introduced the 12L tax incentive mechanism in November 2013. This incentive gives organisations a tax deduction for every 45c/kWh energy saved, which was increased to 95c/kWh in 2015 (South African National Energy Development Institute [SANEDI] 2016). The aim of the rebate is to increase investments in energy efficiency strategies (Department of Energy 2016).

Government also introduced financial incentives within the renewable energy sector. The Renewable Energy Feed-in Tariff (REFIT) was discussed in Chapter 2. This government intervention was established in order to give IPPs the opportunity to sell excess energy back into the national energy grid and to increase the implementation of renewable energy projects (see 2.4.6.1). In 2011, government replaced the REFIT system with the Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), which is based on a tendering process in order to increase investments in renewable energy projects (see 2.4.6.2). This programme is used as the primary vehicle to gain access to private sector funding and investments, in order to increase the generation of new electricity.

Since 2011, the REIPPPP has had five successful bid windows with a total of 92 IPPs participating in the market. The five bid windows attracted R192.6 billion in committed investments, of which R53.2 billion was from foreign investors and financiers (Department of Energy 2015a). By the end of the fifth round, government estimated that the total projected cost financed by domestic equity was R30.7 billion, with approximately R108 billion being financed through debt finance (Department of Energy 2015a). With this kind of investment, renewable energy projects and the risks associated with them are increasing, making it essential to ensure sound risk management processes in order to attract proper financing (Watts 2011). Watts (2011) also points out that the large increase in investments in renewable energy projects was due to financial incentives and political pressures to reduce carbon emissions. One of the objectives of the White Paper on Renewable

Energy of 2003 was to implement financial instruments and incentives within renewable energy projects. The objectives are:

- to ensure that a reasonable amount of national resources and investments be spent on renewable energy projects;
- to set targets for the spending of public resources;
- to introduce suitable fiscal incentives;
- to extend government and institutional support; and
- to assist in the creation of a suitable investment climate for renewable energy.

The next section presents a discussion of the financial instruments that governments have used to attract suitable finance and investments.

3.2.1 Financial instruments

Financial instruments and incentives were used by governments to attract investments in energy projects (Department of Energy 2013). The need for these incentives is due to the high costs of renewable energy technology and the slow implementation of these projects (International Renewable Energy Agency [IRENA] 2014). Some of the successful financial instruments used by governments to support the implementation of renewable energy are investment incentives, production incentives, and renewable portfolio standards/obligations (Town 2004). Turner *et al.* (2013) indicate that these policy incentives are the biggest drivers of renewable energy investments worldwide. These three incentives were analysed and are discussed in more detail in 3.2.1.1.

3.2.1.1 Investment incentives

Investment incentives include renewable energy generator tax credits which were used by the United States of America (USA) (DME 2004:28, Turner *et al.* 2013) and India (IRENA 2014) in order to increase the investment in renewable energy projects. These tax credits gave renewable energy asset owners a direct decrease in taxes based on either the volume of energy produced or their total investment in renewable energy projects (IRENA 2014:28). In the United States, these tax credits however expired at the end of 2013 (Cassell 2013) mostly due to the high costs incurred for government (IRENA 2014).

Michelez *et al.* (2011) explain tax exemptions or reductions where renewable energy producers were exempted from paying carbon tax. They show that these tax exemptions or reductions made investment in renewable energy an attractive option for investors. Although tax incentives encourage investment in renewable energy, most governments cannot rely on these only, but must use them to complement other measures (Michelez *et al.* 2011). The DME (2004:28) indicates that tax exemptions stimulated investments in renewable energy technologies. Although tax incentives were successful in most industries, manufacturing companies showed the least success in using this short-term incentive, because it does not stimulate the production of renewable energy (Edkins *et al.* 2010). Although tax incentives could assist with the stimulation of renewable energy production, they are used in most countries as an additional incentive for organisations to implement renewable energy within their organisations. The SA government introduced environmental tax breaks, whereby organisations can depreciate their investments in renewable energy, giving them a cash-flow advantage to assist in the implementation of renewable energy projects (South African Revenue Service [SARS] 2013).

In South Africa, tax rebates were introduced by government not only in energy efficiency projects through the 12L tax rebate, but also in the renewable energy sector in order to stimulate investment in energy projects. Tax incentives and rebates are used in most countries as additional incentives for investments in energy projects. One of the objectives of this study was to find out whether the possibility of a tax rebate influences decisions by organisations to implement energy projects.

3.2.1.2 Production incentives

Production incentives include feed-in tariffs as used by Denmark, Spain and Germany (Town 2004) as well as France and Australia (Turner *et al.* 2013) and Italy (Menanteau, Finon & Lamy 2003). Michelez *et al.* (2011) indicate that feed-in tariffs use a fixed guaranteed price at which IPPs could sell the renewable energy they generate to the electricity power network. Pegels (2010) supports the view that feed-in tariffs guarantee producers a fixed price for power generated by renewable energy for a certain period. Most of the schemes introduced throughout the world have been long-term schemes with a period of ten to twenty years. Winkler (2005) mentions that these relatively high guaranteed prices for electricity by feed-in tariffs were one of the major factors for the success of these schemes, which created good returns on investment for the producers of electricity. Michelez *et al.* (2011) also indicate that these feed-in tariffs encouraged long-term investments in the renewable energy sector. This view is supported by Pegels (2010) who states that due to the advance guarantee of price, long-term investment planning was made possible. However Michelez *et al.* (2011) indicate that these prices are reduced over time as technologies mature and the cost of producing renewable energy decreases. This is also substantiated by IRENA (2014), which indicates that the rapid decrease in the cost of renewable technologies has caused an increase in the installation of renewable energy projects. Edkins *et al.* (2010) indicate that one of the advantages of feed-in tariffs is that investors can minimise their risk by having the assurance of long-term set tariffs, which could improve their access to finance.

In 2009, the SA government introduced REFIT, which was a feed-in tariff scheme, to increase the implementation of renewable energy projects (Edkins *et al.* 2010). The implementation of REFIT came about due to the success that feed-in tariff policies had enjoyed in countries like Germany and Spain (Edkins *et al.* 2010). Feed-in tariffs are seen as a low-exposure mechanism that provides fixed prices for electricity production, regardless of the market price (Turner *et al.* 2013). Winkler (2005) and Menanteau *et al.* (2003) indicate that with feed-in tariffs, government sets the prices of different technologies and guarantees these prices for a specific period. One of the disadvantages of feed-in tariffs, especially for developing countries, is that governments are not able to pay these high prices for the agreed period (Winkler 2005). Another disadvantage is that due to historically low electricity costs in South Africa, the implementation of renewable energy has relatively much higher initial costs, especially for government, which will be required to subsidise the additional costs (Winkler 2005). IRENA (2014:15) indicates that because of the decrease in technology costs and the increase in renewable energy projects, governments were forced to re-evaluate the feed-in tariffs, which created uncertainty in the market and negatively influenced investor confidence in energy projects. In South Africa, the feed-in tariff incentive (REFIT) was discontinued in 2011 and replaced by the REIPPPP, which was based on a competitive bidding process with greater transparency. The reasons for the discontinuation were various legal issues under the country's procurement framework, the unwillingness of Eskom to support the programme, and the contravention of public finance and procurement regulations (Department of Energy 2015b).

The feed-in tariff (REFIT) was discussed in order to give a background to the financial incentives that have been available in the renewable energy industry. The feed-in tariff was, however, discontinued and therefore did not form part of this research.

3.2.1.3 Portfolio standards and obligations

The last incentive is renewable portfolio standards and renewable obligations, where a block of energy supply is set aside by law for renewable energy capacity, based on competitive bidding. Countries that have implemented this incentive include the Philippines and some states within the United States (Town 2004). Menanteau *et al.* (2003) state that European countries, such as the Netherlands, Denmark, Sweden, Italy and the United Kingdom, are using this incentive. Developing countries that have introduced this incentive are China, Morocco, Peru, South Africa and Brazil (IRENA 2014). Michelez *et al.* (2011) indicate that renewable portfolio standards or renewable obligations require electricity suppliers to provide a certain percentage of electricity through renewable energy sources. These quotas are measured through tradable green certificates. Producers have the option to produce these themselves or to buy them in the market. In terms of tradable green certificates, a set proportion of electricity in the market has to be produced by renewable energy sources. Certificates are issued by the renewable energy producer, who benefits from generating renewable energy either by selling the electricity at market price or by selling certificates in the green certificate market (Menanteau *et al.* 2003). Menanteau *et al.* (2003) indicate that setting targets for renewable energy is effective in achieving the production of renewable energy sources. Winkler (2005) found that one of the advantages of the renewable obligation is the combination of a set target for energy production with a tendering process. This combined approach increases the competitiveness of bidders and encourages a reduction in costs. The approach is substantiated by IRENA (2014), which indicates that the auction process increases price discovery for renewable-based electricity through the market forces of supply and demand. They also show that the auction process boosts the efficiency of procuring renewable energy projects (IRENA 2014). Menanteau *et al.* (2003) confirm that an advantage of the bidding system is the control that governments have over the levels of subsidies for renewable energy production. Winkler (2005), however, indicates that one of the disadvantages of this process is the administrative burden that is placed on the institution to manage the tendering process. A critical factor is government protection of the process. Some governments deliberately inhibit collusion between the suppliers, as such collusion is aimed at inflating the price of energy (Winkler 2005). IRENA (2014:26) also lists the challenge of ensuring the timely development and sustainable generation of the winning bids in energy projects. The tendering process addresses issues such as economic development, price, job creation, local content and ownership (Cassell 2013).

Based on the advantages of the competitive bidding process – an increase in competition, a reduction in cost, price discovery and increased efficiency in procuring renewable energy projects – South Africa changed from a production incentive scheme (REFIT) to a portfolio standard (REIPPPP) in 2011. Although there is still a heavy administrative burden and the possibility of collusion between suppliers, the REIPPPP incentive has had great success in South Africa with five competitive bids between 2011 and 2015.

The section above highlighted the financial incentives for renewable energy implementation. This fell outside the scope of the research but presents opportunities for further research, specifically in terms of organisations' implementation of and access to these financial incentives.

The success of the REIPPPP can be ascribed to the transparency of selection, as the competitive bidding process ensured cost-effective, affordable and suitable renewable energy projects. Although the incentive programmes aid in increasing energy production through renewable energy sources, most governments and organisations are still concerned about the cost of implementation and the availability of investments for these projects. Aspects related to cost and investments are discussed in 3.2.2.

3.2.2 Costs and investment

Cost and investment are important elements of the implementation of energy projects. In South Africa, many organisations are concerned about the cost of energy due to increases in electricity tariffs (PSEE 2015). Through the implementation of energy efficiency projects, organisations can enjoy significant cost savings and decrease energy demand on the electricity grid. This promotes energy security, decreases energy costs and reduces carbon emissions (PSEE 2015). According to RUSEFF (2011), some of the benefits that can be gained from energy efficiency projects are:

- the setting of energy efficiency targets;
- an overall reduction in costs and an increase in profits;
- improvements in productivity;
- security and sustainability of the energy supply;
- resource conservation; and
- reduction of GHG emissions.

The IEA (2014) also lists benefits: reduction in GHG emissions, energy savings, energy security and a decrease in energy prices.

However, with the implementation of energy efficiency projects, there are operational and transactional costs in the form of energy audits and time spent on research and discussion on the various strategies available (Department of Energy 2016).

For renewable energy projects, the DME (2004) has indicated that the greatest challenge for South Africa will be to identify the renewable energy technologies that would most benefit the country. The DME (2004) indicated that wind energy has a high capital cost but low running cost, while solar energy has a high capital cost and a medium running cost. Turner *et al.* (2013) indicate that with the increase in renewable energy projects over the next decade, the need for large amounts of capital will also increase.

Although South Africa has a vast number of renewable energy sources of which it could make use, such as solar energy, wind, hydro and biomass, the initial cost outlays are higher and the payback period is longer compared to electricity production through fossil fuel (Pegels 2010). Pegels (2010) goes on to comment that the technologies involved in renewable energy projects are still in their infancy, which creates high volatility and increases risks in implementation. This is supported by Winkler (2005), who indicates that although the costs of renewables are decreasing, they are still higher than the production of coal-fired electricity. Beugeling *et al.* (2002) indicate that although renewable energy sources are free, the most significant factor in implementing renewable energy projects is the cost. According to Fakir (2010:34), the initial capital required to establish coal-fired power plants is 50% of the total cost, compared to initial capital costs of 80–90% for renewable energy plants. This creates the challenge of finding long-term financing and methods to reduce capital cost outlays (Fakir 2010:35). There is, however, a global trend towards increasing investments in renewable energy as the costs of these technologies decrease (Fakir 2012).

Konopi (2014) indicates some of the factors that influence the increase in investments in renewable energy projects:

- the need to meet current reduction targets for carbon emissions;
- the basic desire to secure a long-term energy supply;
- the need to decrease the dependency on fossil fuels; and
- the potential high investment returns on renewable energy projects.

Michelez *et al.* (2011), on the other hand, indicate that although investments in renewable energy have increased, there are inherent barriers to the implementation of these, namely:

- cost – there is high capital cost involved in renewable energy projects;
- analysis – there is insufficient data to do proper project planning; and
- risk – there is a high level of uncertainty regarding the guarantees of cash flow and securities.

Michelez *et al.* (2011) also indicate the barriers that financial institutions face, especially those in developing countries, namely:

- the lack of funds and financial conditions relating to interest rates, collateral and debt maturities;
- the lack of instruments to stimulate renewable energy; and

- the lack of information and willingness to invest in renewable energy due to the low level of awareness and understanding.

According to Beckers, Chiara, Flesch, Maly, Silva and Stegemann (2013), all big infrastructure projects are faced with cost overruns, delays, unavailable private funding and failed procurement processes. Nevertheless, most of these problems are foreseeable and can be managed through forward-looking risk management (Beckers *et al.* 2013). Furthermore, improved risk management is core to driving profit and losses, creating value and increasing competition (Beckers *et al.* 2013:10). In addition, Michelez *et al.* (2011) arrived at a similar conclusion, indicating that the biggest challenge to obtaining financing for renewable energy projects is the inability to quantify and manage the risks associated with these projects. It can therefore be deduced that effective risk management is a crucial component of sustainable development within the renewable energy sector.

Because of ongoing investment in renewable and energy efficiency projects, the need to manage the risks associated with these projects has become very apparent and an important consideration for organisations. Boland and Duquesnoy (2012) found that an increase in energy projects is driven by organisations that wish to improve their financial performance by lowering their operational costs. These operational costs include possible increases in GHG emissions expenditure, increasing energy costs and the tightening of organisational budgets. Turner *et al.* (2013) indicate that by 2020, investment in renewable energy projects is estimated to increase by 50%, which will double the expenditure in terms of organisations' risk management services. Norris (2013) specifies that, if organisations want to encourage investments, they need to implement sound risk management strategies in order to reduce risks to investors. This is substantiated by Turner *et al.* (2013), who believe that through risk management, organisations will be able to sustain the energy mix in a cost-effective and intelligent way.

From the above, it is clear that risk management is a crucial factor for organisations to consider before implementing energy strategies. It was therefore necessary to investigate the concept of risk management in more detail.

3.3 Risk management

Chapter 1 showed that risk management has become an important part of the functions of organisations. The chapter also dealt with various risk categories and a typical risk management process. Chapter 2 reported on energy management within organisations. From the literature, it was evident that energy management is influenced not only by government policies and requirements set by organisations but also by finance and risk management aspects associated with energy projects. It seems clear that sound risk management practices are necessary to attract capital and investments in order to implement energy strategies.

However, it appears that there is currently no clear definition of energy risk management in the literature. Most previous studies on energy risk management focussed on the management of risk within the energy market. The energy market can be defined as the trade and supply of energy in the commodity markets (and also in the electricity market) (Wikipedia 2017). Sadeghi and Shavvalpour (2006) indicate that within the energy market, proper risk management is dependent on good portfolio management tools as well as a proper foundation for forward prices. They focussed their study on the management of price risks in the energy sector and the effect of price volatility on energy risk management. Huisman (2009) focussed on the risk management of energy in utility companies in the energy market, and discusses various instruments that can be incorporated in the risk management process. Weron (2000) found that energy price risk management was still relatively new in 2000 and that the commodity market for energy was far less developed than the interest rate or foreign exchange markets. This is supported by Doege, Fehr, Hinz, Lüthi and Wilhelm (2007), who state that electricity energy is now traded as a commodity on the international market due to the restructuring of the power markets since the 1990s. Doege *et al.* (2007) investigated the risk management of various pricing schemes within the power industry. Khindanova and Atakhanova (2002) considered the modelling of energy risk management due to high price volatility in the energy market, with a focus on value at risk (VaR) models. All these studies focussed primarily on the energy sector and on the financial risk management aspects of this sector, including futures, forward trading and hedging against market fluctuation. In order to define energy risk management clearly for the purposes of this study, the definitions of risk management and energy management needed to be addressed.

Risk management is defined in Chapter 1 (see 1.2.1) as a process where different risks are identified, evaluated, measured and managed on a continuous basis. In Chapter 2 (see 2.2), energy management was defined as a systematic tool used by organisations in order to improve their energy performance, which may include energy conservation, energy efficiency and renewable energy. Based on these two definitions and for the purposes of this study, energy risk management was defined as a process of identifying, evaluating, measuring and managing energy strategies (including energy conservation, efficiency and renewable energy) to improve the energy performance of an organisation.

According to Small (2012), identifying and managing the risks of innovative and sometimes pioneering energy projects can be challenging. This is substantiated by Williams (1995, cited by Mills 2001), when he states that the identification of risks is the most difficult stage in the risk management process. Small (2012) further claims that most projects fail due to energy risks not being properly identified, managed or transferred. This is often caused by a lack of a formal risk management process, which will be elaborated on in 3.4.

3.4 The risk management process

According to ISO31000, a risk management process comprises setting the context, risk assessment (identification, analysis and evaluation), risk treatment, mitigation and implementation of control measures. There are two stages in the risk management process that occur on a continuous basis: the monitoring and review stage, and ongoing communication to all stakeholders. ISO31000 shows that the risk management process is an interactive process, where the implementation of a structured and consistent process assists the organisation to manage risks effectively, efficiently and coherently.

Small (2012) found that the chief factor that threaten innovative energy projects is the failure to identify, manage and treat risks appropriately. Small (2012) further indicates that the increase in the scale of new renewable energy projects necessitates recognition, identification and management of the renewable energy risk involved in such projects.

The risk management process is a continuous process and should not be viewed as a once-off activity within an organisation (Mills 2001). Section 3.4.1 presents the different aspects of the risk management process, as set out in Figure 3-1.

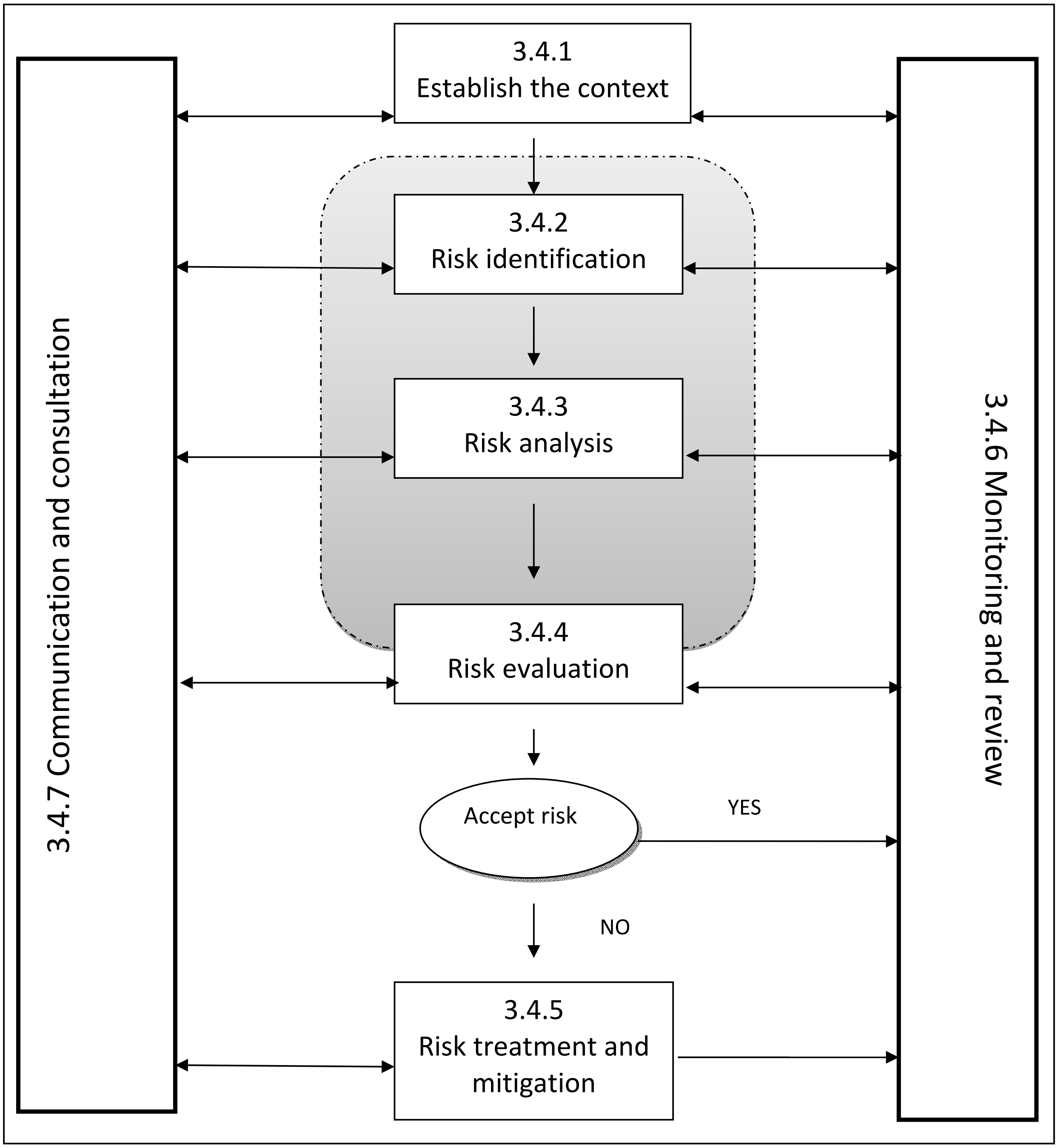


Figure 3-1 The risk management process

Source: (ISO 2009)

Each component will be dealt with in detail in the sections below.

3.4.1 Establishing the context

According to Berg (2010), this stage in the risk management process is undertaken to understand the environment of the organisation. This involves the evaluation of the external environment and the internal culture of the organisation. Purdy (2010) supports this view by indicating that at this stage, organisations define what they want to achieve and identify the internal and external factors that could affect the achievement of their objectives. This stage aims to establish, with a certain degree of accuracy, the challenges and objectives within the organisation (Sousa, De Almeida & Dias 2012). This part of the analysis also involves the review of policies and regulatory requirements, standards and codes, industry guidelines and corporate documents relating to risk management within the organisation, the overall business plan and the development of the risk criteria (Berg 2010). Berg (2010) goes on to comment that the broad risk criteria should be developed during this stage, but that detail is filled in and refinement done in the identification and analysis part of the risk management process. In this early part of the process, the organisation evaluates its environment in order to define the goals of its energy strategy. The organisation plans its strategy by reviewing the relevant policies, regulatory requirements and standards, and by deciding which are relevant for the particular organisation.

3.4.2 Risk identification

According to Purdy (2010), the risk identification stage involves a systematic process aimed at understanding what could happen, knowing how and why to manage risk, and when risk is likely to occur. During this stage, organisations identify the risks that are likely to affect goals and objectives (Berg 2010). This is one of the most important stages in the risk management process, with all real and perceived risks needing to be identified in order to ensure a proactive risk management approach within the organisation (Berg 2010).

In Chapter 1, the risks involved in energy projects were identified as financial, liquidity, market, credit, operational, reputational, disaster, strategic and regulatory risks. These risks are discussed in more detail in the next section.

3.4.2.1 Financial risk

Watts (2011) argues that financial risk in this regard is the risk of having insufficient access to capital to manage the energy project. This is supported by Chapman (2011) and Banks (2010) (see 1.2.2) who define financial risk as the risk of loss due to a decrease in profitability because of adverse events that influence the financial activities of the organisation. Chapman (2011) notes some benefits for implementing financial risk management:

- the improvement of financial planning and management;
- the making of better investment and hedging decisions;, and
- getting organisations to develop monitoring systems and to increase the practice of due diligence when outsourcing.

According to Watts (2011), the most important risk in renewable energy projects is financial risk, due to the significant amount of investment required for these projects. This is confirmed by RUSEFF (2011), which established that energy efficiency and renewable energy projects require long-term investments and large capital assets. Research by Watts (2011) found that 29% of financial risk is classified as high risk and 48% as medium risk. Financial risks could have adverse effects on the turnover of organisations, which influences planning, management and investment decisions. The present research evaluated whether financial risk influences the establishment of energy management strategies within the financial services sector.

3.4.2.2 Market risk

Market risk refers to the risk of loss due to changes in the market value of the underlying instruments used in energy-related strategies. According to Watts (2011), market risk in terms of energy is the risk of an increase in commodity prices or inputs or a decrease in the output of electricity in the energy market. Michelez *et al.* (2011) classify market risk as economic risk, which also includes commodity risk, exchange rate risk, interest rate risk, liquidity risk and credit risk. This was also the case for Lockwood (2012), who says that market risk, as an element of economic risk, is the risk that the demand for certain products will not be sufficient to cover the project costs. Research by Watts (2011) found that 54% of respondents rated market risk as a medium risk in renewable energy projects. Market risk could have a strong adverse effect on an organisation. Interest rate increases could increase the cost of borrowing, which will decrease investment in energy projects. In addition, exchange rate fluctuations might have an adverse effect on energy technologies that need to be imported. The present research evaluated whether market risk has an influence on organisations' energy management strategies.

3.4.2.3 Credit risk

According to Burger, Graeber and Schindlmayr (2014), credit risk relates to the risk that the counterparty to the transaction will not be able to fulfil the contractual agreements. This is supported by Simkins and Simkins (2013) who state that credit risk refers to the ability of the customer or vendor to pay or deliver. Credit risk is therefore the risk that a counterparty will not be able to make the necessary payments or will default on the contract, and create a financial loss for the organisation. Credit risk could therefore result in an economic loss to the organisation if the counterparty does not adhere to the terms of the contract related to energy strategies. According to Lee and Zhong (2015), credit risk in energy projects is relatively easy to quantify and manage. Credit risk related to energy projects therefore needs to be quantified at an early stage in the process and should be managed accordingly

3.4.2.4 Liquidity risk

Burger *et al.* (2014:144) distinguish between market liquidity risk and funding liquidity risk. Market liquidity risk is the risk that there will be no market for the commodity, and funding liquidity risk is the risk that it will not be possible to meet liability obligations when they become due. Young (2014) supports this view, stating that liquidity risk is the risk that an organisation will be unable to make the financial payments to the counterparty or that the marketable assets will be insufficient. This is an important risk for energy projects, due to the level of investment and capital required to implement these projects. Organisations are subject to liquidity risk if they are unable to produce enough marketable energy, or when they are unable to repay the loans associated with energy projects. The present research aimed to evaluate whether liquidity risk has an influence on the energy management strategies of organisations.

3.4.2.5 Operational risk

The management of operational risk is an increasing focus for organisations, as a result of the intricacy of products, technology development, the expansion of domestic and international markets, and the possibility of loss and failure due to operational vulnerabilities (Young 2014). Watts (2011) identifies operational risk in renewable energy projects as the risk of closure of the plant due to unavailable resources, damage to the plant or the failure of components within a renewable energy project. Operational risk is therefore the risk of loss, or failure due to damage to physical assets, wear and tear, negligence, accidents or design flaws (Turner *et al.* 2013). According to Turner *et al.* (2013) and Rivža and Rivža (2012), operational risk comprises of:

- loss due to damage or failure caused by accidents, theft, fire, natural catastrophes or malfunctioning equipment;
- loss of revenue arising from failure or damage to the business operations of the organisation; and
- loss and retention of qualified and experienced personnel.

Operational risk is traditionally managed through prevention and contingency plans to avoid potential disastrous consequences in terms of economic loss, environmental outcome and loss of human life (Management Solutions 2014). Operational risk loss refers to the additional cost that is incurred when certain events occur (Management Solutions 2014). Operational risk can be assessed through self-assessment questionnaires or scenario analysis (Management Solutions 2014). Organisations therefore need to identify the operational risks involved in their energy strategies in order to assess and manage the strategies effectively. In a study by Watts (2011), 44% of respondents classified operational risk as a medium risk for renewable energy projects, with 15% classifying it as high risk. Pegels (2010) states that the technologies used in energy projects are relatively new, and that there is a tendency to higher volatility and greater risk as a result. The presents study aimed to evaluate whether operational risk has an influence on organisations' energy management strategies

3.4.2.6 Reputational risk

Reputational risk is defined as the risk of loss due to damaging publicity and harm to the public image of the organisation (Ghosh 2012). Because technological challenges that still exist in the energy industry, organisations that decide to implement energy projects face the possibility of reputational risk as well as economic risk if the project fails (Pegels 2010). Small (2012) indicates that as a result of the possibility of negative publicity caused by certain aspects of renewable energy projects, the threat to reputational risk can be very high. This is confirmed by Allianz Group and WWF (2005) who indicate that investments in renewable energy and conventional energy could have reputational risk consequences for organisations. Reputational risk could have negative consequences for the organisation by decreasing sales, harming recruitment of high-level staff and increasing the cost of debt. The present research aimed to investigate whether reputational risk has an influence on organisations' energy management strategies.

3.4.2.7 Regulatory risk

Watts (2011) indicates that political and/or regulatory risk is very significant because of the poor macroeconomic outlook of most countries. All businesses are exposed to regulatory risk to a certain degree, as taxes could change, new taxes could be implemented, and there could be changes in the subsidies and policies of a country (Burger *et al.* 2014). Watts (2011) further emphasises that regulatory risk includes changes in policies within countries that could affect the profitability of energy projects. Dentons (2014) substantiates this point by stating that political risk is a major factor in energy projects, especially in developing countries. Dentons (2014) lists some of the political risks as corruption, political instability, high taxes or duties, nationalisation, import restrictions and adverse changes in exchange control regulations. According to Turner *et al.* (2013), renewable energy projects currently rely on policy support more than fossil fuel projects do, and therefore have greater regulatory risks when policies change. Michelez *et al.* (2011) support this view, stating that renewable energy projects should focus on regulatory risks due to the long-term subsidy schemes by government involved in renewable energy projects. Burger *et al.* (2014) also show that regulatory and/or political risk is very difficult to mitigate and should be analysed properly in order to make sound investment decisions. Organisations need to evaluate the political and/or regulatory environment and the possible effects that changes in policies would have on energy projects. The present research evaluated whether regulatory risk has an influence on organisations' energy management strategies.

3.4.2.8 Strategic risk

According to Watts (2011), strategic risk can be defined as risk that affects the viability of the business. Within energy projects, ‘strategic risk’ refers to the risk of working with out-dated technology (Watts 2011). Young (2014) states that organisations make strategic plans to increase their profitability, and an incorrect strategic decision could have an adverse effect on the organisation. Watts (2011) indicates that the owner and operators of renewable energy projects (and of energy efficiency strategies) should be confident that the potential threats, including business interruptions, have been well considered, so that the project stands a chance of being successful. Failure of technology could have a significant effect on the operations of the energy project and on the organisation as a whole. The present research investigated the influence of strategic risk on organisations’ energy management strategies.

3.4.2.9 Disaster (weather or environmental) risk

Disaster risk, as defined by Banks (2010), is the risk of loss when physical infrastructure is damaged, leading to a cessation of all business operations. Chapman (2011) adds that disaster risk involves the risk of loss due to fire, natural disasters, floods and terrorist attacks, which could have a negative influence on the operations of the organisation. Banks and Schaffler (2006:35) report that large-scale construction programmes could carry economic risks due to excess capacity brought on by a low demand for electricity. Watts (2011) refers to not only the importance of weather-related risk, but also the risk of damage to the environment due to the construction of large renewable energy projects. Dentons (2014) supports this view, stating that lenders and investors pay particular attention to the environmental and social risks associated with energy projects. According to Michelez *et al.* (2011), renewable energy projects such as solar and wind projects, depend largely on the weather, which is unreliable and could have an adverse effect on the revenue gained from a project. Business interruptions could occur because of weather or other environmental events, which may result in a loss of revenue (Turner *et al.* 2013). Disaster risk in energy projects therefore refers to loss due to natural disaster, fire, floods or terrorist attacks, all of which would affect the operations of an organisation. The present research aimed to investigate whether disaster risk has an influence on the energy management strategies of organisations.

The above paragraphs presented a discussion of the risks associated with energy projects that were investigated during the present research. The risks that were identified are summarised in Table 3–1.

Table 3-1 Risks facing energy projects

Risk types	Risk exposures	Description
Financial risk	Insufficient access to capital Economic slowdown/slow recovery	Decrease in profitability due to adverse events that influence financial activities
Strategic risk	Loss or damage	Outdated technology or failure of technology
	Start-up delays	Revenue losses arising from delays in project construction
Operational risk	Loss, damage and failure	Accident, theft, fire, natural catastrophe, malfunctioning equipment
	Business interruptions	Revenue loss arising from failure, damage or extreme weather
	Personnel	Responsibilities, qualifications and experience of personnel
Market risk	Weather	Variability in revenue due to inconsistency in output, incurring additional balancing charges
	Curtailment	Regional grid oversupply, where power outputs cannot be sold
	Power prices	Variation in revenue due to wholesale price volatility
Liquidity or credit risk	Counterparty	Default by counterparty in power purchase agreement
Regulatory risk	Policy	Backdated support cuts Change in energy policy and incentives
Reputational risk	Organisation/brand image	Damage to brand image of organisation due to failure of energy projects Technology challenges
Disaster risk	Organisation	Loss due to fire, floods, natural disasters or terrorist attacks

Source: Adapted from Rivža and Rivža *(2012) and Turner et al. (2013)*

Table 3-1 summarised the risks involved in energy projects, namely financial, strategic, operational, market, liquidity, credit, regulatory, reputational and disaster risks. Research was done by the AON company (professional company providing services in risk, retirement and health solutions) in 2013 and 2015, identifying the risks in organisations for that period. Table 3-2 shows the top ten identified risks from the 2013 and 2015 AON Global Risk Management survey and the projections for 2016 and 2018 respectively. The risks ranked numbers one to three, for both 2013 and 2015, were economic slowdown/slow recovery, regulatory/legislative changes and increasing competition in the market. Increased competition, according to AON (2015), is especially significant in the construction and telecommunication industries, due to competitive bidding and antimonopoly rules, and competition from foreign suppliers. AON (2015) predicted that weather or natural disaster risks would move into the top ten ranking within the next few years. This is due to adverse weather conditions across the world and increases in natural disasters and weather-related events. These also correspond with the risks identified for energy strategies in Table 3-1. In the 2015 AON Global Risk Management survey, it is evident that damage to reputation or brand had jumped from number four to one, and new risks that are in the top ten are property damage (due to flooding and severe weather), third-party liability, and cybercrime. The top ten risks are indicated in Table 3-2.

Table 3-2 Top ten risks for 2013, 2015 and projections for 2016 and 2018

Risk description	**Ranking 2013**	**Ranking 2015**	**Projected ranking 2016, based on 2013 projections**	**Projected ranking 2018, based on 2015 projections**
Economic slowdown/slow recovery	1	2	1	2
Regulatory/legislative changes	2	3	2	3
Increasing competition	3	4	3	1
Damage to reputation/brand	4	1	8	5
Failure to attract/retain top talent	5	5	5	6
Failure to innovate/meet customers' needs	6	6	4	4

Business interruption	7	7	11	12
Commodity price risk	8	11	7	
Cash flow/liquidity risk	9	12	10	-
Political risk/uncertainty	10	15	6	-
Third-party liability		8		11
Computer crime/hacking/ viruses/malicious codes	–	9	–	7
Property damage	–	10	–	16

Source: AON (2013) and AON (2015)

The top ten risks that were identified in the table above also relate to energy projects and the risks related to these projects, as was discussed previously (see 3.4.2).

- **Reputational risk** (damage to reputation or brand and failure to innovate or to meet customers' needs) is the risk of loss due to damaged publicity and harm to public image. Reputational risk could have a negative effect on an organisation, resulting in decreased sales, an increase in financial needs and a decrease in the requirement for high-level professionals and business partners.
- **Operational risk** (failure to attract or retain top talent, and business interruptions) is the risk of loss due to complexity of products, technology developments, expansion of internal and external business and operational vulnerabilities. Organisations need to identify the various operational risks within their energy strategy in order to assess and manage the risk accordingly.
- **Regulatory risk** (regulatory/legislative changes, political risk/uncertainty and increasing competition) is the risk of loss due to change in taxes, subsidies and policies. Changes in the policies and taxes regarding energy strategies could have a negative effect on the profitability of the organisation.
- **Market risk** (commodity price risk) is the risk of loss due to changes in the market value of the underlying instruments. Market risk includes commodity risk, interest rate risk and exchange rate risk. Market risk could have an adverse effect on the organisation in terms of reluctance to invest in energy projects due to changes in interest rates, commodity prices and the exchange rate.

- **Liquidity risk** (cash flow/liquidity risk) is classified as the risk that the organisation will not be able to meet its financial obligations to a counterparty related to its energy strategies. This is an important risk in implementing energy strategies due to the high level of capital investment required for these strategies.
- **Financial risk** (economic slowdown/slow recovery) is the risk of loss due to insufficient access to capital to implement energy projects. Financial risk could have an adverse effect on the turnover of an organisation, which will influence planning, management and investment decisions regarding the implementation of energy strategies.

AON (2015) further classified the top three risks per industry. The commerce sector, as indicated in section 1.1, includes financial services, information technology, tourism and government. This study focussed only on the financial services sector, comprising banking, insurance, investments and finance organisations. Table 3-3 shows the top three risks in the commerce sector. The number one risk for financial services (banks, insurance, investment and finance) in the commerce sector is damage to reputation or brand (reputational risk). The second-highest risk is regulatory or legislative changes, encompassing changes to taxes, policies related to the industry and changes to business operations. Both the commerce sector and the energy sector have risks in common, as can be seen when Table 3–1 is compared with Table 3–3. These risks include:

- economic slowdown or slow recovery (financial risk);
- weather or natural disasters (disaster risk);
- failure of disaster recovery plan or business continuity plan (operational risk);
- property damage (financial and operational risk);
- failure to innovate or to meet customers’ needs (reputational risk); and
- increasing competition (reputational risk).

Table 3-3 Top three risks in the commerce sector

Industry	Key risk 1	Key risk 2	Key risk 3
Banks	Damage to reputation or brand	Regulatory or legislative changes	Economic slowdown or slow recovery
Government	Damage to reputation or brand	Failure of disaster recovery plan or business continuity plan	Regulatory or legislative changes
Hotels and hospitality	Weather or natural disasters	Damage to reputation or brand	Property damage
Insurance, investment and finance	Damage to reputation or brand	Regulatory or legislative changes	Economic slowdown or slow recovery
Technology	Failure to innovate or to meet customers' needs	Increasing competition	Damage to reputation or brand
Telecommunication and broadcasting	Damage to reputation or brand	Regulatory or legislative changes	Increasing competition

Source: AON (2015)

Based on the above, it is clear that risk identification is a crucial aspect of energy projects in order to gain access to finance, attract investments and ensure an effective risk management process. Organisations need to identify the risks to which they are exposed with the implementation of energy strategies, such as market risk, operational risk, credit risk, regulatory risk, reputational risk and environmental risk in order for them to analyse, evaluate and treat the relevant risks within their organisation. The risk analysis, evaluation and treatment stage of the risk management process are discussed in the next section.

3.4.3 Risk analysis

During the risk analysis stage, the various sources of risk and the likelihood and consequences of these risks occurring without control measures in place are evaluated (Berg 2010). Purdy (2010) supports this view, pointing out that, according to ISO31000, risk analysis is mainly concerned with the development of an understanding of the risks within an organisation, their consequences and the likelihood that they will occur. This stage aims to quantify the risks that have been identified by judging the probability of each risk occurring (Mills 2001). Khindanova and Atakhanova (2002) also indicate that the quantification of risk is an extremely important part of the risk management process. At this stage, organisations identify appropriate control measures and estimate the effectiveness of the control measures on the level of risk (Berg 2010). One of the commonest techniques used in the risk analysis stage seems to be the risk matrix (Berg 2010). The risk matrix identifies the likelihood and consequences of each risk type that is analysed. Table 3-4 shows a basic risk matrix that can be used for the analysis of risks.

Table 3-4 Risk matrix

Significant			Consequence				
			Insignificant outcome	Minor outcome	Moderate-minor outcome	Major outcome	Catastrophic
Likelihood	1	Rare	Low	Low	Moderate	High	High
	2	Unlikely	Low	Low	Moderate	High	Very high
	3	Moderate/ possible	Low	Moderate	High	Very high	Very high
	4	Likely	Moderate	High	High	Very high	Extreme
	5	Almost Certain	Moderate	High	Very high	Extreme	Extreme

Source: Berg (2010)

During the risk analysis stage, organisations rank the risks that were identified in the risk identification stage according to the likelihood of their occurring and the consequences of these risks, in order to estimate the inherent or unprotected risk if there are no controls in place (Berg 2010). Organisations then need to decide whether the risks will be accepted, monitored or mitigated. Risks that are classified as 'high' to 'extreme' need mitigating actions, whereas 'moderate' risks can be monitored and 'low' risks accepted. This stage is important for the organisation to rank the various risks related to energy projects in order to evaluate the likelihood of the risks occurring and the consequences should they do so. The next stage in the risk management process is risk evaluation, which is discussed in the next section.

3.4.4 Risk evaluation

The next stage in the risk management process is the evaluation of the analysed risks. At this stage, the risks are compared to the approved risk tolerance criteria of the organisation (Berg 2010). Purdy (2010) explains that this stage involves decision-making regarding the level and priority value of each risk, through the criteria established in the context stage. Management's role is to decide whether to accept, control, transfer or avoid the various risks that had been identified. In order to make sound decisions and to understand the various risks, management needs to understand the outcomes of previous projects and the future context of the envisaged project (Michelez *et al.* 2011). Based on the risks, the outcomes of previous projects and the projections for new projects, management decides whether to accept the risk or not. If accepted, the risk is monitored and reviewed on a regular basis. If the risk is not accepted, the organisation has to decide on a relevant risk treatment or mitigation strategy for the risk. Organisations need to evaluate all the risks in energy management in order to make sound decisions on risk treatment, mitigation and implementation, which will be discussed in the next section.

3.4.5 Risk treatment, mitigation and implementation

The risk treatment stage in the risk management process involves the development of a cost-effective strategy to treat the risk (Berg 2010). Purdy (2010) supports this view, indicating that this stage involves the development and implementation of existing and new controls within the organisation. This can be done by avoiding the risk, reducing or mitigating the risk, transferring the risk or retaining the risk (Berg 2010). Rivža and Rivža (2012) support this view, listing the five methods of risk treatment as:

- The avoidance of risk – the commonest method to manage risk. The cause of the risk that could lead to large losses is eliminated or totally avoided through changes in the strategy.
- The reduction of risk – aims at reducing the likelihood of the risk occurring or the magnitude of the risk's consequences. The organisation develops preventative measures that will decrease the probability of the risk occurring, and the relevant people warn the organisation about possible emergent risks.
- The acceptance of risk – involves accepting the consequences and the financial implications of the risk, should the risk event materialise.
- The transfer of risk – involves a party finding a second party to take on the risk, usually an insurance company. The consequences of the risk are then transferred to the insurance company on the basis of a set contract.

- The diversification of risk – the risk of loss is covered by other business activities within the organisation. The revenues of various business activities are used to offset the losses incurred; thus, ameliorating the effect of the losses on the organisation.

In a study by Watts (2011), a high percentage of the respondents indicated that they were successful at identifying the risks pertaining to energy projects, but that they were less successful at mitigating and transferring toese risks. All the risks need to be monitored and reviewed on a continuous basis and should be communicated to all stakeholders.

The method of risk treatment, mitigation and implementation is based on the aim and context of the risk assessment of energy projects (Rivža and Rivža 2012). Limited data and mechanisms available for the transfer of risks in energy projects is one of the obstacles faced by organisations (Watts 2011). Regulatory risk and weather risk, for example, are mitigated through diversification, both geographically and through technology, while operational risk is mitigated through investing in proven technologies. Research further shows that insurance is a common risk-transferring tool, but that in the future, financial derivatives and special-purpose vehicles will become available to hedge against these risks (Watts 2011). Financial derivatives and special-purpose vehicles did not form part of this study, but create the opportunity for further study in the field of energy management.

The risk management treatment, mitigation and implementation stage involves the development of cost-effective strategies in order to manage the risks within energy projects. The risks that were identified and analysed can be avoided, reduced, mitigated or transferred. The risks are then monitored and communicated to all stakeholders within the organisation in order to identify areas that need further management, and new risks that occur in the organisation.

The monitoring and review stage, coupled with communication to all stakeholders, is done on a continuous basis, and is discussed next.

3.4.6 Risk monitoring and review

Risk management is a dynamic process that needs to be monitored and reviewed on a continuous basis (Berg 2010). This stage includes control assurance, environmental scanning, gathering new information that becomes available and learning lessons from the risk and controls. At this stage, the project risk plan is compared to the actual implementation of the plan, and the results obtained from this are then incorporated into the risk management process to enhance the energy project (Michelez *et al*. 2011). Purdy (2010) points out that at this stage, appropriate actions can be taken as new risks emerge, or if the existing risks change due to changes in the internal or external environment. This stage also assists with monitoring the success and effectiveness of the risk control measures that had been implemented, and with making relevant changes, where required. This is a dynamic process where lessons are learned from the successes and failures of the risk analysis stage (Purdy 2010). The risk monitoring and review process forms an important part of the energy risk management process. With the growth in the energy market, organisations need to review their energy processes on a regular basis, and they continually identify new risks that may affect the organisational structure and strategies negatively.

3.4.7 Communication and consultation

Clear communication to all stakeholders within the organisation is an essential part of the risk management process (Berg 2010). Chapman (2011) indicates that the communication and consultation stage comprises a process of gathering all relevant information regarding the key risks identified, the opportunities and the decisions of the organisation. Purdy (2010) points out that communication and consultation should take place between internal as well as external stakeholders, and that it is important to understand the objectives of stakeholders in order to evaluate their involvement level and their views when setting the risk criteria. All employees of the organisation need to understand the risk management process, and should identify and report on new risks within their departments.

3.5 Conclusion

Chapter 3 dealt with the financial and risk-related aspects of energy projects. Various financial aspects, such as incentives used to promote energy projects, were discussed. These included bank loans, cash grants and tax incentives. Although these incentives all assist in the implementation of energy projects, governments and organisations are still concerned about the high cost of investing in these projects.

Due to the continuous implementation of energy projects, the need to manage the risks associated with these projects has become an important consideration for organisations. The risk management process was discussed, including the setting of context, identification, analysis, evaluation, treatment, monitoring, review and communication of energy projects. The risks that were identified were financial risk (market, credit and liquidity risk) and non-financial risk (operational, reputation, disaster, strategic and regulatory risk).

The structured approach to energy risk management (Figure 3-2) combines all aspects of the energy management system, as indicated by ISO50001 (Figure 2-2) as well as the risk management process (Figure 3-1). The structured approach will be discussed in more detail in Chapter 5.

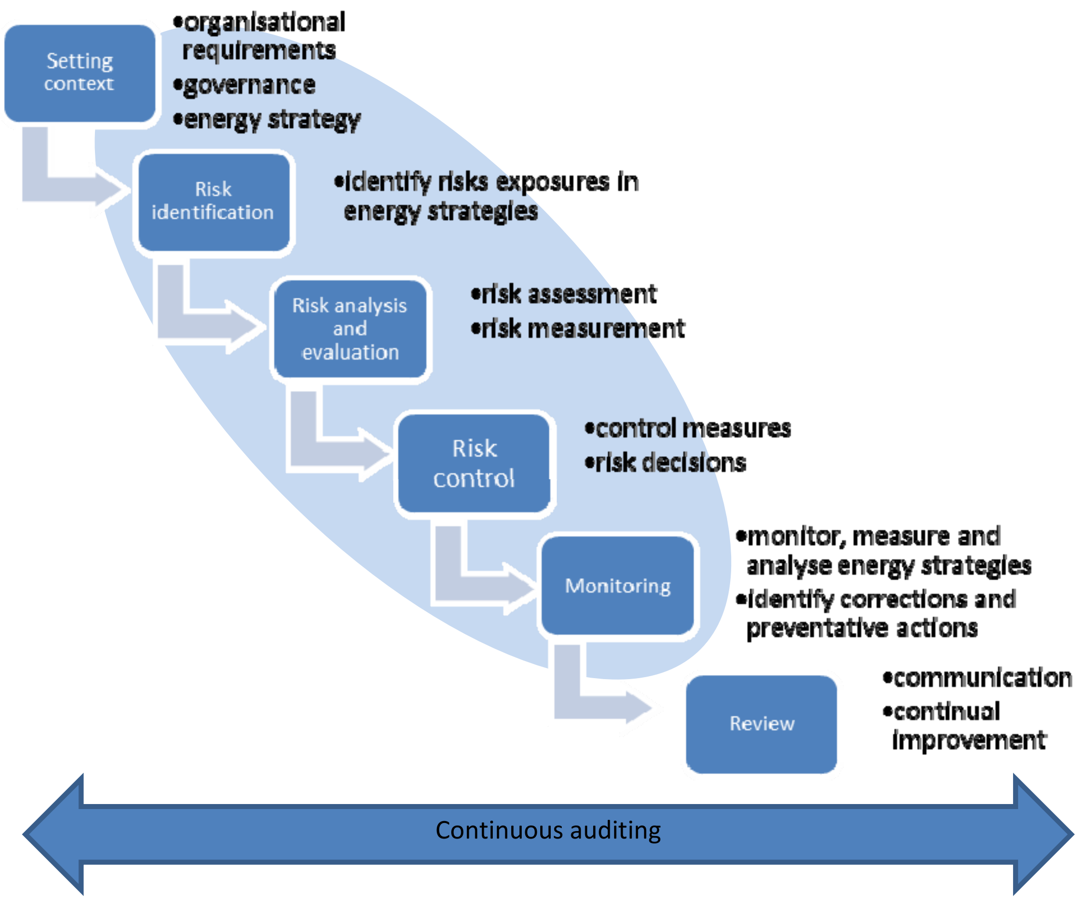


Figure 3-2 Structured approach to energy risk management

Source: Author

CHAPTER 4 DESIGN AND METHODOLOGY

4.1 Introduction

From the literature review, the criteria for the implementation of an energy risk management strategy for organisations were identified and discussed. The objective of the present study was to validate these criteria for successful implementation of energy projects in the risk management context of an organisation. To achieve the objective, primary research was conducted in the financial services sector of the SA economy.

The objective of this chapter is to discuss the methodology that was used in order to achieve the objectives and analyse the data of the study. This chapter covers the research design, population and sampling, data gathering methods and statistical analysis techniques used to analyse the data.

4.2 The business research process

According to Creswell (2009), there are four philosophical worldviews in research: post-positivism, constructivism, advocacy or participation, and pragmatism. A post-positivist worldview is concerned with the need to identify and assess the causes that influence outcomes (Creswell 2009). This research made use of a post-positivist worldview in order to identify and assess the energy risk management criteria and their influence on organisations. The major elements of this view are determination, reductionism, empirical observation, measurement and theory verification. Some of the key assumptions of the post-positivist view include that –

- knowledge is hypothetical and the absolute truth is never found;
- all research is imperfect;
- research is a process of making claims about a theory and then testing these claims in order to refine or abandon some of them;
- the data, evidence and rational considerations of research shape knowledge;
- research aims at finding relevant and true statements which will serve as explanations for the situation under consideration; and
- objectivity is an important part of the research process, with researchers having to examine all assumptions that create bias (Creswell 2009).

Du Plooy-Cilliers *et al.* (2016) and Kumar (2011) indicate that the research process consists of various stages. This research will focus on seven of the major stages in the research process, namely:

Stage 1: Formulating the research problem and objectives

Stage 2: Choosing the research design

Stage 3: Constructing a research instrument for data collection

Stage 4: Selecting a sample

Stage 5: Gathering the required data

Stage 6: Processing and analysing the data gathered

Stage 7: Drawing conclusions and reporting on findings

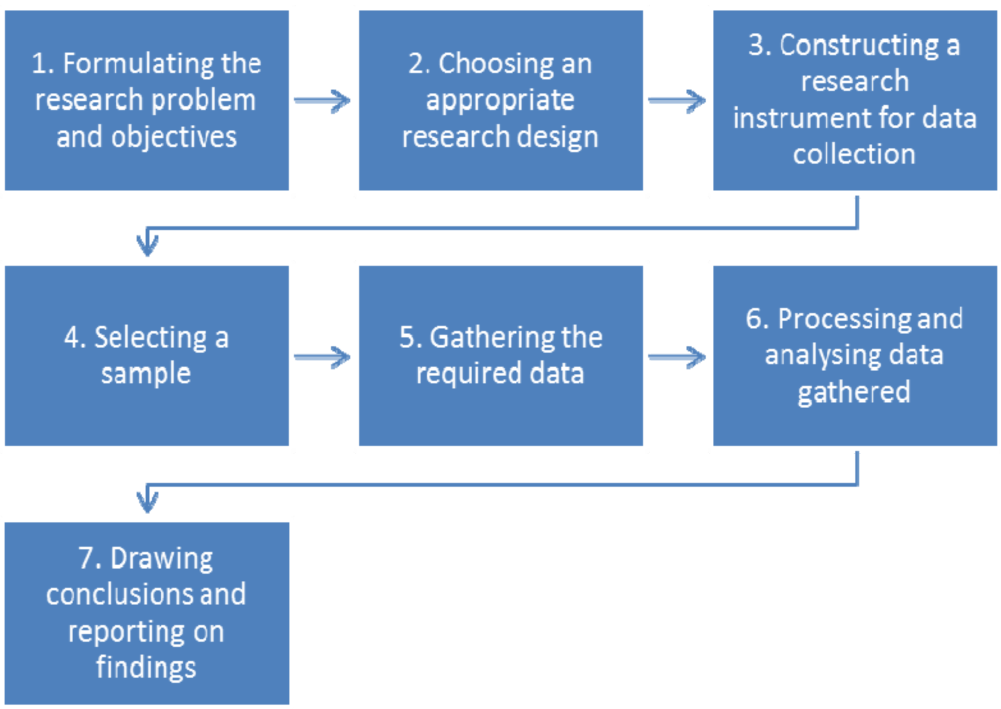


Figure 4-1 Stages in the business research process

Source: Adapted from DuPlooy-Cilliers et al. 2014 and Kumar (2011)

Each of these stages is discussed in detail in the following sections.

4.2.1 Stage 1: Formulating the research problem and objectives

The first stage in the research process consists of formulating the research problem and the objectives of the study. According to Kumar (2011), a research statement is any question or problem that the researcher wants to investigate or evaluate. This is confirmed by Creswell (2009) who indicates that the research statement is an issue or problem that arises and which the researcher wants to investigate. The formulation of the research statement is the most important stage in the research process (Kumar 2011). A research statement can be formulated based on people, problems, programmes or phenomena (Kumar 2011). There are seven steps in the formulation of a research statement:

- identify the broad field of study;
- divide the broad field into sub-areas;
- select the area of interest to the researcher;
- formulate the research questions;
- express the research objectives;
- assess the objectives; and
- double-check the statement to ensure that it is structured correctly for what the researcher wants to investigate.

The research problem statement and objectives for this study are discussed next.

4.2.1.1 Problem statement

The research problem consists of any question, assertion or assumption that the researcher wishes to investigate or challenge in order to find a solution (Kumar 2011). The aim of naming the research problem is to identify the main issues that will be evaluated in the research (DuPlooy-Cilliers, Davis & Bezuidenhout 2014). The formulation of the problem statement is a crucial step in the research process and formulation should be concise and clear (DuPlooy-Cilliers *et al.* 2014). There are five criteria for the research problem which need to borne in mind and adhered to for the problem to constitute a sound foundation for research:

- answerability: The problem must be answerable or researchable through observation;
- feasibility. The study should be managed according to time, cost, sample size and methodology;
- scope. The study scope should be manageable and should not be too wide or too narrow;

- theoretical value. The study should contribute to the body of knowledge in the study field; and
- relevance. The study should make a notable contribution and be relevant to current issues (DuPlooy-Cilliers *et al.* 2014).

Based on the literature review, it is apparent that risk management is an important part of organisational functioning and assists in managing the important risks of an organisation. With the increased focus on energy management within organisations due to the scarcity and increasing prices of energy, and the continuous investment in energy projects, it is imperative for an organisation to incorporate energy management into its risk management processes.

The purpose of the present research was to establish a structured approach to the management of energy risk, to ensure the maximum efficiency of organisational processes and their contribution to the environment.

4.2.1.2 Research objectives

Research objectives are the goals that the researcher sets out to achieve with the research (Kumar 2011). The primary objective is an overall statement of the main aim of the study, whereas the sub-objectives are the specific issues relating to the topic that the research will aim to answer (Kumar 2011). Each sub-objective should include only one aspect of the research being investigated and should be clearly formulated (Kumar 2011).

The primary objective of this study was to provide a structured energy risk management approach for organisations in developing countries to contribute to the effective management of energy sources and add value to a sustainable environment. In order to achieve this objective the following sub-objectives (SOs) were defined:

- SO1: Evaluate the current definitions of energy risk within organisations.
- SO2: Determine the various energy risk management processes.
- SO3: Determine the criteria to be considered for effective energy risk management.
- SO4: Determine the perceived success of energy strategies within organisations.

- SO5: Evaluate the perceived success of energy conservation, efficiency and renewable energy methods within organisations.
- SO6: Determine the management criteria for effective energy risk management.
- SO7: Determine the influence of finance on the implementation of energy strategies.
- SO8: Identify the effect of energy strategies on organisations.
- SO9: Develop a structured approach for the implementation of energy risk management.

From the literature study, it was evident that a need exists for an energy risk management strategy within organisations. Therefore, empirical research was conducted in order to provide answers to the problem statement and research objectives as discussed in the previous section.

The first stage in the research process comprised formulating the research problem and objectives, as indicated in Figure 4.1. The second stage of the process was concerned with choosing an appropriate research design. The next section presents a discussion of the various research designs and the appropriate research design for this study.

4.2.2 Stage 2: Choosing an appropriate research design

According to Malhotra (2010), a research design can be defined as a framework or blueprint for conducting the research project. Welman and Kruger (2001) define it as a plan in order to obtain research respondents and to gather the relevant information. This is confirmed by Kumar (2011), who indicates that the research design is a practical plan that the researcher uses in order to obtain information in an objective, valid, economical and accurate way. The research design is the roadmap used to gather the information needed to answer the research objectives. It is the general strategy for solving the research problem (Leedy & Ormrod 2016). Various research designs are available and the choice will depend on the nature of the research problem (Creswell 2009; Walliman 2010). There are two broad functions of the research design: to identify the procedure that will be followed in the study, and to ensure quality through validity, objectivity and accuracy (Kumar 2011).

There are three main types of research design: qualitative, quantitative and mixed methods, as indicated in Figure 4-2 (Creswell 2009). The next section reflects an evaluation of each of these designs in order to describe the design that was suitable to meet the research objectives of this study.

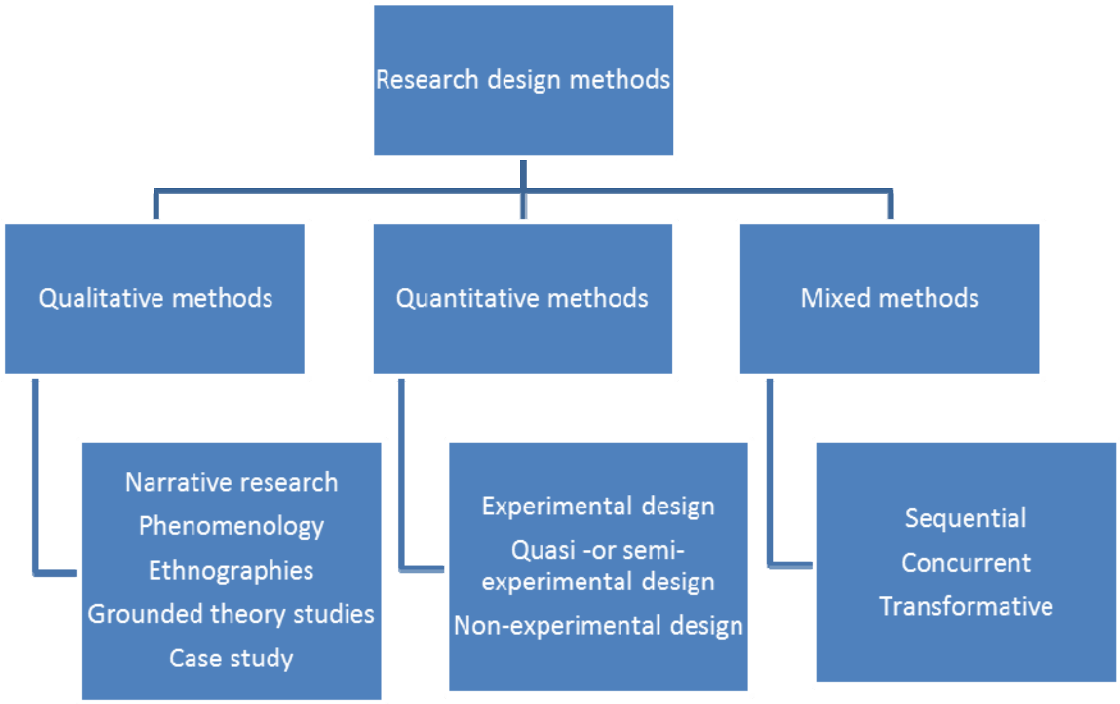


Figure 4-2 Research design methods

Source: Adapted from Creswell (2009)

4.2.2.1. Qualitative research design

Qualitative research is defined by Creswell (2009) as the exploration or understanding of individuals based on a social or human problem. With qualitative research, the aim is to gain an understanding of complex situations (Leedy & Ormrod 2016). The primary focus of qualitative research is to explain, understand, explore and discover the different feelings, attitudes, values, beliefs, perceptions and experiences of a group of people (Kumar 2011). Qualitative methods are mostly used when an evaluation is conducted into the variation and diversity of aspects of social life (Kumar 2011). Qualitative research comprises of ethnography, grounded theory, case studies, phenomenological research and narrative research, as indicated in Figure 4-2 (Creswell 2009).

Ethnography research focusses on a cultural group and they way they interpret their own behaviours (Creswell 2009; Walliman 2010). This is confirmed by Leedy and Ormrod (2016) who indicate that ethnographic research focusses on an in-depth study of a cultural group in their natural setting. Grounded theory is used when the researcher forms an abstract theory of the views of the respondents (Creswell 2009). Leedy and Ormrod (2016) further indicate that this type of study aims to derive theory by making use of more than one stage of data collection and interpretation. Case study research involves the intensive evaluation of a programme, event, activity, process or individuals (Creswell 2009). This is confirmed by Kumar (2011), who indicated that case studies are based on an individual, group, community or a subgroup of the population. Leedy and Ormrod (2016) also indicate that this type of study is based on a single individual, event or programme where the research aims to extract data about an unknown or misunderstood topic. Case studies are based on the assumption that the information being studied is typical of cases of a certain type and that it can therefore provide insight into the group involved in the case study (Kumar 2011). Phenomenological research involves the evaluation of principles of human behaviour about a certain phenomenon (Creswell 2009). This is the study of respondents' perspectives and views of their social reality (Leedy & Ormrod 2016). Lastly, narrative research involves am evaluation of the lives of the respondents where the respondents tells their life stories (Creswell 2009).

4.2.2.2 Quantitative research design

Quantitative research aims to identify relationships between variables (Leedy & Ormrod 2016). Quantitative research design is precise, well-structured and specific, with data tested for validity and reliability (Kumar 2011). Quantitative research design can be evaluated from three perspectives:

- the number of contacts with the population;
- the reference period of the study; and
- the nature of the study (Kumar 2011).

This study focussed on the nature of the investigation, which can be classified as experimental, semi- or quasi-experimental and non-experimental, as indicated in Figure 4-2 (Creswell 2009; Kumar 2011).

- *Experimental design*

Experimental design is used to establish a cause and effect relationship or the effect that a specific treatment will have on an outcome (Kumar 2011). This is confirmed by Creswell (2009), who indicates that experimental research evaluates whether a specific treatment will have an effect on the outcome. According to DuPlooy-Cilliers *et al.* (2014), experimental design produces an outcome which is evaluated based on a specific intervention. Leedy and Ormrod (2016) support this view, indicating that this type of design randomly selects respondents to be exposed to certain treatments or interventions, which are observed and measured to test the effect. In experimental design, the elements are randomly grouped into an experimental and a control group, with the intervention taking place in the experimental group and not in the control group, so that the researcher may establish the differences between the two groups (DuPlooy-Cilliers *et al.* 2014).

- *Non-experimental design*

Non-experimental design or survey design aims to evaluate attitudes, opinions and trends, by making use of a sample of the population. This design provides a description of quantitative and numerical values (Creswell 2009). Survey designs may be cross-sectional survey designs, before-and-after survey designs or longitudinal survey designs (DuPlooy-Cilliers *et al.* 2014). With cross-sectional survey designs, data is gathered from respondents only once during the research process. This type of design aims to establish the overall phenomenon at a specific point in time (DuPlooy-Cilliers *et al.* 2014).

With before-and-after survey designs, the survey is administered to the respondents on more than one occasion in order to evaluate the outcome of a specific intervention on the attitudes of the respondents (DuPlooy-Cilliers *et al.* 2014).

Longitudinal survey design evaluates the long-term effect of a specific intervention on respondents. This method makes provision for changes over time (DuPlooy-

Cilliers *et al.* 2014). Leedy and Ormrod (2016) further explain that with this type of study, the respondents are evaluated over the course of a specific time period (e.g.monthly or yearly),and the data is collected at various points in time.

- *Quasi- or semi-experimental design*

Quasi- or semi-experimental designs have properties of both experimental and non-experimental design. Part of the study may be experimental and part non-experimental (Kumar 2011). With a quasi-experimental design, respondents are not randomly assigned to different groups (DuPlooy-Cilliers *et al.* 2014; Leedy & Ormrod 2016).

4.2.2.3 Mixed methods research design

There are generally three strategies for mixed methods research, sequential mixed methods, concurrent mixed methods and transformative mixed methods, as indicated in Figure 4-2 (Creswell 2009). According to Creswell (2009), the sequential mixed method is used when a researcher compares the findings of one method (quantitative or qualitative) with the findings of another (qualitative or quantitative) method. Concurrent mixed methods enable the researcher to combine the findings of both qualitative and quantitative approaches to give a comprehensive analysis of the research problem (Creswell 2009).

Lastly, the transformative mixed method is used when a researcher makes use of a specific theoretical lens in order to gain a broad perspective of data, containing both quantitative and qualitative methods.

Based on the research objectives and problem of the present research study, the quantitative, non-experimental cross-sectional survey research design was followed. The non-experimental research design was chosen because the research objective and problem aimed to evaluate the attitudes and opinions of a sample of managers within the financial services sector on energy management issues in their organisations. The research design yielded quantitative and numerical values to describe the research problem and objectives. The research was based on a cross-sectional survey design, with data gathered only once from the respondents. The overall phenomenon was evaluated at one point in time, as is explained by DuPlooy-Cilliers *et al*. (2014).

4.2.3 Stage 3: Constructing a research instrument for data collection

Stage 3 in the research process focusses on data collection and the data measuring methods. The data collection methods are used to gather data from primary and secondary data sources. Data measuring methods are for instance nominal, ordinal, interval, ratio and Likert-type scale questions. These methods are discussed in the following sections.

4.2.3.1 Data collection method

Data collection is one of the most important steps in the research process. Data that is collected incorrectly might yield invalid results and findings (DuPlooy-Cilliers *et al.* 2014).

Data collection methods may comprise secondary or primary data. Primary data collection involves collecting data from a sample or population in order to answer the research question(s) (Kumar 2011). DuPlooy-Cilliers *et al*. (2014) concur with this statement, saying that primary data may include observation, interviews or any other method of research in order to gather the relevant information to answer the research question(s). Secondary data collection is a process where the data is already available and the researcher uses the data to extract the relevant information required for the research (Kumar 2011). Secondary data sources can consist of books, published journal articles, online sources and many more sources (DuPlooy-Cilliers *et al.* 2014). The main methods of collecting data are indicated in Figure 4-3.

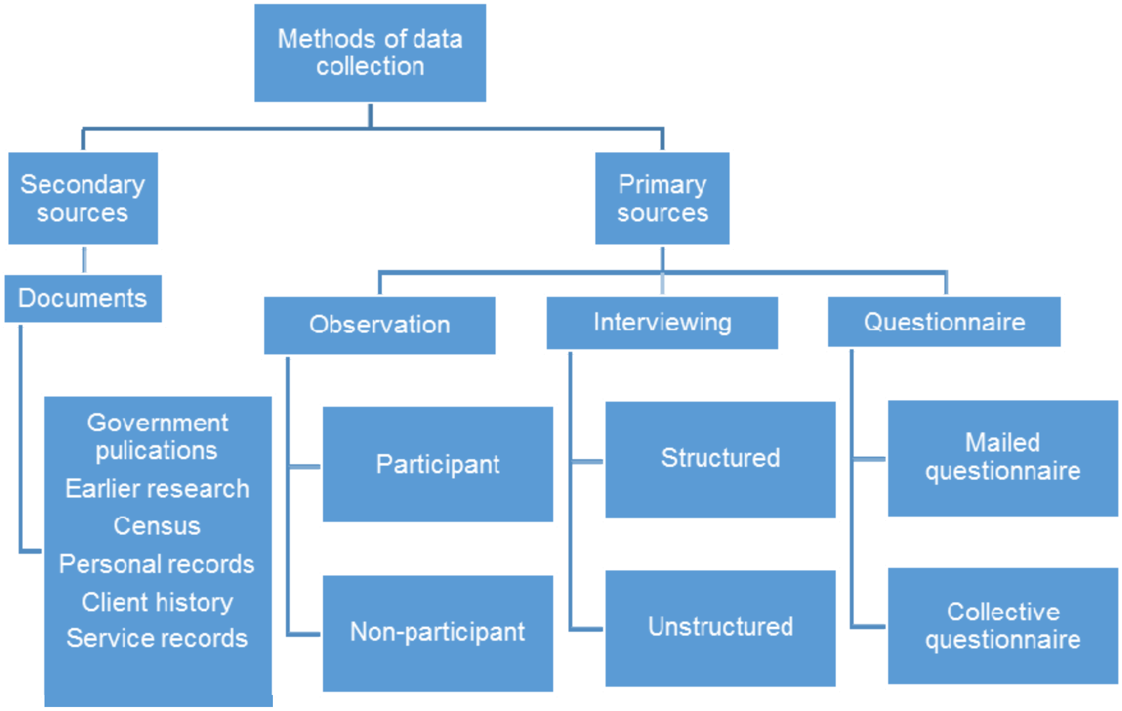


Figure 4-3 Data collection methods

Source: Kumar (2011)

- o *Secondary data analysis*

In this study, secondary data analysis was conducted in order to realise the objectives as described in section 1.4. The purpose of the secondary data analysis was to gain a deep understanding of the research problem prior to conducting primary research. Secondary data may consist of government publications, previous research, personal records or the mass media, including newspapers, magazines and the Internet, as indicated in Figure 4-3. A variety of sources were used for this study, including accredited journal articles, government reports, books written on the topic, conference proceedings and Internet sites.

According to Kumar (2011), some of the disadvantages of secondary data methods are:

- the validity and reliability of the data may vary between sources;

- there might be personal bias when using newspaper articles and magazines, as the user might be less rigorous and objective when using these than when using research reports;
- the data required might not be readily available; and
- the data available might not be in the required format for the particular study.

o *Primary data analysis*

According to Welman and Kruger (2001), it is advisable to make use of primary data rather than secondary data. The main reason is that each time the data is used some distortion is introduced, whether deliberately or inadvertently. Primary data collection can be done by observation or interviewing or by means of a questionnaire, as indicated in Figure 4-3. The method chosen will depend on the objective of the study and the skills of the researcher (Kumar 2011).

- Observation

Observation means watching and listening in a purposeful, systematic and selective way in order to gather the relevant data (Kumar 2011). During an observational study, respondents are systematically and objectively observed in a particular situation (Leedy & Ormrod 2016). Observations are mostly used when the data cannot be gathered by questioning, as the respondents are either uncooperative or do not know the answers. Observation could take the form of participant or non-participant observation. With participant observation, the researcher takes part in discussions while the group is being observed. In non-participant observation, the researcher remains a passive observer, watching, listening and drawing conclusions regarding what respondents are discussing or doing (Kumar 2011). Some of the challenges associated with observational research are:

o respondents tend to alter their behaviour when they know that they are being observed;
o there might be observer bias;
o interpretations may vary from observer to observer; and
o there is the possibility that not all observations are recorded accurately (Kumar 2011).

- Interviewing

Interviews are mostly used to gather data from people by asking questions by means of which the researcher tries to elicit information from the person being interviewed (Kumar 2011). Interviews can be either structured or unstructured. With structured interviews, the form content and wording of the questions are inflexible. With unstructured interviews, only certain predetermined questions are asked and no more (Leedy & Ormrod 2016). The structure, content and questions are all flexible (Kumar 2011). With this type of interview, standard questions are asked, but the researcher may ask additional questions in order to get more information from the respondent (Leedy & Ormrod 2016).

One of the advantages of structured interviews is that they provide the same types of information for all respondents, which can be compared in the analysis (DuPlooy-Cilliers *et al.* 2014). Unstructured interviews are mainly used in qualitative research but could also be used in quantitative research, differing only in the way the data is analysed.

Some of the advantages of interviews are the following:

- it is an appropriate approach when the study is complex and for studies of a sensitive nature;
- in-depth information can be collected because of the probing of the interviewer;
- the information can be supplemented by verbal and non-verbal communication;
- the interviewer can explain the questions in more detail;
- the interview has a large application, which can be used for any type of population (Kumar 2011).

Disadvantages of interviews are:

- the interview process is time-consuming and expensive;
- the quality of the data gathered will depend on the quality of the interaction between the participant and the interviewer;
- the quality of the data will depend on the experience and communication skills of the interviewer;
- the quality of the data gathered may differ between different interviewers;

- research bias may occur due to the framing of the questions by the interviewer (Kumar 2011).

- Questionnaire

Questionnaires can be defined as written questions on the study topic (Kumar 2011). Questionnaires can be either mailed to respondents or collectively administered. A mailed questionnaire is the commonest method and may be sent by post or by email (Kumar 2011). One of the primary disadvantages of a mailed questionnaire is the low response rate from respondents, and the fact that data have limited applicability to the overall population (Kumar 2011). Collective questionnaires, on the other hand, are used when the researcher has a captive audience, for example in a classroom, or with a group of people participating in a function (Kumar 2011). This method has a higher response rate and the researcher is available to answer questions and explain the purpose of the study more clearly (Kumar 2011).

Some of the advantages of questionnaires are that this method is inexpensive and it offers great anonymity to the respondents. Respondents might be more willing to answer truthfully if they know they will remain anonymous. The disadvantages, however, are:

- the method is only applicable in the case of respondents who can read and write;
- the response rate is low, as many respondents fail to return questionnaires;
- the low response rate gives rise to self-selecting bias;
- the respondents do not have the opportunity to clarify issues or questions that they do not understand;
- it is not a suitable method when spontaneous responses are required, as respondents have time to reflect on the questions;
- respondents' answers may be influenced by other questions in the questionnaire;
- the respondents might consult with others; and
- the information gathered cannot be supplemented with other information (Kumar 2011).

Table 4-1 summarises the various research methods. Since the objective of this study was to gather data to examine certain perceptions and opinions of stakeholders in the financial services sector of South Africa regarding energy risk management, it was decided that a structured questionnaire would be the best method to collect the data. A questionnaire was chosen because the respondents were in different geographical locations and this was the most cost-effective way to reach them.

Table 4-1 Summary of research methods

Quantitative methods	Mixed methods	Qualitative methods
Pre-determined methods	Both pre-determined and emerging methods	Emerging methods
Instrument-based questions	Both open- and closed-ended questions	Open-ended questions
Performance data, attitude data, observational data, and census data	Multiple forms of data drawing on all possibilities	Interview data, observation data, document data, and audio-visual data
Statistical analysis	Statistical and text analysis	Text and image analysis
Statistical interpretation	Across database interpretation	Themes, patterns interpretation

Source: Adapted from Creswell (2009)

4.2.3.2 Data measuring

Data measuring is defined by Leedy and Ormrod (2016) as the limiting of the data in order to interpret and compare aspects of it. The measurement scale used in the questionnaire will have certain implications for the data analysis (DuPlooy-Cilliers *et al.* 2014). Measuring scales could include nominal scales, ordinal scales, interval scales, ratio scales and Likert-type scales. According to DuPlooy-Cilliers *et al*. (2014), certain quantitative analysis techniques need certain levels of measurement, with the ratio scale having the highest level of measurement and the nominal scale the lowest level of measurement. These will be discussed in more detail in the following section.

- *Nominal scale*

Nominal scales are a basic measurement tool where data is divided into categories which can then be compared (Walliman 2010). Nominal scales are concerned with naming the different data points (Leedy & Ormrod 2016). DuPlooy-Cilliers *et al*. (2014) indicate that, with nominal scales, the variables are labelled or named using numbers. There are an infinite number of ways to name the data points in the research, and all the nominal scale does is limit the data points. For example, one could assign a 1 to males and a 2 to females. Although nominal scales are simplistic, they divide the data into discrete categories (Leedy & Ormrod 2016). Walliman (2010) points out that nominal scales should have distinctive categories and that there should be no overlap in the categories. Nominal scale variables usually refer to geographical location, age, income or gender (DuPlooy-Cilliers *et al.* 2014). The following criteria need to be incorporated when making use of nominal scales:

- Categories must be comprehensive. Elements of the sample must fall within each of the categories.
- Categories must be mutually exclusive. Each element of the sample must fall into one category only.
- The number assigned to each category has no mathematical significance (DuPlooy-Cilliers *et al.* 2014).

The statistical methods that can be used to analyse nominal data are mode, percentage, and the chi-square test (Leedy & Ormrod 2016).

- *Ordinal scale*

The ordinal scale evaluates data as greater than (>) or smaller than (<) a certain value (Leedy & Ormrod 2016) and is used for ranking variables (DuPlooy-Cilliers *et al.* 2014). This type of scale does not indicate how much of a difference exists between variables (DuPlooy-Cilliers *et al.* 2014). With ordinal scales, the sub-groups are arranged in order of the magnitude of certain characteristics, with the distance between the sub-groups being unequal (Kumar 2011). Ordinal scales can be evaluated by means of the statistical methods for nominal scales, but could also use the median, percentile rank and Spearman's rank order correlation (Leedy & Ormrod 2016).

- *Interval scale*

With interval scales, there are two main characteristics: the units of measurement are equal and there is a zero-point, established subjectively (Leedy & Ormrod 2016). Interval scales reflect equal distances between data points and therefore allow for statistical techniques that are not possible with nominal or ordinal scales. Interval scales have a starting and ending point with the entire scale divided into equal intervals (Kumar 2011). With this type of scale, the difference between values can be measured (DuPlooy-Cilliers *et al.* 2014). Statistical methods that can be used to evaluate the interval scale are range, mean, standard deviation (SD), Pearson's product moment correlation, t-test, ANOVA, regression and factor analysis (Leedy & Ormrod 2016; Shukla 2008).

- *Ratio scale*

Ratio scales have two main characteristics: the units of measurement are equal (as with interval scales) and there is an absolute zero point or true zero (Leedy & Ormrod 2016). A zero value on a ratio scale means that the element being measured is absent (DuPlooy-Cilliers *et al.* 2014). The difference between the intervals is always measured from the zero point (Kumar 2011). Ratio scales can express data in terms of multiples and fractional parts. With ratio scales, the following statistical methods can be used: geometric mean, harmonic mean, coefficient of variation and proportional comparisons (Leedy & Ormrod 2016)

- *Likert-type scale*

The Likert-type scale is used where all items or statements have an equal importance or weight (Kumar 2011). This type of scale requires respondents to rate their degree of agreement or disagreement towards certain statements or questions (DuPlooy-Cilliers *et al.* 2014). The responses to the items are added to create a total score for the respondent (DuPlooy-Cilliers *et al.* 2014). The Likert-type scale therefore gives the total of all the numbers assigned to the various Likert-type items (Brown 2011). The Likert-type scale does not measure attitudes but ranks responses in terms of their intensity regarding an issue (Kumar 2011). The Likert-type scale consists of two parts: the item (question or statement) and the evaluation (response from the participant). Likert-type scales contain various items and are therefore considered more reliable than single-item scales. The reliability, however, needs to be tested by means of Cronbach's alpha or other statistical method (Brown 2011). The Likert-type scale usually comprises 5 to 7 points, as indicated in the example of a five-point Likert-type scale below (DuPlooy-Cilliers *et al.* 2014).

Example of five-point Likert-type scale:

1	2	3	4	5
Strongly disagree	Disagree	Undecided	Agree	Strongly agree

According to Brown (2011), the Likert-type scale consists of various items and can therefore be taken as a form of interval scale. The statistical analysis methods used may include correlation analysis, analysis of variance, factor analysis and various other descriptive statistical methods (Brown 2011).

Table 4-2 summarises the various measuring scales, their characteristics and the statistical possibilities of each.

Table 4-2 Measuring scales, characteristics and statistical possibilities

Measuring scale	**Characteristics**	**Statistical possibilities**
Nominal scale	Names or designations of discrete units or categories	Determines mode, percentage and chi-square
Ordinal scale	Values as 'more than' or 'less than' No specified size to intervals	Determines median, percentile rank and rank correlation
Interval scale	Equal intervals Subjectively established zero point (does not represent 'nothing' or 'something')	Determines range, mean, standard deviation, product moment correlation, t-test, ANOVA, regression and factor analysis (inferential statistics)
Ratio scale	Equal intervals Absolute zero point	Determines geometric mean, harmonic mean, coefficient of variation and proportional comparisons (inferential statistics)
Likert-type scale	All items or statements have an equal importance or weight regarding attitude of respondent	Determines correlation analysis, ANOVA, factor analysis and various other descriptive statistics

Source: Adapted from Leedy and Ormrod (2016)

This study focussed predominantly on Likert-type scale measurements as units of analysis. Some of the general demographic and organisational questions made use of nominal scales, and the energy target questions were based on ordinal scales.

- Nominal measurement questions are designed in order to classify objects, individuals or responses based on common characteristics. These types of questions may include geographical location, job position in the organisation, number of years' service and industry in which the organisation operates.
- Ordinal measurement questions are designed to rank sub-groups in a certain order. Energy targets required respondents to rank the targets of their organisation in terms of 'less than', 'between' and 'more than' a certain percentage value.
- Likert-type scale measurement questions are designed to capture opinions, attitudes and beliefs. With these types of questions or items, the respondents are required to indicate whether they agree or disagree with the statements or questions provided. Generally, respondents will be asked the extent to which they agree with a particular statement. The options presented follow a logical sequence based on the idea of 'to no degree', 'to some degree', 'to a moderate degree', 'to a degree' and 'to a strong degree'. Respondents will also have the option to choose 'don't know' if they are undecided.

4.2.4 Stage 4: Selecting a research sample

Welman and Kruger (2001) report that a research problem usually has a specific population which may be groups, individuals, events, human products or certain conditions to which the objects are exposed. The population has all the characteristics or attributes in which the researcher is interested (DuPlooy-Cilliers *et al.* 2014). The number of population elements might be too many to analyse, and resources and time might not allow for this (DuPlooy-Cilliers *et al.* 2014). For this reason, populations are usually reduced to a sample from the population.

Sampling can be defined as the selection of a few respondents from the bigger population (Kumar 2011). The sample is therefore a sub-group of the population under investigation. The sample becomes the basis for estimating or predicting the outcome of the research objective for the population. Sampling has the advantage of being cost-effective and saving time and human resources (Kumar 2011). On the other hand, the disadvantages of sampling is that the research will reflect only an estimate or prediction for the total population, and will not uncover information about the total population of the study with absolute accuracy (Kumar 2011). Sampling therefore involves a trade-off between time and money saved, and accuracy of information. Sampling in quantitative research aims to achieve the maximum precision within the sample and so sampling bias is strenuously avoided (Kumar 2011). Sampling bias may occur when the sample is selected by non-random methods. The sampling frame does not include all the respondents in the population or the elements in the sample are unwilling or unavailable to participate (Kumar 2011).

In order to obtain the sample the researcher needs to calculate the sample size required (DuPlooy-Cilliers *et al.* 2014). General guidelines on the selection of a sample size from the population (*N*), as cited by Leedy and Ormrod (2016), are the following:

- population size smaller than 100 – sample the entire population
- population size of about 500 – sample 50% of the population
- population size of about 1 500 – sample 20% of the population
- population size beyond a certain point (*N*=5 000) – the percentage is irrelevant and a sample of 400 will be sufficient.

The population for the present study comprised managers within the financial services sector of the SA economy, namely banking, investment, insurance and risk management. Due to the vast number of managers in the financial services sector it was not feasible to include all in the research study. It was therefore imperative to draw a representative sample of the elements from within this population.

4.2.4.1 Types of research samples

There are two basic methods of sampling; random or probability sampling, which comprises simple random sampling, stratified random sampling and cluster sampling, and non-random or probability sampling, which comprises quotas, judgemental, accidental, snowball and expert sampling. The sampling methods are shown in Figure 4-4 (Kumar 2011).

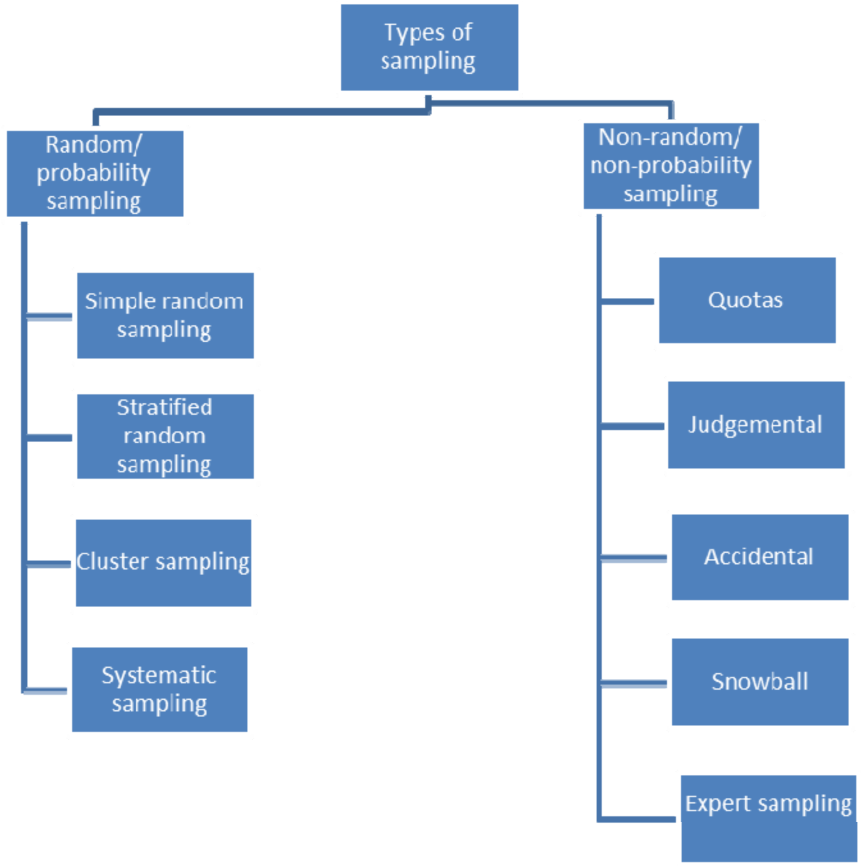


Figure 4-4 Types of sampling

Source: Adapted from Kumar (2011)

- *Probability sampling*

For probability or random sampling, it is important that all the elements in the population have an equal and independent opportunity to be selected as part of the sample (Kumar 2011). This is confirmed by Welman and Kruger (2001), who indicate that with probability sampling, the researcher can calculate the probability that each element in the population would have an equal chance of being included in the sample. DuPlooy-Cilliers *et al*. (2014) indicate that in probability sampling, each unit in the population has a fair and equal chance of being chosen for the sample. According to Kumar (2011), probability sampling has two key advantages:

- o the sample represents the total sampling population and results obtained can therefore be generalised to the entire population; and

- there are statistical analysis techniques that can be used only with data collected through probability sampling, which can test for conclusive correlations within the population.

Probability sampling comprises the following:

i. simple random sampling;
ii. stratified random sampling
iii. cluster sampling and
iv. systematic sampling.

i. Simple random sampling

Simple random sampling is the most commonly used method of selecting a probability sample. With a simple random sample, each participant in the population has an equal chance of being selected (DuPlooy-Cilliers *et al.* 2014). This is confirmed by Kumar (2011) who indicates that each participant in the population will have an equal and independent opportunity of selection. Leedy and Ormrod (2016) indicate that this method is easier when the population being investigated is small and when all respondents within the population are known.

In simple random sampling, the first step is to identify the number of respondents or elements within the population. The next step is to decide on the sampling size (*n*) and, lastly, the sampling size (*n*) is selected by making use of an appropriate selection method, which may include 'fishbowl drawing' or a computer programme (Kumar 2011). The advantage of simple random sampling is that it is representative of the total population of the study and that, because it is selected using random methods, it does not favour one participant over another (Welman & Kruger 2001). Another advantage of simple random sampling is that it eliminates researcher bias (DuPlooy-Cilliers *et al.* 2014).

ii. Stratified random sampling

With stratified random sampling, the population is grouped into different sub-units which share the same characteristics within the population (DuPlooy-Cilliers *et al.* 2014). Thereafter, a sample is drawn from each sub-unit, making use of simple random sampling (DuPlooy-Cilliers *et al.* 2014). This method of sampling has the advantage of guaranteeing equal representation of each sub-unit under investigation. It is most appropriate when the sub-groups being investigated have roughly the same population size (Leedy & Ormrod 2016).

iii. Cluster sampling

According to DuPlooy-Cilliers *et al*. (2014), cluster sampling is used when the population is geographically widely dispersed or when the cost of reaching the population is too high. Leedy and Ormrod (2016) confirm this, stating that the method is mainly used when the population is dispersed over a large area when it is not feasible to sample the total population. One way of obtaining the clusters is to divide a map into different geographical sections or clusters, which should be similarly sized and contain a diverse mix of the individuals (Leedy & Ormrod 2016).

iv. Systematic sampling

Leedy and Ormrod (2016) indicate that this method makes use of a particular sequence, which is determined by chance. There are five steps to follow in order to select a systematic sample (Kumar 2011):

- the elements in the population (*N*) are listed;
- a decision in made on the sample size (*n*)
- the interval size is determined by dividing the total population by the sample size;
- by using statistical techniques, the researcher then selects one element from the first interval (*n*th order); and
- finally, the researcher selects the same order element from all the remaining intervals (Kumar 2011).

An advantage of this method is that it is cheaper than simple random sampling and more practical (Welman & Kruger 2001).

b) Non-probability sampling

According to DuPlooy-Cilliers *et al*. (2014), non-probability sampling is used when it is impossible to determine the total population, or where there is no access to the total population. In non-probability sampling, the elements within the population do not have an equal chance of being selected for the sample (DuPlooy-Cilliers *et al.* 2014). Leedy and Ormrod (2016) further indicate that with this sampling technique, it is not possible to predict or guarantee that all elements in the population will be represented in the sample. Non-probability sampling does not focus on the representativeness of the sample but rather on the number of respondents that need to be evaluated in order to get an in-depth understanding of the research problem, or until data saturation is reached (DuPlooy-Cilliers *et al.* 2014). A disadvantage of non-probability sampling is that the results cannot be generalised to the entire population (DuPlooy-Cilliers et al. 2014).

Non-probability sampling, as indicated in Figure 4-4, comprises:

i. quota sampling;
ii. judgemental or purposive sampling;
iii. accidental or convenience sampling;
iv. snowball sampling; and
v. expert sampling.

i. Quota sampling

Quota sampling is mostly used when the sample population is easily accessible, such as where the sample is selected from a location convenient for the researcher (Kumar 2011). With quota sampling, the respondents are selected in the same proportion as found in the general population (Leedy & Ormrod 2016). Each participant needs to conform to the population parameters set out for the study. A list is made of the characteristics of the target population, and these characteristics are allocated to a proportion of the sample (DuPlooy-Cilliers *et al.* 2014). Quota sampling assists in making the final sample, which will display the characteristics as established in the population parameters (DuPlooy-Cilliers *et al.* 2014). This is a very cost-effective way of choosing a sample size and it guarantees the inclusion of the relevant respondents needed for the research study (Kumar 2011). The disadvantage is that the sample is not based on a probability method, and therefore the findings cannot be generalised to the population.

ii. Judgemental or purposive sampling

With judgemental or purposive sampling, the elements within the sample are chosen according to a list of specified characteristics (DuPlooy-Cilliers *et al.* 2014). This is confirmed by Kumar (2011) who indicates that the main consideration in purposive sampling is the judgement about who will be able to supply the best information required for the research study. Therefore each participant is chosen for the specific purpose of the research (Leedy & Ormrod 2016). One advantage of this method is that each participant in the study will add value to the research, as each fits the research parameters. Respondents who do not fit the parameters are removed from the sample (DuPlooy-Cilliers *et al.* 2014). One disadvantage of this method of sampling is that each researcher makes use of different ways of obtaining respondents, and it is therefore not possible to evaluate the representativeness of the sample (Welman & Kruger 2001).

iii. Accidental or convenience sampling

Accidental or convenience sampling does not try to create a representative sample of the population (Leedy & Ormrod 2016). According to DuPlooy-Cilliers *et al*. (2014), accidental sampling does not have a sample frame, and elements are included in the sample on the basis of availability. Convenience sampling is mostly used in the pre-testing of a questionnaire, where the researcher makes use of elements that are known or those that are readily available (DuPlooy-Cilliers *et al.* 2014). One disadvantage of this method of sampling is that the results cannot be generalised to the population, as some elements may have been left out due to the location or respondents chosen (DuPlooy-Cilliers *et al.* 2014).

iv. Snowball sampling

This method is mostly used with qualitative research and relies on referrals from respondents for further respondents who might be available and interested in participating (DuPlooy-Cilliers *et al.* 2014). With this type of sampling, a small group of respondents is chosen, and these respondents then act as informants to increase the sample (Welman & Kruger 2001). This process continues until the required number of respondents for the research is reached. The method is particularly useful when there is insufficient information available about the population under consideration (Kumar 2011).

v. Expert sampling

Expert sampling is similar to judgemental sampling but differs in that the respondents need to be known experts in the field of study (Kumar 2011). This method is mostly used in qualitative research.

Some important considerations to consider when choosing a sampling method are budget, time, resources, purpose and error allowance (DuPlooy-Cilliers *et al.* 2014).

The present study made use of a non-probability sampling method as there was no access to a list of the total number of respondents in the population. The disadvantage of this method is that the results cannot be generalised to the entire population. Purposive non-probability sampling was selected, with respondents chosen based on the criteria that they worked in the financial services sector, were managers in their organisations, within the borders of South Africa.

The next section focusses on the process of gathering the required data. This stage is an important part of the research process, as the calibre and effectiveness of data gathering has an influence on the analysis and interpretations of data.

4.2.5 Stage 5: Gathering the required data

Data collection is one of the most important aspects of research. Incorrect data could have an effect on the results and the findings of the study (DuPlooy-Cilliers *et al.* 2014). Sections 4.2.5.1–4.2.5.3 will look at the questionnaire, the types of questions asked and the pre-testing of the questionnaire to ensure validity and reliability.

4.2.5.1 The questionnaire

For the questionnaire to produce suitable data, it needs to be carefully developed, constructed and distributed (Leedy & Ormrod 2016). The structure of a questionnaire should be professional and the questionnaire should be easy to answer in order to encourage respondents to complete and return the questionnaire. DuPlooy-Cilliers *et al*. (2014) identify certain issues that need to be taken into consideration when constructing a questionnaire. When designing a questionnaire, the researcher should:

- provide an introduction indicating who is doing the survey and the reason for the survey;
- assure respondents of anonymity and confidentiality;
- provide an estimated time for completion of the questionnaire;
- give clear and simple instructions;
- design individual questions in a clear and unambiguous manner;

- create a logical flow of questions and a professional layout;
- ensure that the questionnaire is short;
- include demographic factors at the end if possible;
- include a thank you to respondents for their time; and
- engage in pre-testing of the questionnaire.

Designing a questionnaire might seem easy, but questionnaires can be difficult to construct and administer. Improperly done, they can yield unusable data and a low response rate (Leedy & Ormrod 2016). It is therefore important to consider the guidelines when constructing a questionnaire.

The design of the questionnaire will vary, depending on the way in which it will be administered and the amount of contact envisaged between the respondent and the researcher. Questionnaires can be either self-administered (such as mail interviews and electronic interviews) or interviewer-administered (such as telephone interviews and personal interviews). With self-administered questionnaires, the questionnaire is sent to the respondents either by conventional mail (so-called 'snail mail') or electronically through the Internet, and completed by the respondent (Leedy & Ormrod 2016). Interview-administered questionnaires are completed during telephone interviews or during structured interviews in person, with the researcher asking the questions and capturing responses from the respondent (Leedy & Ormrod 2016).

This study made use of the self-administered questionnaire, using the Internet. This method was deemed cost-effective and had the added advantage of enabling a wide reach of respondents, across a huge geographical area. Email interviews were not used because of technological and software product limitations (Malhotra 2010). The research preferred to make use of an Internet/web questionnaire, allowing flexibility in the design and enabling up-to-date feedback. A disadvantage of this method is that the possibility exists of respondents completing the questionnaire more than once. This could create bias, and make statistical representativeness problematic (Malhotra 2010).

The advantages and disadvantages of questionnaires were discussed in section 4.2.3.1 and are summarised in Table 4-3.

Table 4-3 Advantages and disadvantages of questionnaires

Advantages	Disadvantages
Less expensive	Application limited
Greater anonymity	Low response rate
Greater coverage (geographical area)	Self-selecting bias
Easier processing	No clarification of questions possible
Simple to use	No spontaneous response
Data is reliable	Responses to questions might influence responses to other questions
Coding, analysis and interpretation are fairly easy.	Respondents could consult with others
	Response cannot be supplemented with additional information
	Structured questions might decrease the validity of certain types of data
	Wording of questions can be difficult

Source: Adapted from Kumar (2011) and Malhotra (2010)

4.2.5.2 Types of questions

The design of the individual questions in the questionnaire will depend on the information that is required for the research. For the purpose of this research, original questions were developed based on the literature review and formulated to reach the objective of the study. The questions were structured according to categories, each aimed at achieving a certain objective as summarised below:

- Energy targets: the first section of the questionnaire was aimed at determining the energy targets set by organisations and required by regulations.
- Energy management methods: the objective of this section was to determine the energy management methods used by organisations, and the effectiveness of these strategies, namely energy efficiency, energy conservation and renewable energy strategies.
- Management: the objective of this section was to evaluate the policy and regulatory requirements regarding energy management for organisations, and the effectiveness of the management strategies implemented.

- Risk management and finance: the objective here was to evaluate the finance required and reasons for the energy strategies selected, and to evaluate the risks to which organisations were exposed due to the energy strategies they implemented.

The form and wording of questions is extremely important as part of the research instrument, as the questions determine the quality of information gathered (Kumar 2011). Questions can take two forms: open-ended or close-ended. With open-ended questions, no response is suggested to the respondents (Kumar 2011). Open-ended questions invite respondents to answer in their own words in order to elicit ideas or feelings that might not have been considered by the researcher (DuPlooy-Cilliers *et al.* 2014). Some of the advantages and disadvantages of using open-ended questions are shown in Table 4-4.

Table 4-4 Advantages and disadvantages of open-ended questions

Advantages	**Disadvantages**
Provide more in-depth information	Analysis more difficult
Respondents can express themselves freely, providing more variety in the information	Some respondents might not be able to express themselves and information is lost
Eliminate investigator bias since respondents can express themselves freely	Increase interviewer bias

Source: DuPlooy-Cilliers *et al*. (2014).

Closed-ended questions, on the other hand, provide a fixed number of answers or options from which the respondent has to choose (DuPlooy-Cilliers *et al.* 2014). Respondents are required to tick the answer that best describes their responses. It is advisable always to include the category ‘other’ or ‘explain’ in order to accommodate responses that are not listed (Kumar 2011). The advantages and disadvantages of closed-ended questions, as indicated by DuPlooy-Cilliers *et al*. (2014), are summarised in Table 4-5.

Table 4-5 Advantages and disadvantages of closed-ended question

Advantages	Disadvantages
The options fit pre-designed categories, ensuring that the information needed is obtained	Information obtained lacks depth and variety
Responses are easier to analyse	Greater possibility of investigator bias as the researcher may list only the response pattern in which he or she is interested
	The response pattern of questions may influence the thinking of respondents, leading to information that does not reflect the respondents' opinions
	Ease of answering a ready-made list might create the possibility that the respondent will only tick the answer without thinking of the response

Source: Adapted from DuPlooy-Cilliers *et al*. (2014).

The questionnaire used in the present study consisted predominantly of closed-ended questions using a five-point Likert-type scale. A Likert-type scale gives the target population the option of choosing a favourable or unfavourable attitude towards a variety of statements (DuPlooy-Cilliers *et al.* 2014). A Likert-type scale also assumes that all items or statements in the questionnaire have equal importance or weight, and focusses on determining the attitude of the respondent participant towards the statement in question (Kumar 2011).

4.2.5.3 Pre-testing for validity and reliability

When a measuring instrument is used for the gathering of data it is important that the validity and reliability of the instrument be tested. Validity and reliability are usually ensured through large sample sizes, random sampling and a reliable research instrument (DuPlooy-Cilliers *et al*. 2014). Pre-testing (or piloting) of a questionnaire can be done on a small group of respondents to test whether they understand the questions, that the questions provide the kind of information that the researcher wishes to gather and that the structure and sequence of questions make sense (DuPlooy-Cilliers *et al.* 2014). The aim of pre-testing is to eliminate problems in the understanding of the questions, and to determine the appropriateness of the questions for yielding clear and unambiguous responses before the actual research is conducted (Kumar 2011). Erroneous data collection will result in erroneous findings and conclusions.

Kumar (2011) affirms the importance of pre-testing. Pre-testing assists in evaluating whether the questions included in the questionnaire are well understood by respondents. The purpose of the pre-test is not to gather data but to identify possible problems with the research instrument and to reveal additional information that may be required before the actual research is undertaken (Kumar 2011). This is confirmed by DuPlooy-Cilliers *et al*. (2014), who indicate that the main purpose of pre-testing is to reveal problems that might not have been foreseen when the questionnaire was designed. The data obtained from the pre-testing will not be used in the research, but only to determine and correct mistakes in the research instrument (DuPlooy-Cilliers *et al.* 2014).

The validity and reliability of the research instrument is an important part of the research process. Reliability and validity can be increased through large sample sizes, random sampling methods and a reliable research tool (DuPlooy-Cilliers *et al.* 2014). For the purpose of this research, the survey questionnaire was pre-tested in order to establish its validity and reliability.

a) Validity

Validity, according to Kumar (2011), is the accuracy with which the research process is conducted and the appropriateness of the information gathered. DuPlooy-Cilliers *et al*. (2014) and Leedy and Ormrod (2016) indicate that validity is determined based on whether the research instrument measures what it was intended to measure, in other words, whether or not the instrument chosen for the research actually reflects the reality of the different constructs being tested

Validity must first be evaluated in terms of internal and external validity. According to DuPlooy-Cilliers *et al*. (2014), internal validity is concerned with whether the research method chosen will answer the relevant research question. Leedy and Ormrod (2016) state that internal validity is the degree to which the data collected and the design used are able to yield accurate conclusions about the data. External validity, on the other hand, aims to generalise the findings to the larger population (DuPlooy-Cilliers *et al.* 2014). With external validity, the aim is to be able to apply the relevant results in situations outside the scope of the research study; in other words, to generalise to the greater population (Leedy & Ormrod 2016).

According to Leedy and Ormrod (2016), four distinctive validity categories can be made. These are face validity, content validity, criterion validity and construct validity:

- Face validity is the extent to which the specified research instrument appears to measure what is intended. This method of validity is useful in order to ensure participation from respondents, but because it is a very subjective method, it is not always the most dependable indicator of validity (Leedy & Ormrod 2016).
- Content validity refers to whether the instrument used measures what it was intended to measure, as evaluated by experts in the field (Creswell 2009; Kumar 2011). Content validity is established when the intended measurement instrument is a representative example of the content being evaluated (Leedy & Ormrod 2016).
- Criterion validity or predictive validity refers to the degree to which the instrument can predict the outcome, and how well the instrument correlates with other results (Creswell 2009; Kumar 2011). Criterion validity is established when the results from the measuring instruments correlate with another related measure (Leedy & Ormrod 2016).
- Construct validity refers to whether the items measure the constructs and concepts (Creswell 2009; Kumar 2011). This aspect of validity measures characteristics that are not directly observable but are presumed to exist in human behaviour (Leedy & Ormrod 2016).

The measuring instrument (in this case, the questionnaire) was concerned with the attitudes of respondents to the various energy risk management criteria that needed to be implemented in their organisations. For this reason, face and content validity were the most appropriate aspects of validity on which to focus. These aspects were tested (piloted) through a diagnostic questionnaire that was sent to academics and researchers in the field of risk management. Face validity was tested to see whether the research instrument appeared to measure what it was intended to measure, and content validity was tested to see whether the measuring instrument was representative of the content being evaluated.

The validity of a research instrument can vary considerably, depending on the purpose of the research, and this aspect is therefore specific to a situation (Leedy & Ormrod 2016). Validity is, however, not enough to determine the effectiveness and suitability of a questionnaire; the questionnaire also needs to be tested for reliability.

In this study, the draft questionnaire was pre-tested to determine the validity by means of a diagnostic questionnaire designed for this purpose. The diagnostic questionnaire is reflected in Annexure A, and will be discussed in more detail in the validity and reliability section below.

In order to develop and complete the questionnaire, the researcher attempted to establish face validity and content validity.

Face validity is concerned with the logical link between the questions or statements and the objective of the research (Kumar 2011). In the present study, face validity was obtained through the evaluation of the draft questionnaire by the researcher's academic supervisor. Feedback on the draft questionnaire was incorporated before the final questionnaire was distributed.

Content validity aims to determine whether the statements or questions measure what they are designed to measure (DuPlooy-Cilliers *et al.* 2014). In order to test the content validity of the questionnaire, an expert in the field, two academics and a statistician were required to evaluate and complete the diagnostic questionnaire.

Feedback from the pre-testing of the questionnaire relating to its content validity is presented in Table 4-6.

Table 4-6 Results from diagnostic questionnaire

Option	Strongly disagree	Disagree	No option	Agree	Strongly agree	Median	Average
	0%	0%	0%	40%	60%	5	4.6
Option	Strongly disagree	Disagree	No opinion	Agree	Strongly agree	Median	Average
	0%	0%	20%	80%	0%	4	3.8
Option	Strongly disagree	Disagree	No opinion	Agree	Strongly agree	Median	Average
	0%	0%	0%	60%	40%	4	4.4
Option	Strongly disagree	Disagree	No opinion	Agree	Strongly agree	Median	Average
	0%	20%	20%	40%	20%	4	3.6
Option	Strongly disagree	Disagree	No opinion	Agree	Strongly agree	Median	Average
	0%	20%	0%	20%	60%	5	4.2
Option	Strongly disagree	Disagree	No opinion	Agree	Strongly agree	Median	Average
	0%	0%	20%	40%	40%	4	4.2
Option	Strongly disagree	Disagree	No opinion	Agree	Strongly agree	Median	Average
	0%	0%	20%	40%	40%	4	4.2
Options							Response percentage
Yes							20%
No							80%
Option							Response percentage
0–5 minutes							0%
5–10 minutes							0%
10–15 minutes							100%
15–20 minutes							0%
More than 20 minutes							0%

The feedback in Table 4-6 can be summarised as follows:

- The objectives and aim of the questionnaire were clear, with a median score of 5 and an average of 4.6. All respondents answered the question; 40% agreed with the statement and 60% strongly agreed with the statement.
- The questions were comprehensive regarding risk criteria for the implementation of energy projects in organisations, with a median score of 4 and an average of 3.8. All respondents answered the question; 80% agreed with the statement and 20% had no opinion.
- Of the respondents, 60% agreed and 40% strongly agreed that the instructions on how to complete the questionnaire were clear. All respondents answered the question, with a median score of 4 and an average of 4.4.
- All respondents answered the question relating to the logical structure of the questionnaire, which obtained a median score of 4 and an average of 3.6. There were various opinions on the logical structure of the questionnaire, with 20% disagreeing, 20% having no opinion, 40% agreeing and 20% strongly agreeing. Changes were made to the final questionnaire in order to address the flow of questions.
- Of the respondents, 60% strongly agreed that the questions were easy to understand. All respondents answered the question, which obtained a median score of 5 and an average of 4.2.
- All respondents answered the question relating to the appropriateness of the scale of the questionnaire, which obtained a median score of 4 and an average of 4.2. Of the participant, 20% did not have an opinion, 40% agreed and 40% strongly agreed with the statement.
- Of the respondents, 40% strongly agreed that the questions covered issues that may affect risk management in an organisation, with 40% agreeing and 20% having no opinion. The median score was 4 and the average, 4.2.
- Of the respondents, 80% indicated that there was no question that ought to be added to the questionnaire, with 20% indicating that they would like to add one question that might add value to the research study.
- It took 11 to 15 minutes to complete the questionnaire.

- Some structural changes were suggested by one of the respondents.

Based on the feedback received from respondents during the pre-testing of the questionnaire regarding content validity, it can be concluded that the questionnaire was valid for the purposes of this study. The next section will consider the concept of reliability and the methods available to test the reliability of the research instrument.

b) Reliability

Reliability indicates whether the measuring instrument is consistent, stable, predictable and accurate when used in different situations and at different times (Creswell 2009; Kumar 2011). This is confirmed by DuPlooy-Cilliers *et al*. (2014), who indicate that reliability is linked to the findings of the research which must yield consistent results to be reliable. To establish reliability, the researcher needs to consider whether the same results would be obtained if the research was conducted by a different researcher, at a different time, using the same research instrument. The higher the stability and consistency of the instrument, the greater its reliability is. Another important aspect of reliability is generalisability. This is the extent to which the results from the research can be generalised to the entire population or yield the same results when repeated (DuPlooy-Cilliers *et al.* 2014).

According to Kumar (2011), there are two aspects which determine the reliability of a research instrument: external consistency and internal consistency. With external consistency, the data from two independent processes is compared in order to verify the reliability of the measuring instrument. External consistency can be measured by a test–retest, parallel forms of the same test, or by interrater reliability.

- The test–retest method is a commonly used tool to test the reliability of the research instrument. This test for reliability tests the extent to which the research instrument provides the same results for the same sample of people on different occasions (Leedy & Ormrod 2016). According to the test–retest method, the instrument is tested once and then again under the same conditions at a different time. The degree of similarity or ratio obtained between the test and retest scores will give an indication of the reliability of the research instrument. The greater the ratio, the higher the level of reliability. The equation can be indicated as follows:

$$\frac{\text{Test score}}{\text{Restest score}} = 1 \quad \text{or} \quad \text{Test score - retest score} = 0$$

A ratio of 1 will indicate 100% reliability between the test and retest scores, and any deviation from this will decrease the reliability of the instrument. If the test score minus the retest equals zero, there is no difference between the two tests and the instrument is reliable. As the difference between the two scores increases, the reliability decreases. The main advantage of this method is that the instrument is compared to itself, rather than to another instrument, which might create additional problems. The main disadvantage of this method is that respondents may recall their previous answers. One way to overcome this is to increase the time period between the test and retest of the research instrument.

- With parallel forms of the same test, two research instruments are developed in order to test the same concepts and administer them to two similar population groups. If the outcome is similar, it is assumed that the instrument is reliable. The advantage of this method is that it does not allow the possibility of recall of previous answers as with the test–retest method. The disadvantage is that two instruments need to be constructed in order to test the same concepts, which might be extremely difficult (Kumar 2011).
- Interrater reliability is established when two or more individuals evaluating the research instrument provide similar answers (Leedy & Ormrod 2016).

According to Kumar (2011), internal consistency, is established when similar results are obtained regardless of the sequence of items in an instrument. If items or questions are selected randomly out of the test-question pool, each segment of questions should yield more or less the same level of reliability. When using internal consistency as a reliability measure, the research instrument is administered once to a large, representative sample (Welman & Kruger 2001). The split-half technique is often used to test for internal consistency in the research instrument. Other methods are statistical procedures such as Cronbach's alpha coefficient and the Kuder–Richardson formula 20.

- The split-half technique is designed in order to correlate half the items with the other half, and is typically used when the attitudes of respondents are measured against an issue or phenomenon (Kumar 2011). The questions are divided in half, with questions that test the same concept appearing in different halves. The scores obtained from the two halves are correlated by means of the product-moment correlation and then, using the Spearman–Brown formula, the reliability of the entire instrument is tested (Kumar 2011). The higher the correlation between the two halves, the higher the internal consistency of the research instrument (Shukla 2008).
- Cronbach's alpha coefficient shows the degree to which the items in a research instrument measure the same attributes (Welman & Kruger 2001). In order to calculate Cronbach's alpha coefficient, the variance on the entire instrument and the variance on the individual items are both needed. With Cronbach's alpha, a value greater than 0.7 is considered acceptable for internal reliability (Shukla 2008).
- The Kuder–Richardson formula 20 is used for either–or responses such as 'yes/no' or 'true/false'.

Reliability in research is concerned with the findings of the research (DuPlooy-Cilliers *et al.* 2014). For the purpose of this research, internal consistency was used as a measure to test reliability. The research instrument was administered only once to the respondents, after which the data was tested for reliability, making use of Cronbach's alpha coefficient. Internal consistency aims to measure how consistently each item measures the same construct (DuPlooy-Cilliers *et al.* 2014). With this method, the performance of each item is correlated with the performance from all respondents (DuPlooy-Cilliers *et al.* 2014). Cronbach's alpha was used to test the correlation between the items in the questionnaire and the responses of all respondents. A questionnaire was developed to measure respondents' opinions of energy risk management within their organisations, with only the Likert-type scale items in the questionnaire being tested for reliability, not the biographical information also. The scale items consisted of 'don't know', 'to no degree', 'to some degree', 'to a moderate degree', 'to a degree' and 'to a strong degree'. Cronbach's alpha for these five items was 0.9651, which indicated a relatively high standard of internal consistency.

4.2.6 Stage 6: Processing and analysing the data gathered

Once the data has been obtained from respondents, the analysis and processing of the data may commence. The first stage in the data analysis process is to make sure that the data is free of inconsistencies and that the data is complete. This is known as "editing" (Kumar 2011). Editing involves evaluating the completed research instrument to identify errors, incompleteness, misclassifications or gaps (Kumar 2011). After it has been established that the data is clean, the next stage is to code the data. Coding focusses on the measuring scale used in the research instrument and the way the data is to be presented (Kumar 2011). The final stage is to process the data in a meaningful and understandable way, which is known as "data analysis".

Creswell (2009) indicates six steps that need to form part of the data analysis stage:

Step 1: Report on the number of responses from the questionnaire. This can be done in a table format with numbers and percentages.

Step 2: Discuss the method that will be used to determine response bias. Response bias can be defined as the effect that non-responses will have on the research results.

Step 3: Discuss the descriptive statistics, such as means, standard deviations (SDs) and ranges of scores.

Step 4: Determine reliability. This can be done by means of Cronbach's alpha.

Step 5: Discuss the inferential statistics used, such as the statistical programme, the rationale for using the statistics and the underlying assumptions.

Step 6: Present the results in tables and/or figures and interpret the results from the statistical tests.

4.2.6.1 Statistical analysis

Statistical analysis evaluates the data into meaningful findings and should be objective and defensible (DuPlooy-Cilliers *et al.* 2014), where 'objectivity' means that there is no bias and 'defensible' means that the results are statistically significant based on the conditions of the research (DuPlooy-Cilliers *et al.* 2014). Statistical analysis consists of gathering the data, analysing, interpreting, formatting and presenting it, and lastly, making projections and drawing conclusions regarding the data set (DuPlooy-Cilliers *et al.* 2014).

After considering various statistical methods and the advantages and disadvantages of each method, the researcher decided to apply the following statistics to the data obtained:

a) descriptive statistics – by means of percentage responses and frequency distributions; and
b) inferential statistics – by means of parametric measures, such as analysis of variance (ANOVA), Pearson's product moment correlation and regression.

a) Descriptive statistics

In order to understand the data, descriptive statistics can be used. Descriptive statistics summarise the results and allow for certain basic questions to be answered (DuPlooy-Cilliers *et al.* 2014). For the purpose of this research, percentage responses and frequency distributions were used in order to evaluate the descriptive statistics of each item in the questionnaire. The data is displayed by making use of bar charts and contingency tables.

- Percentage responses

The number of responses is indicated in percentage value. Percentages are a way to communicate findings effectively and accurately (Kumar 2011).

- Frequency distribution

The frequency distribution gives a visual indication of the distribution of the sample value and shows the number of times a particular data value occurs within the data set (DuPlooy-Cilliers *et al.* 2014).

- Bar chart or contingency tables

Bar charts of contingency tables can be sued to graphically represent data within the data set.

b) Inferential statistics

Inferential statistics allow the researcher to draw conclusions based on a large population by making use of a smaller sample (Leedy & Ormrod 2016). This research made use of parametric tests, including Pearson's product-moment correlation, ANOVA and regression analysis, by using the SPSS (Statistical Package for the Social Sciences) software program. The different inferential statistics that were used are discussed below, including the rationale and the underlying assumptions for these methods.

- Pearson's product-moment correlation

Correlation is used to establish whether a relationship exists between two values. In order to evaluate the strength of the relationship between variables in the present study, Pearson's product moment correlation was used. Pearson's correlation is a bivariate measure that is associated with the strength of the relationship between two variables. When the variables are continuous (as in a Likert-type scale) and the researcher wants to evaluate relationships between variables, Pearson's correlation is an appropriate statistic (Solutions 2013a). Pearson's correlation comprises assumptions that the data is approximately normally distributed, the variance of the two measures is similar (exhibits homoscedasticity), there is a linear relationship between the variables, the sample represents the population, and the variables are measured on an interval or ratio scale (Siegle 2015).

The value of the correlation coefficient (r_s) is between -1 and +1. The closer the value to -1 and +1, the stronger the correlation. A negative correlation (-1) indicates that when the independent variable increases, the dependant variable will decrease. With a positive correlation (+1), the independent variable increases as the dependent variable increases. Table 4-7 shows the interpretation of various correlation coefficients. The interpretation of the correlation coefficient becomes more certain as the number of elements in the data increases (DuPlooy-Cilliers *et al.* 2014).

Table 4-7 Interpretation of correlation coefficients

Value of correlation coefficient	Interpretation
From -1.0 to -0.8	Strong negative correlation The value of y is strongly related to the value of x with a negative slope
From -0.7 to -0.3	Weak negative correlation The value of y may be related to the value of x with a negative slope
From -0.2 to 0.3	No correlation There is no relationship between the variables
From 0.4 to 0.7	Weak positive correlation There may be a relation between the value of y and the value of x with a positive slope
From 0.8 to 1.0	Strong positive correlation The value of y strongly relates to the value of x with a positive slope

Source: Adapted from DuPlooy-Cilliers *et al*. (2014)

Field (2013) indicates that Cohen's standard of effect size for Pearson's correlation (*r*) can be explained as follows:

r = 0.10 to 0.29 (small effect); the effect explains only 1% of the total variance;

r = 0.30 to 0.49 (medium effect); the effects explains 9% of the total variance; and

r = 0.50 and larger (large effect); the effect explains 25% of the total variance.

- Analysis of variance (ANOVA)

The ANOVA procedure measures the differences among three or more means by comparing the variances within the group as well as across the group (Leedy & Ormrod 2016). Field (2013) defines ANOVA as the statistical procedure that makes use of the F-ratio to test the overall linear fit of the data to ascertain whether the means between the groups differ. ANOVA has variance assumptions, such as homogeneity of variances, which may be defined as equality in the variances, and normality, which means the variables are normally distributed (Field 2013).

- Regression analysis

Regression analysis according to Leedy and Ormrod (2016) indicates how accurately one or more variables enables predictions regarding the value of another variable. A single regression generates a regression equation that the single independent variable yields in predicting the dependent variable, whereas multiple regression generates an equation of two or more independent variables in predicting the dependent variable (Leedy & Ormrod 2016). This is confirmed by Field (2013), who says that single regression is a linear model where one variable predicts the outcome of another variable, and multiple regression is a model where an outcome is predicted by a linear combination of two or more predictor variables. The assumptions of multiple regression are linearity, homoscedasticity and multicollinearity (Solutions 2013b).

4.2.7 Stage 7: Reporting research findings and drawing conclusions

The final stage in the research analysis process is to report on the research findings and draw conclusions for the research study. This stage interprets the statistical results that were obtained, discussing the meaning and implications of the results in terms of the purpose of the research (Welman & Kruger 2001). This stage can start with a summary of the main findings, then it could indicate whether the researcher agrees or disagrees with the results based on a comparison with previous research, consider alternative interpretations by objectively evaluating the findings, and point out possible practical implications of the findings (Welman & Kruger 2001).

4.3 Summary and conclusion

In this chapter, the aspects of research design and methodology were discussed in some detail. The research process involves seven stages: formulating the research problem and objectives, choosing a research design, constructing the research instrument, selecting a sample, gathering the data, processing the data, and presenting the findings and conclusions. From the literature, it became apparent that there is a dearth of research on energy risk management strategies within financial organisations. Empirical research was therefore conducted to answer the problem statement and fulfil the research objectives.

Based on the research problem and objectives, a quantitative, non-experimental research design was followed. The quantitative research design method was chosen as the research aimed to identify relationships between variables in a precise, well-structured manner. A non-experimental design (survey design) was chosen because the research objective was to evaluate the attitudes and opinions of a sample of managers within the financial services sector on energy risk management issues in their organisations. The research design yielded quantitative and numerical values to describe the research problem and objectives. As the research covered the perceptions and opinions of respondents from a wide geographical area, it made use of a questionnaire sent via email to respondents. A non-probability sampling method was used, based on a set of criteria, namely that the respondents were in the financial services industry, were managers in their organisations and worked within the borders of South Africa. The research made use of descriptive and inferential statistics, namely percentages of responses, frequency distribution, Pearson correlation, analysis of variance and regression analysis.

The last stage of the research process is reporting on the findings, drawing conclusions and making recommendations regarding the topic and future studies. The next chapter will report on the analysis and interpretation of the data by making use of statistical analysis.

CHAPTER 5 ANALYSIS AND INTERPRETATION OF THE DATA

5.1 Introduction

The purpose of this research was to investigate the criteria required for the implementation of a structured approach to energy risk management in financial services organisations. Out of a total of 144, 78 respondents completed and returned the questionnaires, giving a response rate of 54%. Table 5-1 shows the response rate in numbers and percentages.

Table 5-1 Response rate

	Number	Percentage
Response	78	54%
Non-response	66	46%

In the next section, the results of the questionnaire are presented, and the statistical analysis procedure discussed.

5.2 Discussion of descriptive statistics

The research, as discussed in Chapter 4, made use of percentage responses, frequency distributions and bar or pie charts. Section 5.2.1 presents the demographic information, followed by the results for the various categories of information that was investigated, i.e. energy strategy, energy conservation, energy efficiency, renewable energy strategies, management, finance and risk management.

5.2.1 Demographic information

The first question assessed the number of people employed by the organisations under study. To improve analysis and interpretation, the number of people employed by the organisation was recorded in three categories: fewer than 100; between 101 and 1 000 and more than 1 000 employees. According to responses, 29.5% of respondents were employed in an organisation that had more than 1 000 employees; 47.4% were employed in an organisation of fewer than 100 employees and 20.6% were employed at organisations that had between 101 and 1 000 employees, as indicated in Figure 5-1.

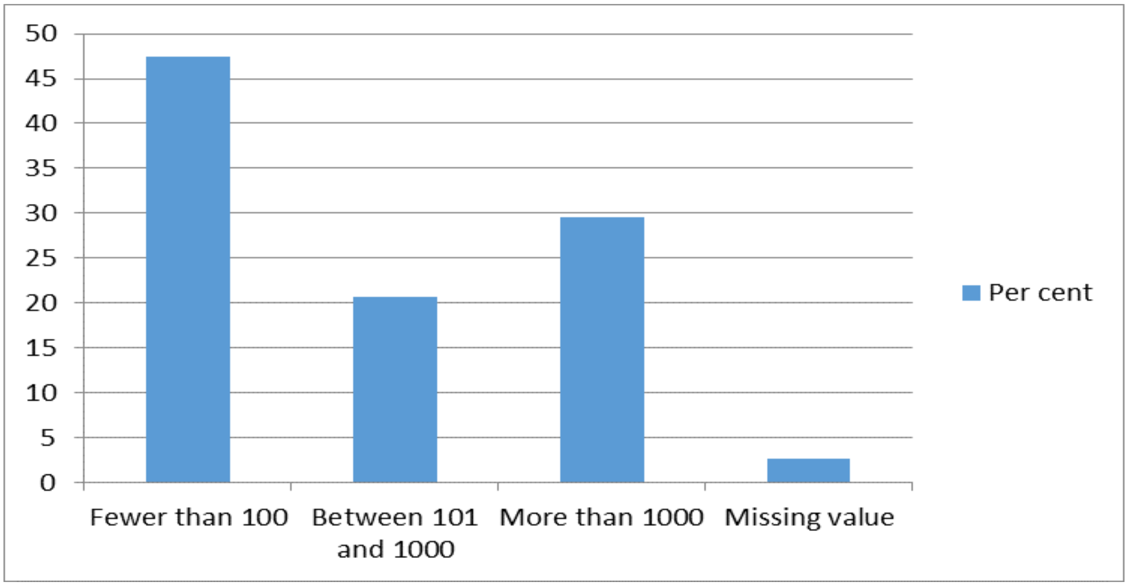


Figure 5-1 Estimated number of people employed by organisations

The second question determined the province where the organisation was located. Most were located in the Gauteng (67.9%), with 15.4% in the Western Cape. The other provinces had very few respondents, with below 4% for each other province, as indicated in Table 5-2.

Table 5-2 Geographic location of organisations

	N	Percentage (%)
Gauteng	53	67.9
Western Cape	12	15.4
Mpumalanga	3	3.8
KwaZulu-Natal	3	3.8
Free State	2	2.6
North West	1	1.3
Eastern Cape	1	1.3
Northern Cape	1	1.3
Missing	2	2.6
Total	78	100

Question 3 identified the various industries within the financial services sector. Figure 5-2 indicates the industry within which the respondents worked. According to data obtained from the research, 28.2% were in the banking industry, 32.1% in insurance, 12.8% in investments and 10.3% in asset management. A further 16.7% indicated other industries, such as financial consulting, government, non-profit organisations, research and overall financial services.

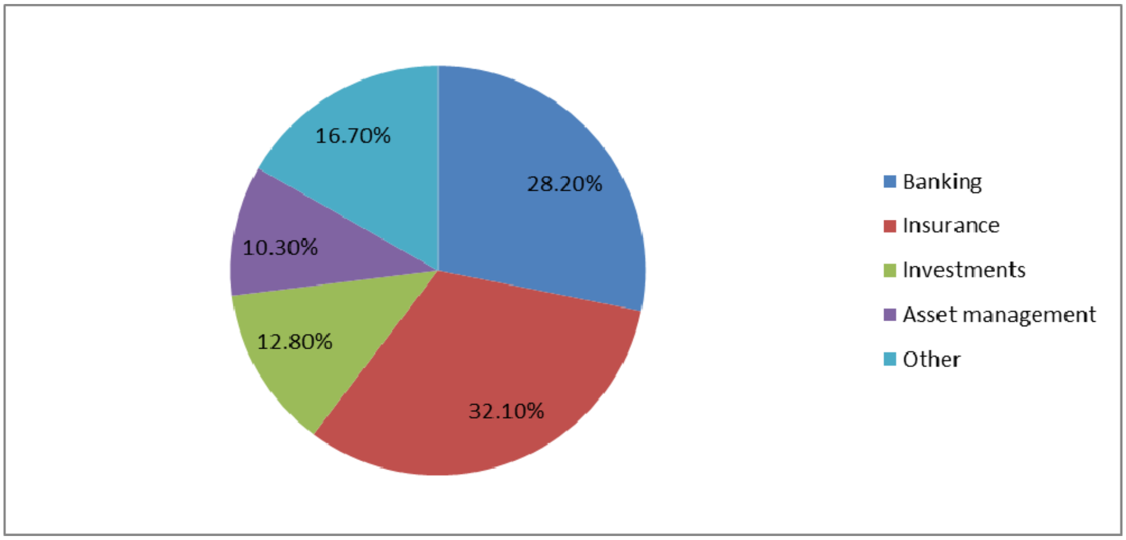


Figure 5-2 Industry within financial services sector

Question 4 identified the position of the participant within the organisation. From the responses, 2.6% indicated that they were energy managers, 11.5% were risk managers and 26.7% were financial managers. Most of the respondents (59%) indicated that they were business managers, such as managers in marketing, information technology (IT), procurement, enterprise development, development director, general manager, management, deal maker, estate manager, business performance manager, facilities manager, or chief executive officer (CEO) of financial institutions. Lastly, 7.7% indicated that they were in research or administration within the financial services sector. According to the data, only 40.8% of the respondents were in the financial, energy or risk management field, meaning that they were directly involved in the setting of risk and energy strategies. The remainder of the respondents were involved in various other aspects of management. Their inputs would be required in order to establish a comprehensive picture of companies' energy risk management strategies. Table 5-3 shows the positions of respondents within their organisations.

Table 5-3 Positions of respondents within their organisations

	N	**Percentage (%)**
Energy manager	2	2.6
Risk manager	9	11.5
Financial manager	13	16.7
Business manager	46	59
Other	6	7.7
Total	78	100

The next question investigated the extent to which the respondents were involved in energy management within their organisations. The responses indicated that 46.2% were not involved in energy management, while 56.4% were involved in energy management. Of the 56.4% involved in energy management, 16.7% indicated that they had some degree of involvement, 12.8% had a moderate degree of involvement, 11.5% had a strong degree of involvement and 12.8% had a very strong degree of involvement, as seen in Table 5-4.

Table 5-4 Involvement in energy management within organisation

	N	**Percentage (%)**
No degree	36	46.2
Some degree	13	16.7
Moderate degree	10	12.8
Strong degree	9	11.5
Very strong degree	10	12.8
Total	78	100

Question 6 showed the number of years of experience that respondents had had in energy management within their organisations. The responses showed that 57.7% had had less than one year's experience in energy management, with 21.8% having had between 1 and 5 years' experience, 12.8% having had between 6 and

10 years' experience and only 5.1% of respondents having had more than 10 years' experience in energy management, as indicated in Figure 5-3.

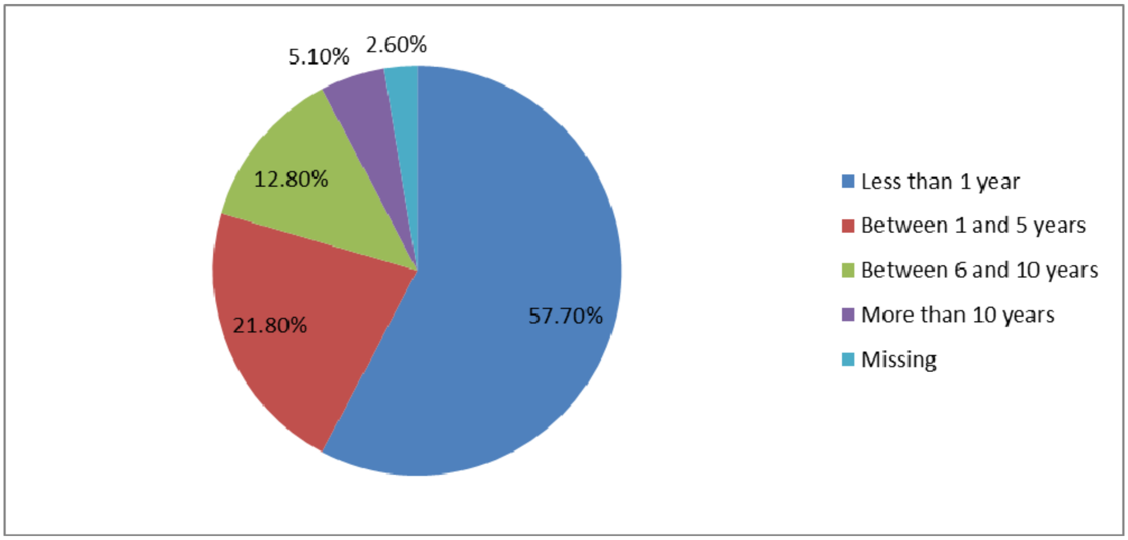


Figure 5-3 Years' experience in energy management

The next section will look at the overall energy strategy of the organisations.

5.2.2 Energy strategy

Energy costs have an effect on the operating costs of the organisation. The first question aimed to identify the energy cost of the organisation as a percentage of its operating cost. To improve analysis and interpretation, the data was recorded into three categories: Don't know, less than 10% and more than 10%. Most of the respondents (47.4%) indicated that the energy cost of their organisation as a percentage of operating cost was less than 10%, and only 16.7% indicated that the cost was more than 10%. From the respondents, 35.9% indicated that they did not know the percentage for their organisation, as indicated in Figure 5-4. One reason for the lack of knowledge on the energy costs of the organisation might be that only 40.8% were within the finance, energy and risk management section, with the rest not directly involved in the finances of the organisation.

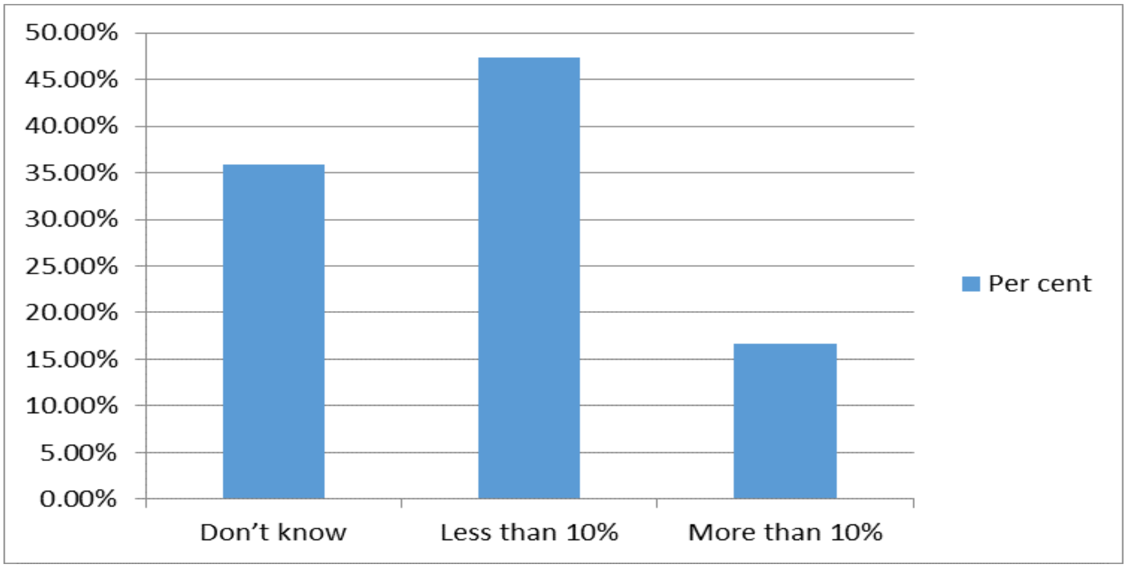


Figure 5-4 Energy cost of the organisation as percentage of operating cost

The next question assessed respondents' understanding of the energy-saving targets of their organisations as a percentage of their energy cost. From the respondents, 43.6% were not aware of the energy-saving targets of their organisations. Another 21.8% indicated that it was between 0 and 3%, with 19.2% indicating it was between 3 and 6%, 3.8% between 6 and 9%, and 11.5%, more than 9%, as illustrated in Table 5-5. The literature (see section 1.2.2) showed that some of the factors that influence the investment in energy projects include the striving to reach GHG emission targets and to decrease the dependency on fossil fuel (Watts 2011). Organisations also need to set targets and objectives in order to improve organisational processes and procedures, as was discussed in section 2.1. The NEES has set overall targets for the economy as well as individual targets per sector. For commercial and public buildings, NEES has set an energy reduction target of 15%. In 2012, there was only a 0.3% improvement in the performance of this sector (see section 2.4.5). According to the data, 43.6% indicated that they were not aware of the energy targets of their organisations. This might be due to a lack of communication to all stakeholders.

Table 5-5 Energy-saving target as a percentage of operating cost

	N	Percentage (%)
Don't know	34	43.6
Between 0 and 3%	17	21.8
Between 3 and 6%	15	19.2
Between 6 and 9%	3	3.8
More than 9%	9	11.5
Total	78	100

According to the literature (see section 2.5.1), organisations usually set a time period in which to reach their energy target. Government needs to implement realistic targets in terms of energy efficiency and renewable energy projects. Organisations also need to set their own targets and objectives in terms of their energy projects, including time period required to reach the target. To improve analysis and interpretation, the data was recorded in three categories: between 1 and 3 years; between 4 and 6 years and more than 7 years. According to data obtained from the research, 65.4% of the respondents indicated that their organisation had short-term energy-saving targets of between 1 and 3 years, 24.4% had medium-term energy-saving targets of between 4 and 6 years, and 10.2% had long-term energy-saving targets of more than 7 years, as indicated in Figure 5-5.

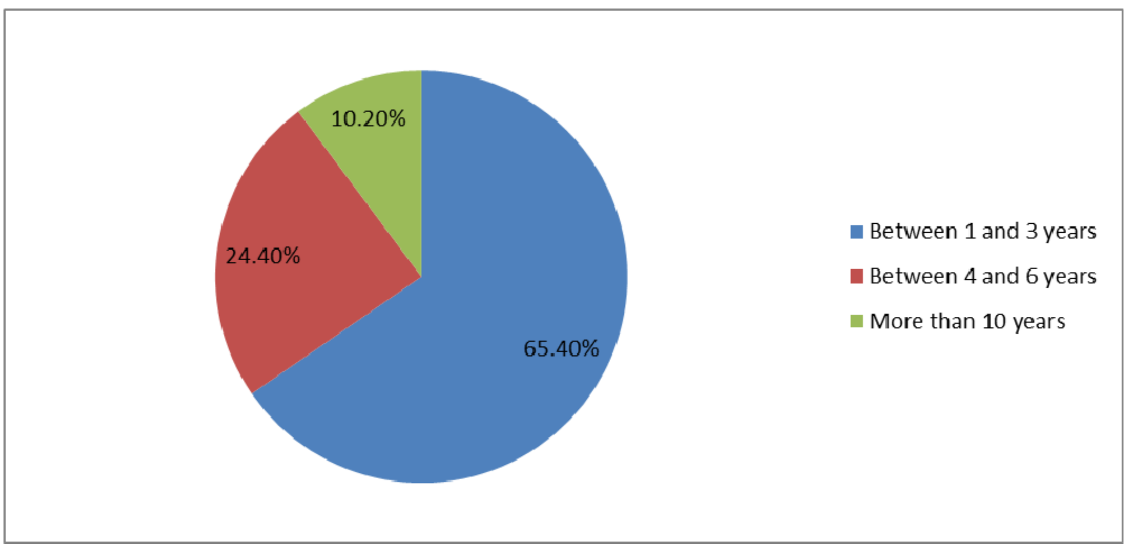


Figure 5-5 Number of years to reach energy-saving targets

The next section assessed the energy strategies of organisations. Respondents were requested to rate different questions in terms of the degree to which each applied to the energy strategy of their organisation.

The first question requested respondents to indicate their opinion regarding the role that energy risk management strategies played within the overall business strategy of their organisation. Of the respondents, 11.6% indicated that they did not know, with 14.1% indicating that energy risk management strategies played no role at all. Another 30.8% indicated that there was some degree of importance, with 10.3%, a moderate degree, 21.8%, a degree and 11.5%, a strong degree of importance within the overall strategy, as seen in Figure 5-6.

In section 5.2.1, it was discussed that organisations are unable to control the per unit energy cost, government policies or the global economy, and that organisations can therefore improve the management of energy by implementing an energy management strategy (ISO50001). Energy management is a focal point of organisational strategy in order to decrease energy costs and GHG emissions. Most of the respondents (74.4%) indicated that energy risk management did form part of their overall business strategy. According to the data, it was evident that organisations see energy risk management as an important part of the business strategy.

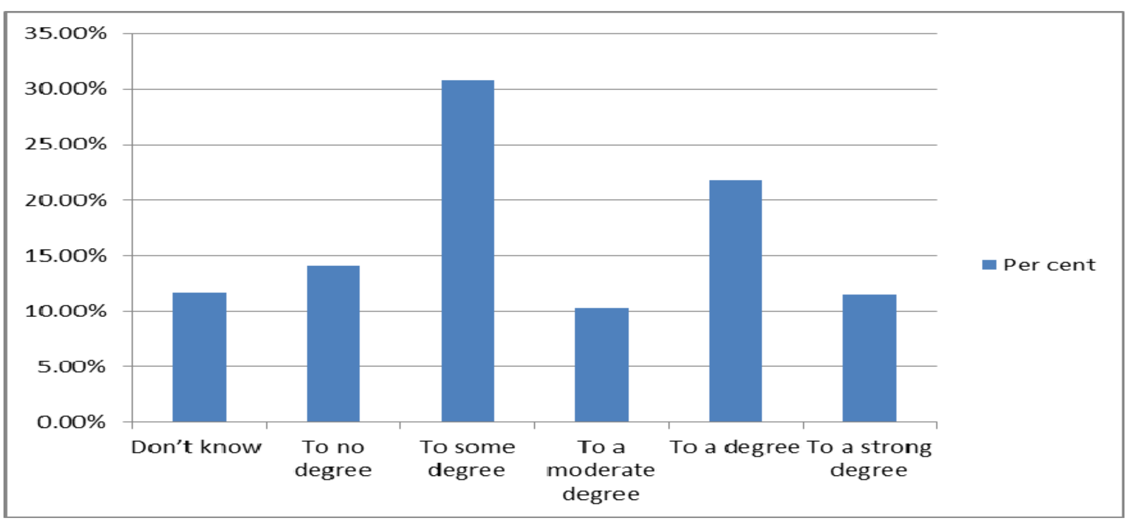


Figure 5-6 Degree of importance of energy risk management strategies in the overall business strategy

The second question evaluated whether the increase in CSR had an influence on the implementation of energy management strategies within the organisation. Of the respondents, 7.7% indicated that they did not know, with 23.1% indicating that the increase in CSR did not influence their organisation to implement energy management strategies. From the literature, it was evident that the implementation of energy strategies assists organisations in enhancing their CSR (see section 2.2.3). CSR was defined by Davidson *et al.* (2006) as the commitment of organisations to make a positive contribution to environmental conservation. The implementation of energy strategies would not only have a positive influence on the CRS but also on the reputation of the organisation (see section 2.2.3.1). Of the respondents, 69.2% indicated that an increase in CSR did have an influence on the energy management strategies of their organisation. Of the 69.2%, 16.7% indicated that this had some degree of influence, 19.2% indicated a moderate degree of influence, 20.5% indicated a degree of influence and only 12.8% indicated that the increase in CSR had a strong degree of influence on the decision by their organisation to implement energy management strategies, as seen in Figure 5-7.

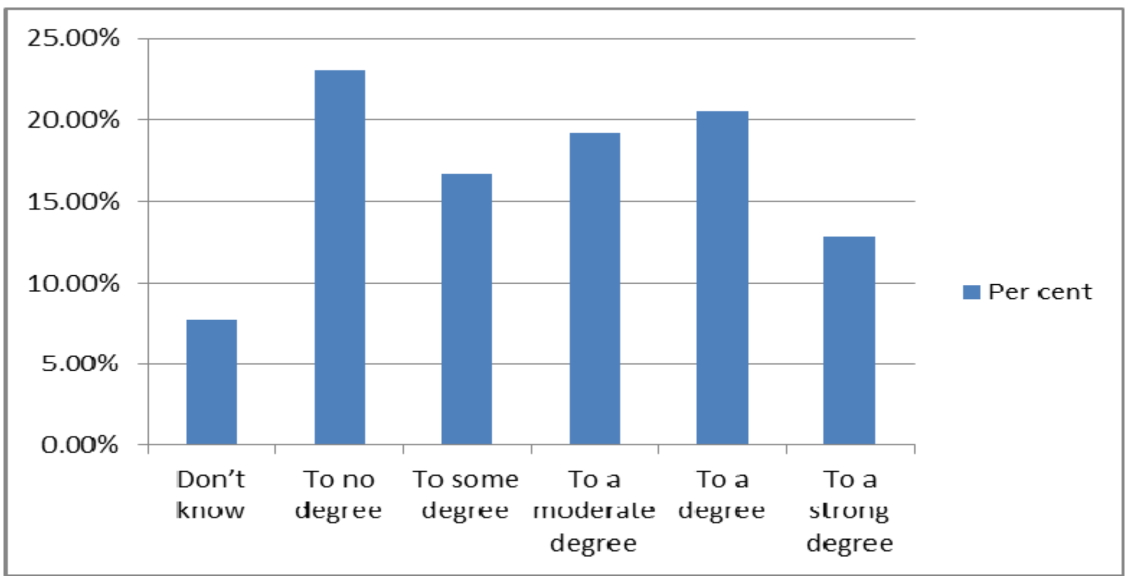


Figure 5-7 Degree of influence of CSR on the implementation of energy management strategies in the organisation

The third question asked respondents to indicate whether they thought that limited knowledge and awareness of energy management strategies had an influence on whether or not their organisation implemented these strategies. The literature indicated that a lack of knowledge and understanding of energy strategies was one of the key barriers for the implementation of these strategies (see section 2.2). In section 2.2.3, it is shown that the literature also highlights not only limited knowledge but also a lack of education and awareness as a barrier to energy strategy implementation. The government, through NEES, aims to support organisations to take advantage of energy opportunities by promoting knowledge sharing and best practice (see section 2.4.5). According to the data, it was evident that limited knowledge and awareness does have an influence on organisations in terms of the implementation of energy strategies. This is evident from the 70.8% who indicated 'some' to 'a strong degree' of agreement with this statement. Of the 70.8% who agreed with the statement, 20.5% indicated that it had some influence on the implementation, 16.7% indicated that it had a moderate influence, 17.9% indicated a degree of influence, while 15.4% indicated that limited knowledge and awareness had a strong influence. Only 17.9% indicated that lack of knowledge and awareness had no influence on the decision by the organisation to implement energy strategies and 11.3% indicated that they did not know whether it had an influence, as indicated in Figure 5-8.

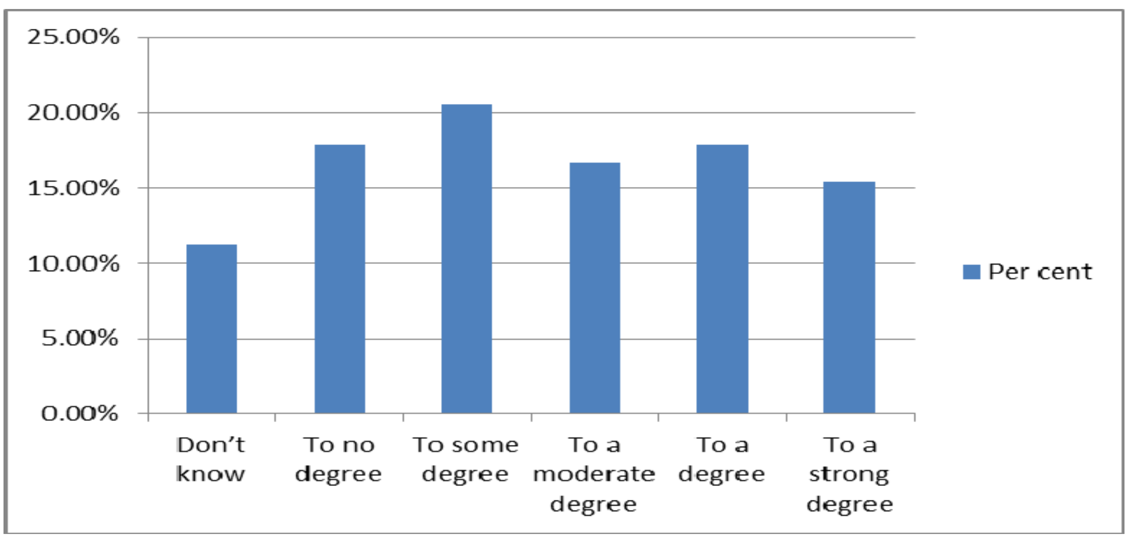


Figure 5-8 Influence of limited knowledge and awareness on the implementation of energy management strategies

According to the data, it is clear that most respondents indicated that limited knowledge and awareness had an effect on the implementation of energy strategies within the organisation. This confirms the assertion by Winkler and Van Es (2007), Harnisch (2009) and Pegels (2010) that one of the barriers for implementing energy efficiency methods is a lack of knowledge and understanding. In order to overcome this barrier, organisations need to investigate the various alternative energy methods to find a suitable solution for their organisations, as well as to provide training and awareness campaigns to their employers.

The fourth question on energy strategy asked respondents to indicate to which degree their organisations implemented an energy risk management strategy. Energy risk management is defined as the process of identifying, evaluating and measuring energy strategies (such as energy efficiency, conservation and renewable energy) to improve the energy performance of an organisation (see section 3.3). With the increases in marketable energy and costs of energy, it is important for organisations to implement an energy risk management strategy (see section 1.1). According to the data, it is clear that 11.3% indicated that they did not know, with 28.2% indicating that their organisation did not have an energy risk management strategy. However, 16.7% indicated that there was some degree of energy risk management strategy, 9.0% indicated a moderate degree of energy risk management strategy, 20.5% indicated a degree, and 14.1% indicated a strong degree of energy risk management strategy, as indicated in Figure 5-9. It is encouraging to see that 60.5% of respondents indicated that their organisation implemented an energy risk strategy to some degree.

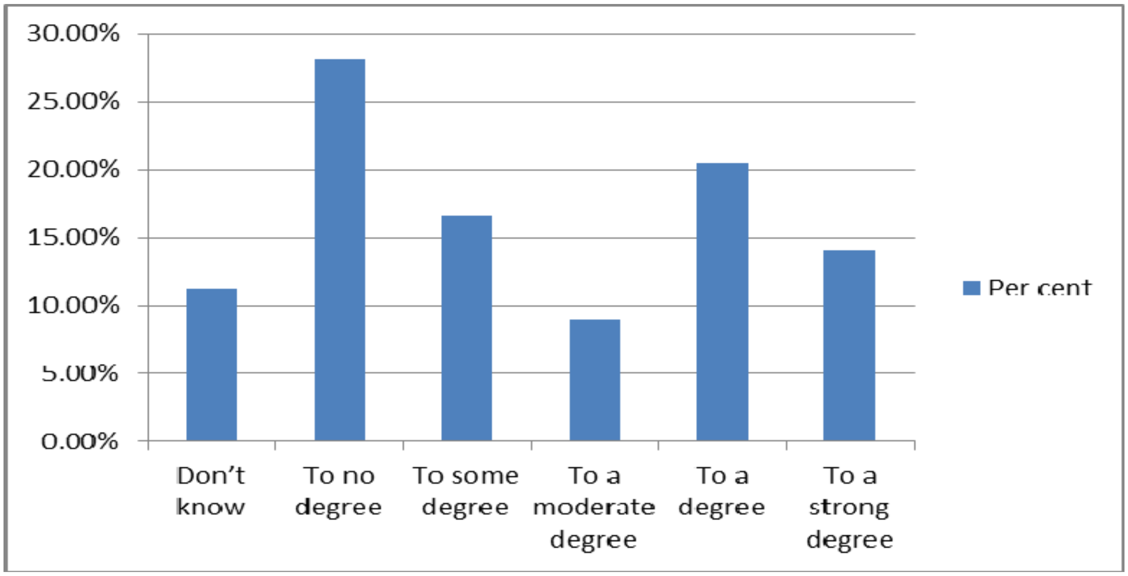


Figure 5-9 Implementation of energy risk management strategy

The last question in the energy strategy section asked respondents to indicate to which degree their top management had a commitment to energy management strategies. From the literature (see section 2.1), it was evident that with increased interest in running green businesses worldwide, top management have realised that sustainable environmental issues need to form part of their overall organisational strategy (Esty & Simmons 2011). The energy policy is set by top management in order to show their commitment towards the improvement of energy performance (see section 2.5.1). It is the responsibility of top management to develop, implement and communicate to all stakeholders the energy management statement in order to improve management strategies (see section 2.5.1). It is also the responsibility of management to acknowledge that energy management forms a core part of organisational strategy (Energy Star 2005a). As seen in Figure 5-10, 24.4% of respondents indicated that their top management had a strong degree of commitment towards energy management strategies, with 12.8% indicating a degree, 14.1%, a moderate degree and 21.8%, some degree of commitment. of the respondents, 14.1% indicated that their top management had no degree of commitment towards energy management strategies and 12.8% said that they did not know.

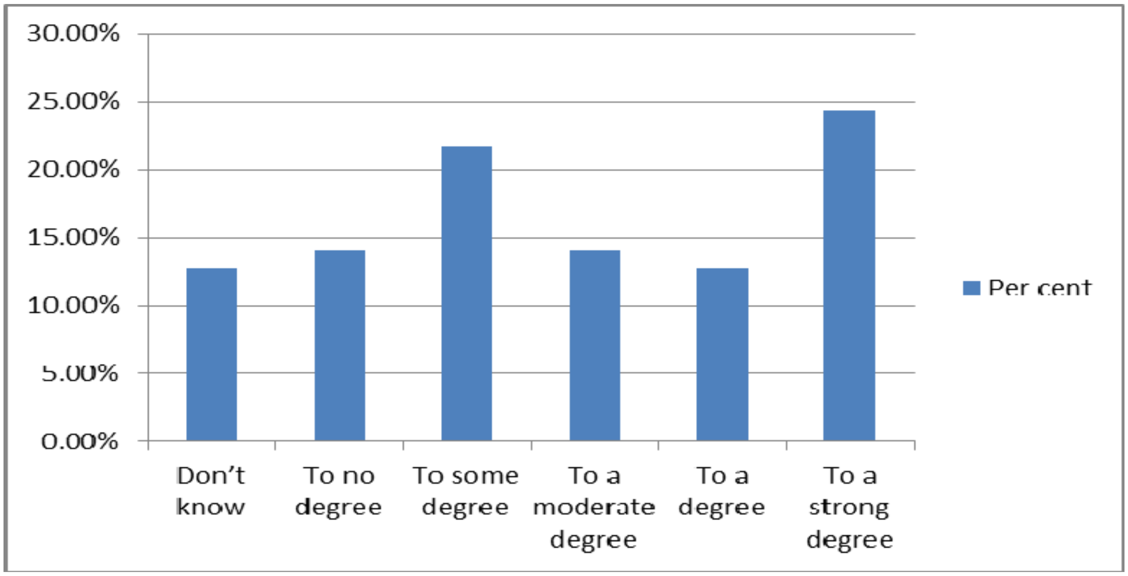


Figure 5-10 Top management's commitment towards energy management strategies

From the demographic information, it was clear that many respondents were not part of the finance department of their organisation and might therefore not have been aware of energy costs or targets. Their lack of knowledge may indicate a lack of communication of an existing strategy to all sections within the organisation.

Energy strategy forms an important part of organisational strategy as was evident from the literature. Looking at responses to the questions in the section on energy management strategy and focussing on the number of 'some' to 'a strong degree' responses, the researcher was able to rank the issues that affect implementation in order of importance:

- making energy risk management part of the overall business strategy;
- top management's commitment to energy management strategies;
- lack of knowledge, awareness and education;
- increasing the CSR; and
- implementing the energy risk management strategy.

According to the data, it was evident that 74.4% of respondents indicated that energy risk management played a role in the overall business strategy of their organisation. This is in line with the literature, which indicated that energy management has become a focal point in organisational strategy in order to decrease energy costs and GHG emissions. Although organisations are unable to control energy costs, policy changes or the economy, they can improve the management of energy within their organisations by implementing sound energy management strategies.

Top management's commitment is the second most important factor in the energy strategy, with 73.1% of respondents indicating that top management in their organisations were committed to energy management strategies and 24.4% indicating that top management had a strong degree of commitment. This is in line with literature, which indicated that top management should realise that sustainable issues need to form part of overall organisational strategy and that energy management strategy should form a core part of organisational strategy.

Limited knowledge and awareness comprised the third factor, with 70.8% of respondents indicating that this had an influence on the implementation of energy strategies in their organisations. This was also evident from the literature, which indicated that the key barriers for implementation are a lack of knowledge, awareness and education. The SA government aims to promote knowledge sharing and best practice through NEES.

The second last factor was influence of CSR on energy strategies, with 69.2% of respondents indicating that CSR had an influence on the implementation of energy strategies within their organisation. This is in line with the literature, which indicated that organisations could increase their CSR by implementing energy strategies. Through CSR, organisations could show their positive contribution to environmental conservation and enhance their reputation with the public.

The last factor was whether or not the organisation implemented an energy management strategy, with 60.5% of respondents indicating that their organisation did implement an energy risk management strategy. This is supported by the literature, which indicated the importance of the energy risk management strategy due to increases in marketable energy and costs of energy. An energy risk management strategy is an important part of the organisation in order to improve its energy performance, and it is noteworthy that 60.5% of companies in the financial sector recognised this.

The next two sections of the questionnaire examined the various energy management strategies that were being implemented, namely energy conservation and efficiency, and renewable energy. These were evaluated regarding effectiveness and the degree to which they were communicated throughout the organisation.

5.2.3 Energy efficiency and conservation methods

This section aims to report on an assessment of the different energy efficiency and conservation methods that organisations were implementing at the time of this study in order to decrease their operating costs. This section will also indicate whether respondents agreed that these strategies were effective and communicated well within the organisation.

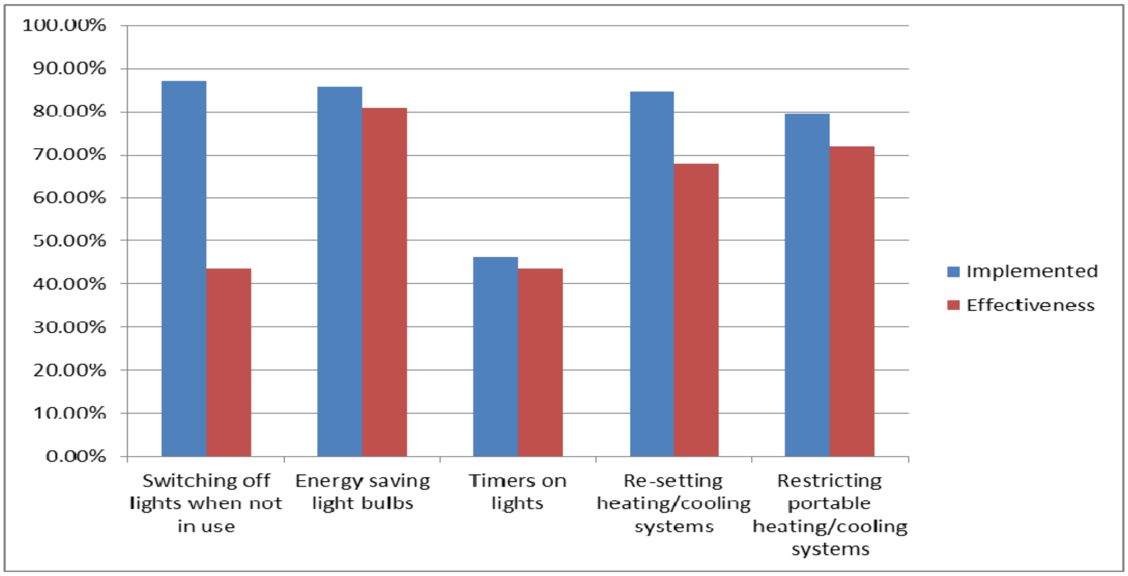


Figure 5-11 Implementation and effectiveness of energy conservation and efficiency strategies

According to Figure 5-11, it can be seen that most organisations switched off lights when not in use (87.2%), used energy-saving light bulbs (85.9%), re-set the central heating and cooling systems (84.6%), and restricted employees' use of portable heating and cooling systems (79.5%). Only 46.2% of the organisations made use of timers on lights as part of their energy efficiency and conservation strategies. This might be due to a lack of awareness of this strategy or its cost implications. It can be deduced that the respondents viewed energy-saving light bulbs (80.8%), resetting heating and cooling systems (68%) and restricting portable heating and cooling systems (71.8%) as the most effective energy strategies, as these were the most implemented. Although 87.2% of the respondents indicated that their companies implemented switching off of lights when not in use as an energy strategy, only 43.6% were of the opinion that this was an effective strategy. The reason might be due to a lack of communication or a resistance to change on the part of the employees of these organisations. From the responses, it could be concluded that energy efficiency and conservation strategies formed part of the overall organisational strategy for most of the participating organisations.

The section also reports on an investigation into whether the energy strategies were communicated to employees and whether this had an influence on decreasing the energy costs of the organisation. Communication is an important part of any process within the organisation and should be done on a continuous basis. According to the data, it is clear that 9.0% of the respondents indicated that they did not know, and 19.2% indicated that the energy strategy was not communicated. Of the 71.8% who indicated that there was communication of the strategy, 23.1% indicated that there was some degree of communication and 21.8% indicated a degree. Only 14.1% indicated a strong agreement that the energy efficiency and conservation strategies were communicated to the organisation, as indicated in Figure 5-12.

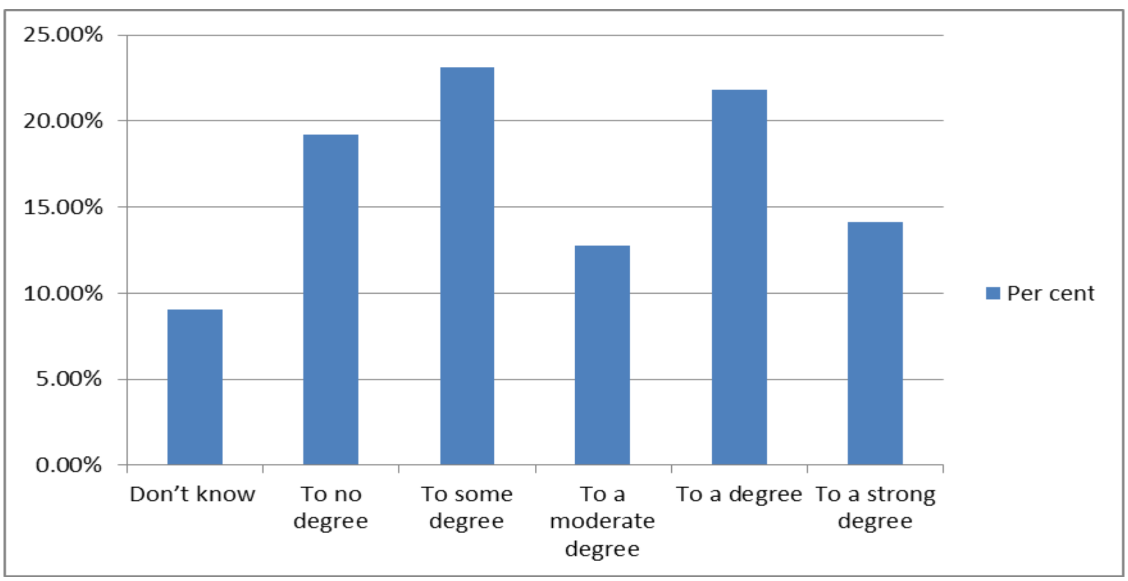


Figure 5-12 Communication of energy conservation and efficiency strategies

Energy efficiency is seen as a low-cost solution to the energy costs of an organisation (TWN Wind Power 2013). The implementation of energy efficiency and conservation strategies could assist organisations to decrease their overall energy costs (see section 2.2). ISO50001 was introduced in 2012 in order to assist organisations in the implementation of energy strategies to decrease energy costs, and decreasing energy costs was identified as a key objective for the IEP (see section 2.4.4). Most respondents indicated that the implementation of energy efficiency and conservation strategies resulted in decreasing energy costs in the organisation. Of the respondents, 44.9% indicated that there was some degree (23.1%) or a moderate (21.8%) degree of reduction, with 34.6% indicating that there was a strong degree of reduction. Only 20.5% indicated that, in their opinion, energy efficiency and conservation strategies had no influence on the cost, or that they did not know what the influence was, as indicated in Figure 5-13.

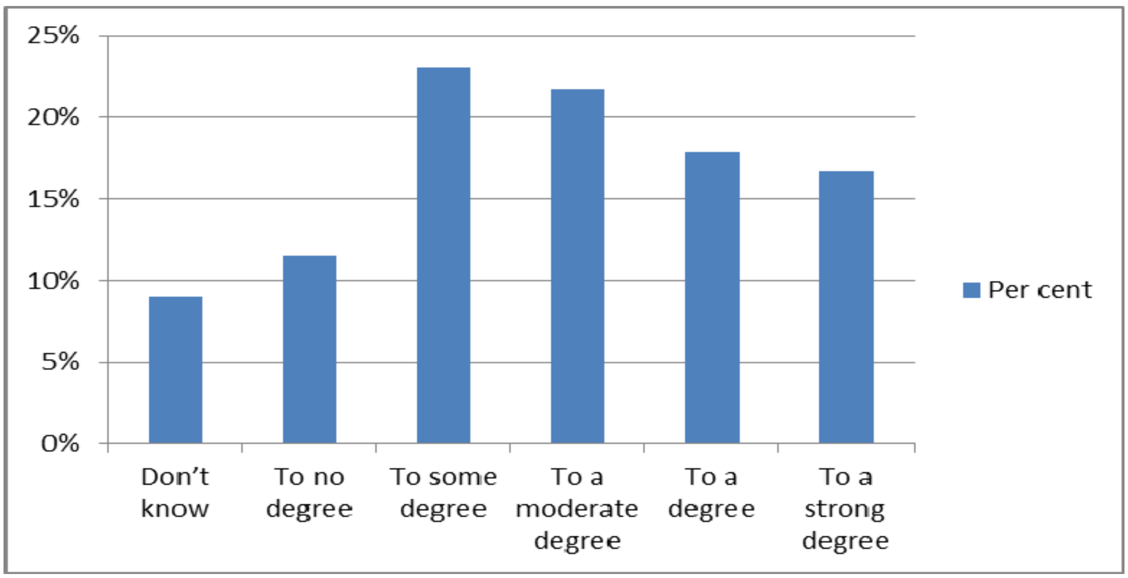


Figure 5-13 Reduction in energy cost through implementation of energy conservation and efficiency strategies

Most respondents indicated that their organisation implemented various energy conservation and efficiency strategies, and most of these were seen as being effective. According to the data, setting timers on lights as a strategy was implemented by less than 50% of the organisations, which may be due to costs or a lack of knowledge. Although more than 80% of the respondents indicated that they implemented the switching off of lights when not in use, half of these respondents indicated that this was not effective. This might be due to a lack of understanding or a resistance to change.

Although most respondents (71.8%) indicated that there was some form of communication on the various energy strategies, communication can usually be improved within organisations by awareness campaigns and training of staff on the benefits of the various strategies. With 79.5% of respondents indicating that the implementation of energy efficiency and conservation methods had a positive effect on energy costs, it is clear these strategies do assist to reduce costs. This is in line with the literature, which points very clearly to decreased costs as an immediate benefit of energy strategies.

The next part of the questionnaire looked at the implementation of renewable energy sources as part of the energy strategy, and whether these methods were effective and well communicated.

5.2.4 Renewable energy methods

This section reports on an evaluation of renewable energy sources used by organisations, their effectiveness and their communication within the overall organisation strategy.

According to the data, it was evident that most organisations (65.3%) did not make use of renewable energy sources as part of their energy strategy. Reasons are likely to be the costs associated with renewable energy sources, and also a lack of knowledge and awareness of the strategies and finance available (see section 2.2.3). Of the respondents, 24.4% indicated that they implemented solar energy, 6.4% implemented wind energy, and 3.9% made some use of biomass. According to the data, it could be deduced that most of the respondents who indicated that they made use of solar energy were of the opinion that this was an effective strategy (21.8%). With regard to wind and biomass, more respondents (15.4%) indicated that these were effective strategies than the percentage that were actually implementing them (10.3%). Only 9% believed that wind turbines were effective and 6.4% believed that biomass was effective, with a mere 5% and 3% respectively who had implemented these. Use of renewable energy sources is shown in Figure 5-14.

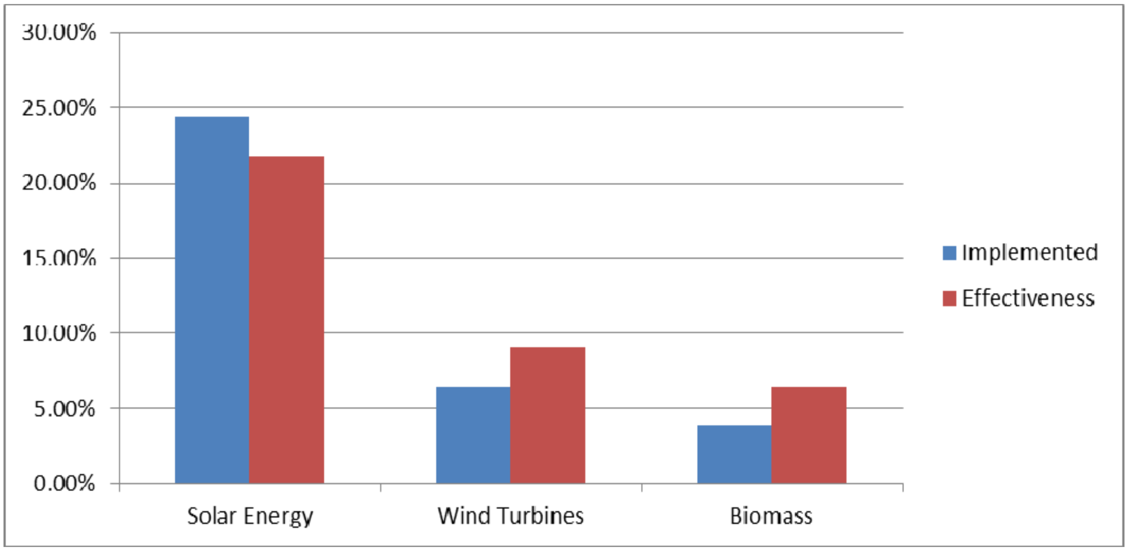


Figure 5-14 Renewable energy implementation and effectiveness

The research further investigated whether the renewable energy strategies were communicated to employees and whether this had an influence on the energy costs of the organisation. Communication forms an important part of the overall business strategy and should be done on a continuous basis. According to data obtained from the research, 11.5% indicated that they did not know, with 33.3% indicating that the renewable energy strategy was not communicated. Management could implement training and education through awareness campaigns in order to increase communication within organisations. Of the 55.1% that indicated that communication was done within their organisations, 25.6% indicated that there was only some communication, with 12.8% indicating a strong agreement that the renewable energy strategy was communicated, as indicated in Figure 5-15.

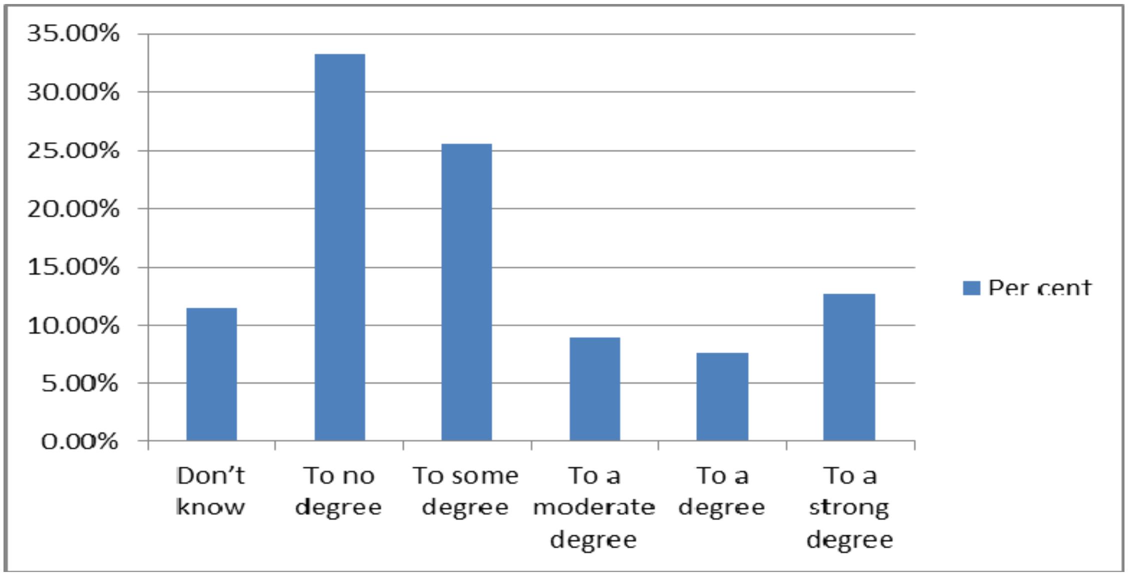


Figure 5-15 Communication of renewable energy strategies

Although the implementation costs of renewable energy strategies are still relatively high, the implementation of these strategies could assist organisations in decreasing their energy costs. About half the respondents (49.9%) indicated that the implementation of renewable energy strategies had the effect of decreasing energy costs in their organisation. The other 50.1% of respondents indicated that they either did not know (12%) or that there was no reduction (38.5%) in cost. Of those who indicated that the implementation had an effect on the energy costs, 21.8% indicated that it was to some degree, 11.5% indicated that it was to a moderate degree, and 5.1% and 11.5% indicated that it was to a degree or to a strong degree respectively, as indicated in Figure 5-16.

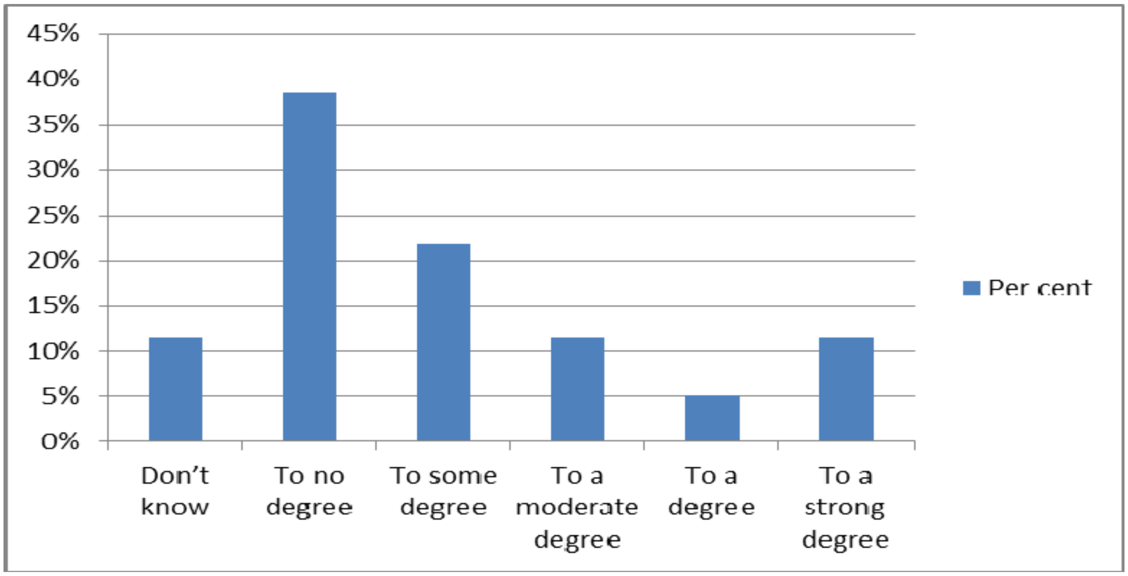


Figure 5-16 Reduction in energy costs through the implementation of renewable energy strategies

Most respondents (65.3%) indicated that they did not make use of renewable energy within their overall energy strategy. This might be due to a lack of knowledge, awareness and education, the cost of implementation or insufficient incentives and finance. The respondents indicated that they believed that renewable energy strategies were effective when implemented, but implementation was nonetheless low. Communication regarding the renewable energy strategies within organisations was still very low at 44.8%, indicating that there was insufficient communication in the participating organisations. This can be improved by implementing education and training through awareness campaigns. The implementation of renewable energy strategies could assist in decreasing energy costs. This was also evident from data obtained from the research, with 49.9% indicating that the strategy had a reducing effect on energy costs. Although most organisations were not using renewable energy as part of their energy strategy at the time of this research, this might be due to the cost of implementation. This would be an area that management within organisations may want to explore further in terms of the various options available.

The next section deals with management issues relating to the energy strategy.

5.2.5 Management issues in energy strategy

This section reflects the results of an examination of management issues involved in energy strategy, namely energy policies, level of energy policy adoption within the organisation and effectiveness of the policy in helping to set energy targets and objectives. The present research investigated whether the energy data was reviewed to identify opportunities for improvement and whether ISO50001 was implemented by organisations. The last stage of the research evaluated whether energy management strategy had an influence on the organisational culture, and whether the organisation appointed a dedicated energy manager and energy team to set targets and objectives.

The energy policy is a formal statement made by management indicating their commitment to improve the overall energy performance of the organisation (see section 2.5.1). The energy policy is a key step in the EnMS and should include all stakeholders. It is therefore the responsibility of management to develop and implement the energy strategy within the organisation in order to assist in improving the overall management strategy (see section 2.5.1). Although most respondents (67.9%) indicated that an energy policy is important for energy risk management within the organisation, 62.8% indicated that their organisation had not adopted a formal energy policy (Table 5-6).

Table 5-6 Importance of energy policy and whether adopted in organisation

	Importance of energy policy	Adoption of energy policy
No degree	32.10%	62.80%
A degree	67.90%	37.20%

Of the respondents who indicated that an energy policy was important for energy risk management within the organisation, 33.3% indicated it was important to some degree, 1.3% indicated a moderate degree, 12.8% indicated a degree and 20.5% indicated a strong degree, as shown in Figure 5-17.

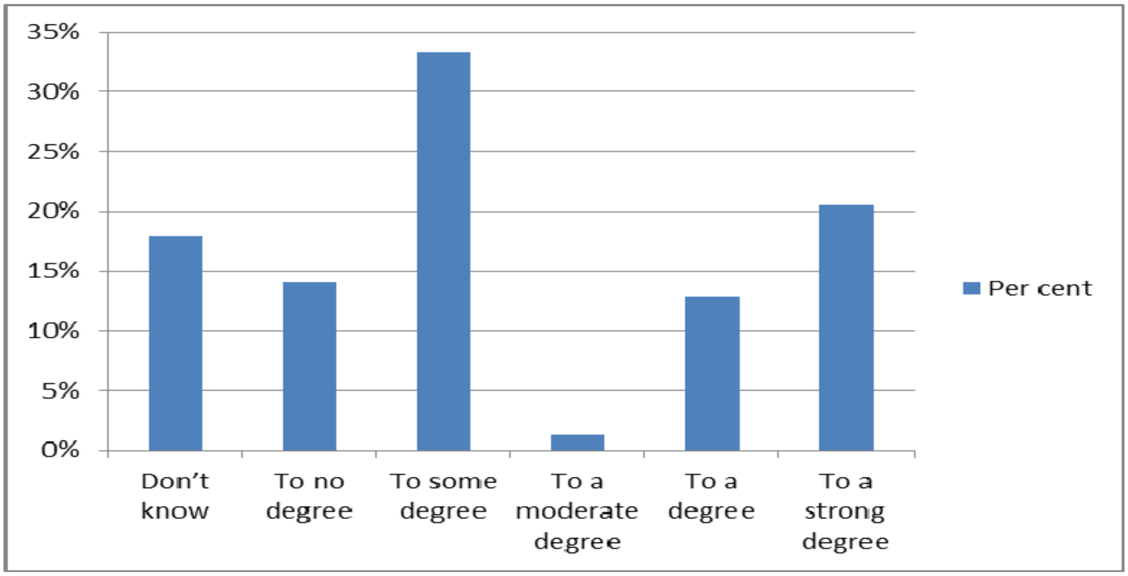


Figure 5-17 Importance of energy policy in organisation

Of those respondents who indicated that an energy policy was adopted within their organisation, 12.8% indicated that it had been adopted to some degree, 2.6% indicated a moderate degree, 10.3% indicated a degree and 11.5% indicated a strong degree, as shown in Figure 5-18. It was evident from the data that organisations need to evaluate their policies in order to implement a formal energy policy, which would show their commitment to improve energy performance.

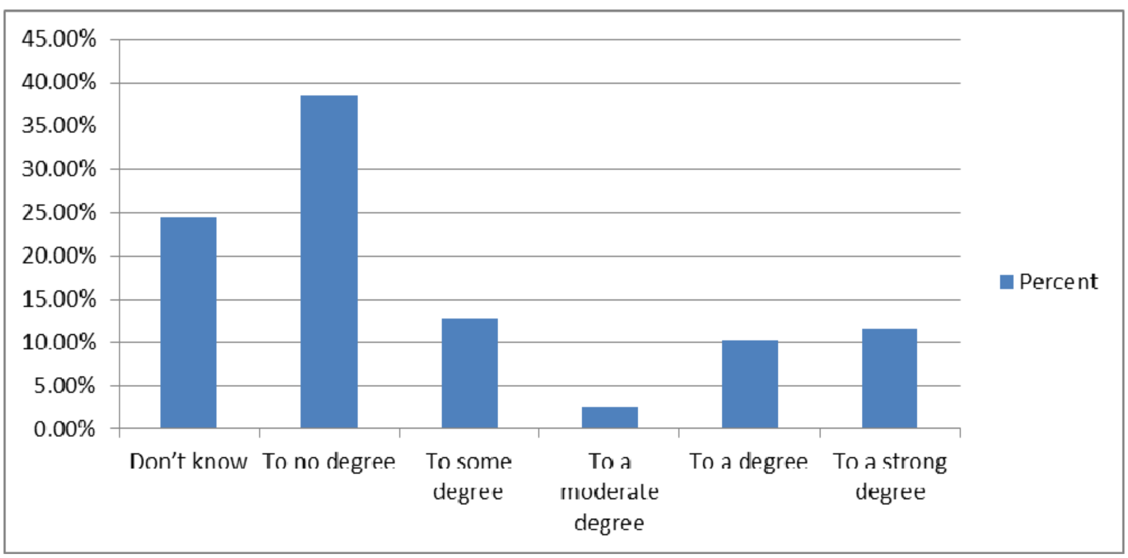


Figure 5-18 Adoption of energy policy in organisation

According to the literature, the energy policy sets the framework for action and assists the organisation to set their targets and objectives (see section 2.5.1). The energy policy, targets and objectives are established to enhance the processes and procedures of the organisation and to create a holistic risk management process (see section 2.1). When asked whether the energy policy served as a guideline for the setting of energy targets and objectives, 52.6% of the respondents indicated that the energy policy did not serve as a guideline, 23.1% indicated that they did not know and 29.5% indicated that it served as no guideline at all. Of the 47.4% who indicated that the energy policy had an influence on the setting of energy targets and objects, 20.5% indicated some degree and only 11.5% indicated a strong degree of influence, as seen in Figure 5-19.

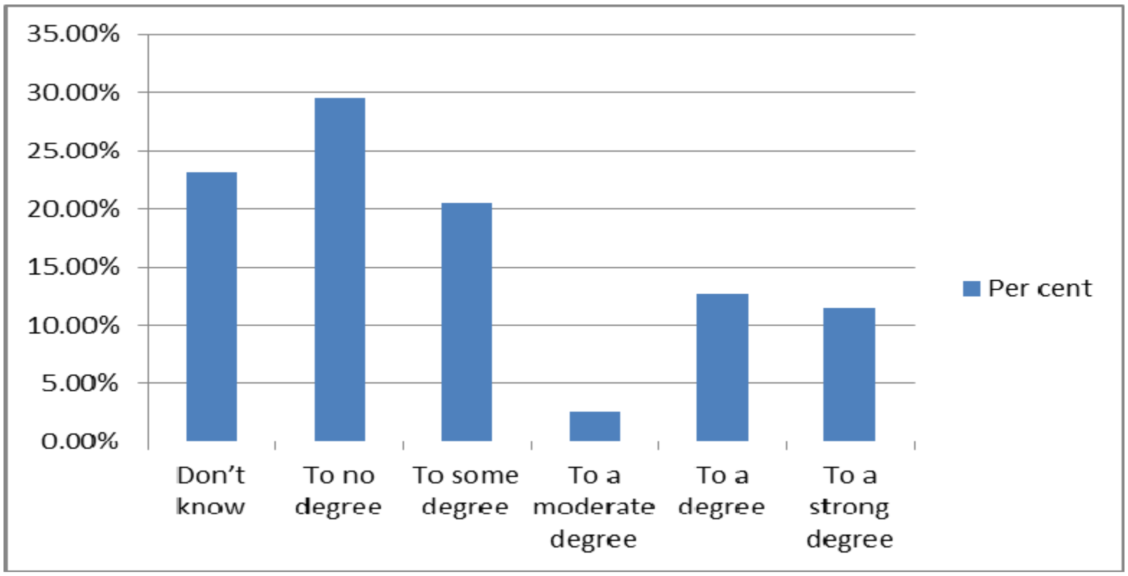


Figure 5-19 Energy policy as guideline for setting energy targets and objectives

According to Gopalakrishnan and Ramamoorthy (2014), the energy review includes an analysis of energy used, total consumption, areas of significant use and opportunities for improvement. This is done in relation to a baseline year. The reviewing of the energy data is essential in order to improve the energy policy and to evaluate the allocation of resources used in the energy management system (Antunes *et al.* 2014). According to the data, it was clear that 56.4% of the respondents indicated that they did not know or that their organisations did not review energy data to identify opportunities for improvement on a continuous basis.

Of the 43.6% who indicated that their organisation did review its energy use, 16.7% indicated that the review was done to some degree, 2.6%, to a moderate degree, 12.8%, to a degree and only 11.5% said it was done to a strong degree, as indicated in Figure 5-20.

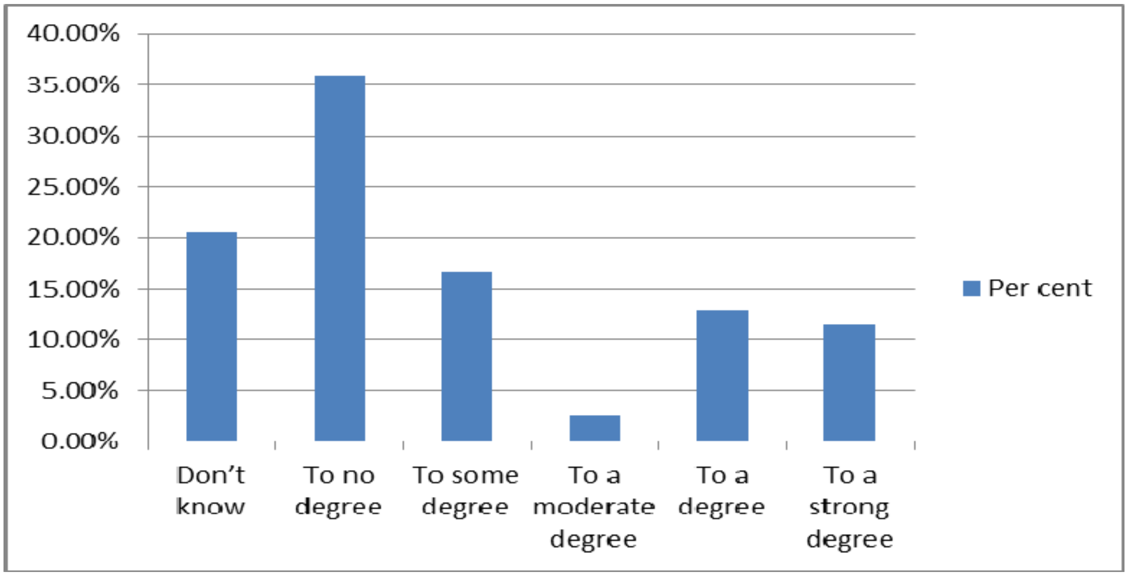


Figure 5-20 Review energy data to identify opportunities for improvement

ISO50001 was introduced in 2011. It came about due to the need to decrease GHG emissions, to promote energy efficiency and to increase the use of renewable energy sources (Piñero 2009). The standard aimed to develop systems and processes for the improvement of energy performance, use and consumption (see section 2.5.1). The fifth question evaluated whether organisations implemented ISO50001. Most respondents (46.2%) indicated that it was not implemented within their organisation while 33.4% indicated that they did not know whether the organisation implemented ISO50001. Only 20.4% indicated that ISO50001 was implemented, with 6.4% indicating to some degree, 6.4% to a degree and 6.4% to a strong degree, as seen in Figure 5-21. The standard applies only to activities that are under the control of the organisation, where it is able to set targets and objectives and control energy use. If targets are not met, ISO50001 gives guidance on how to put plans in place (see section 2.5.1). The low response rate to this question indicated that it is an area that needs attention from companies, who might wish to investigate further in order to devise and implement a formal energy strategy.

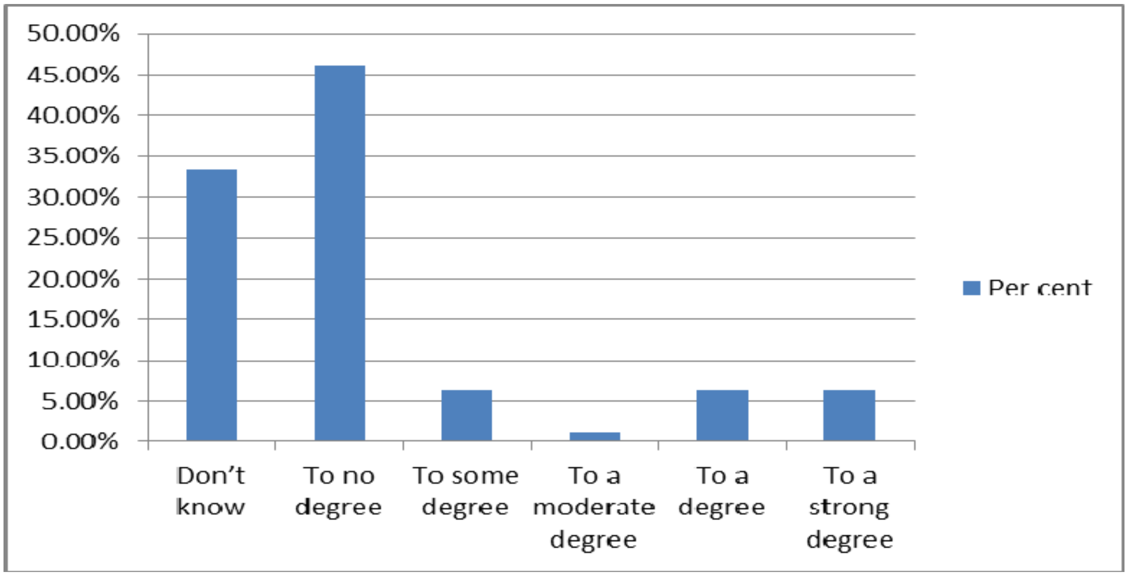


Figure 5-21 Implementation of ISO50001

It is important for management to tailor risk management to the organisational requirements and to root risk management in the practices and culture of the organisation (see section 1.2.3). Berg (2010) also indicates that it is important to understand the overall environment within which the organisation operates (the external environment) and the culture of the organisation (internal environment) when setting risk management strategies. One of the barriers to implementing energy management strategies is the lack of knowledge and awareness in the culture of many organisations (see section 2.2.3.2). The culture of organisations therefore plays an important role, not just for risk management but also for energy management. The data showed that 55.1% of respondents indicated that the energy strategy had an influence on the culture of their organisation, with 23.1% indicating that it was to some degree, 11.5% and 9% indicating it was to a moderate degree and a degree respectively, and 11.5% indicating that it was to a strong degree. Of the respondents, 44.9% indicated that it had no effect (24.4%) on the culture or that they were not sure (20.5%) of the influence this had on the culture of their organisation, as seen in Figure 5-22. According to the data, it was evident that a fair number of respondents indicated that the energy strategy had an effect on the culture of the organisation. Organisations could increase this percentage by awareness campaigns and communication strategies that explain the various energy strategies and the importance of these strategies for overall organisational strategy.

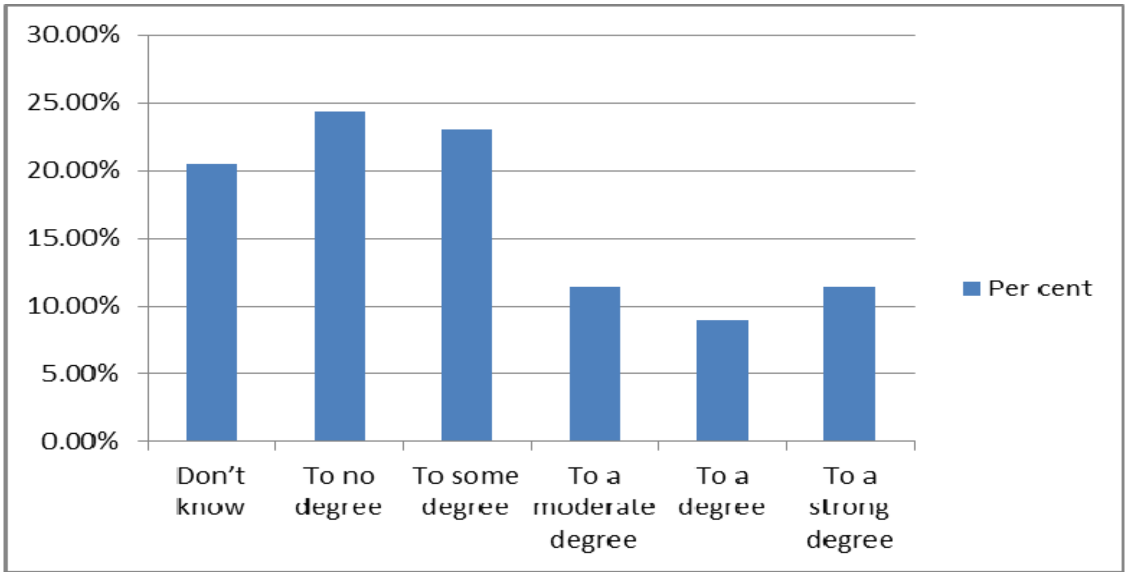


Figure 5-22 Influence of energy strategies on culture of organisation

One of the underlying foundations of the PDCA is the matter of roles, responsibilities and authority regarding energy strategies within the organisation (see section 2.5.1). It is the responsibility of management to appoint an energy manager and energy team within each organisation. The function of this energy team is to set energy targets and expectations for the organisation, to monitor energy performance and improve systems and behaviour of energy use, when required. The energy team further sets energy goals, plans the relevant energy projects, develops cost estimates, and implements and monitors the various energy projects. The final task is to train and communicate the various energy strategies to all in the organisation. Most of the respondents (47.4%) indicated that their organisation did not have an energy manager and energy management team responsible for setting objectives and targets, with 30.8% indicating that they did not know if their organisations had an energy manager. Only 21.8% indicated that their organisation had an energy manager and energy team, as seen in Figure 5-23. This might be due to the fact that most organisations had not yet adopted a formal energy policy (37.2%) or ISO50001 (20.4%) at the time of this research. This is an area that organisations need to investigate further, in order to establish and implement proper energy management strategies within their organisations.

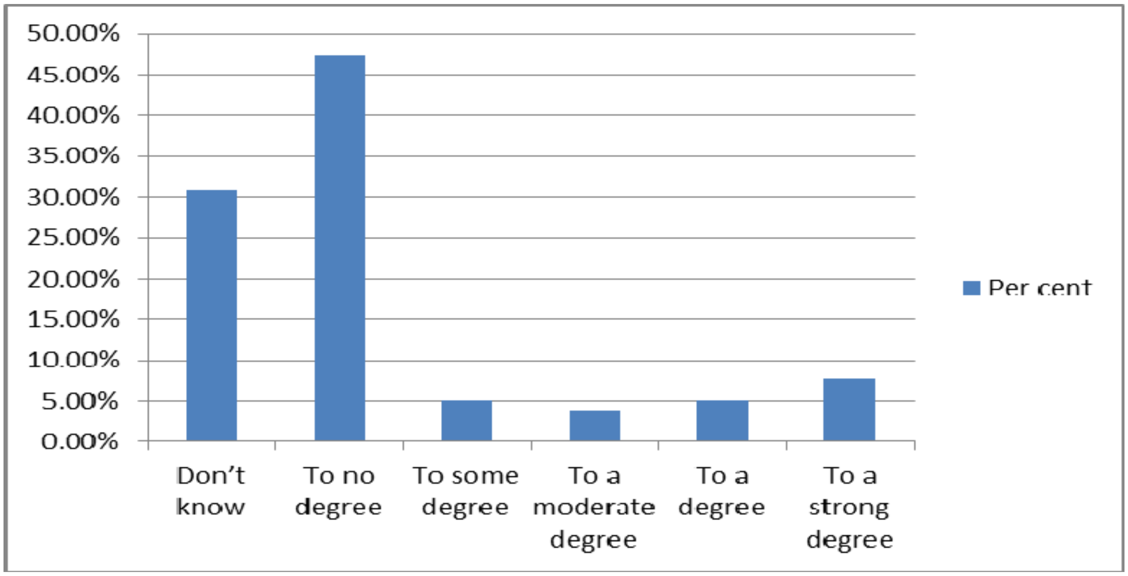


Figure 5-23 Appointment of energy manager and energy management team

The energy policy is an important part of a company's energy strategy as it shows management's commitment to the overall energy performance of the organisation. The energy policy is developed by management in order to assist in the improvement of the overall management strategy of the organisation. The data substantiated this, with 67.9% respondents indicating that the setting of an energy policy was important for their energy risk management. Although respondents indicated that it was important to have a formal energy policy, only 37.2% indicated that their organisations had adopted such a policy. This needs to be improved, as the function of the formal energy policy is to assist organisations in setting the energy targets and objectives. Only 47.4% of respondents indicated that the policy assisted in setting these targets. This might also be due to the low percentage that had in fact adopted the policy.

The importance of setting targets and objectives according to policy was highlighted in the idea of the energy data review. Energy data is reviewed in order to find opportunities for more savings and to improve on a company's current energy strategy. Responses showed that 43.6% of participating organisations reviewed their data. This can be improved in order for organisations to find opportunities for savings and to improve on their current system. The implementation of ISO50001 was very low, with only 20.4% of respondents indicating that it was implemented to some degree. ISO50001 was introduced to assist organisations with developing systems and processes that would improve their energy performance. This might be an area for organisations to investigate as part of their formal energy strategy.

Culture plays an important role, not only in risk management but also in the setting of energy management strategies. A fair number of respondents (55.1%) indicated that energy management strategies played an important role in the culture of their organisation. This could be improved by organisations embarking on awareness and communication campaigns on the energy strategies that form part of their overall energy plan. One of the first steps in setting an energy management strategy is the appointment of an energy manager and energy team. Their role is to set the energy targets and expectations of the organisation, to monitor the energy performance and improve on the systems and behaviour regarding energy use. The data showed that only 21.8% indicated that an energy manager and energy team had been appointed in their organisations. This might be related to the fact that a very low percentage (37.2%) had adopted a formal energy policy, and only 20.4% had implemented ISO50001. This is certainly an area that organisations could investigate further as part of their formal energy management strategy.

The next section deals with the financial and risk management aspects of energy strategies within organisations.

5.2.6 Finance and risk management aspects of energy strategies

One of the methods implemented by government to increase investments in energy strategies is tax rebates. To assist energy efficiency methods, government introduced the 12L tax incentive in November 2013. This incentive gives organisations a tax reduction of 95kWh per unit on energy saved (see section 3.2). The present research investigated whether the possibility of a tax rebate influenced decisions by the organisation to implement energy management strategies. The data confirmed that 34.6%% indicated that they did not know whether it had an influence, with 21.8% indicating that the tax rebate did not influence the decision by their organisation. Of the respondents, 42.3% indicated that the rebate had an influence on the decision, although it seems the influence was small, since only 9.0% indicated that the rebate was a strong consideration, and 17.9% indicated that it had some influence on the decision, as seen in Figure 5-24. A reason for the low response to the tax rebate possibility might be the administrative burden it imposed, or the lack of knowledge and understanding on the various options available to organisations.

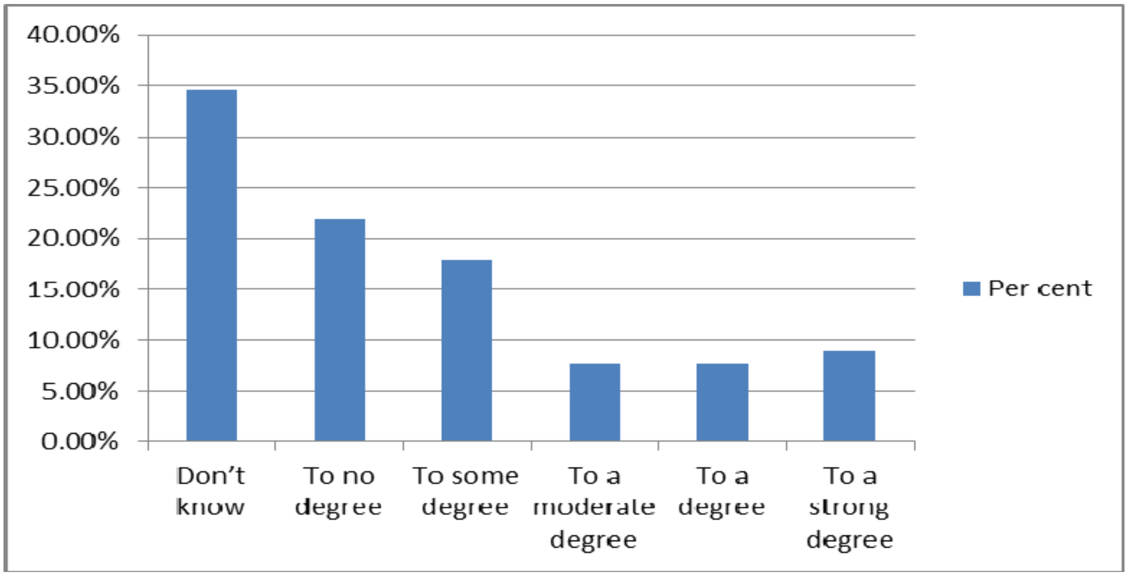


Figure 5-24 Influence of possible tax rebate on energy strategy decisions

One of the benefits of implementing energy management strategies is the possibility of a decrease in operating costs (see section 2.2.3.1). The implementation of energy strategies gives organisations the opportunity to decrease overall operating costs by decreasing the energy costs of the organisation. The data showed that 69.2% of respondents indicated that the possibility of a decrease in operating costs had an influence on the decision by the organisation to implement energy management strategies. Of the 69.2%, 17.9% indicated that it was to some degree, 15.4%, to a moderate degree, 11.5%, to a degree and 24.4%, to a strong degree. Only 6.4% indicated that reduced operating costs had no influence on the implementation of a strategy, with 24.4% indicating that they did not know whether it influenced management decisions, as seen in Figure 5-25. The relatively high percentage of 'don't know' responses might be related to the fact that many of these respondents were not directly involved in the financial aspects of their organisations.

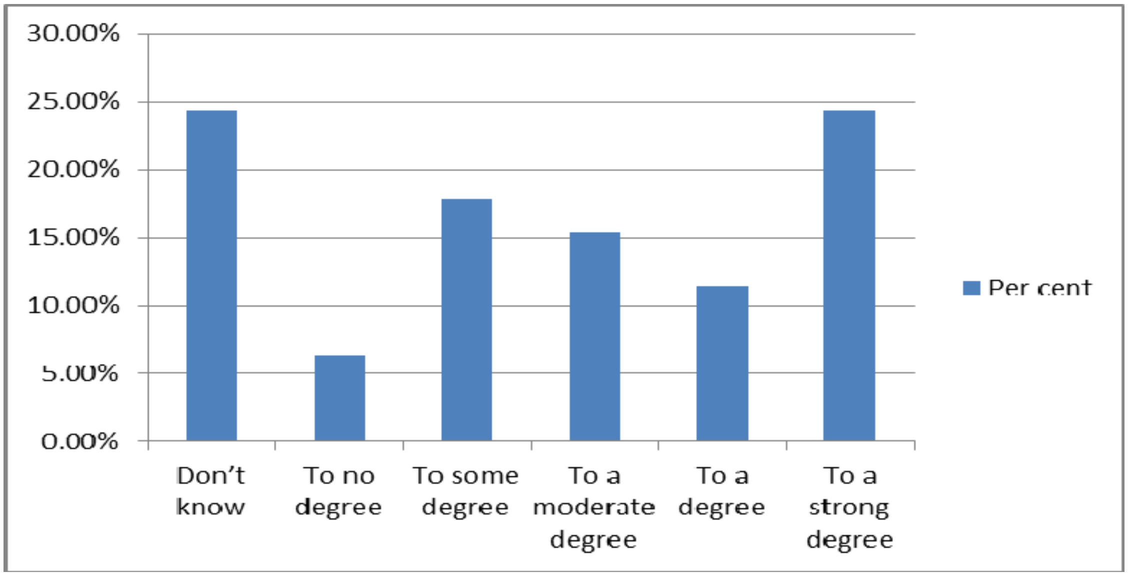


Figure 5-25 Influence of possible decrease in operating cost on energy management strategies

One of the barriers for implementing energy strategies seems to be the inadequate incentives and finance available (see section 2.2.3). The present study investigated whether inadequate incentives and finances had an influence on the implementation of energy management strategies within organisations. The data showed that 32.1% indicated that they did not know, while 20.5% said this had no influence on the implementation. A total of 47.4% indicated that a lack of incentives and finance had an influence on the strategy, with 20.5% indicating some degree, 6.4%, a moderate degree and 9%, a degree. Only 11.5% felt that inadequate incentives and finance had a strong influence on decisions regarding energy strategies, as seen in Figure 5-26. One of the reasons for this percentage might be the lack of knowledge regarding the various finance options and incentives that are available to organisations. Some of these financing methods are bank loans, loans through suppliers of energy-efficiency equipment, cash grants and tax incentives (see section 3.2). Further research could be conducted on the various finance options and possible reasons why organisations are not making use of these methods in order to increase their implementation of energy strategies.

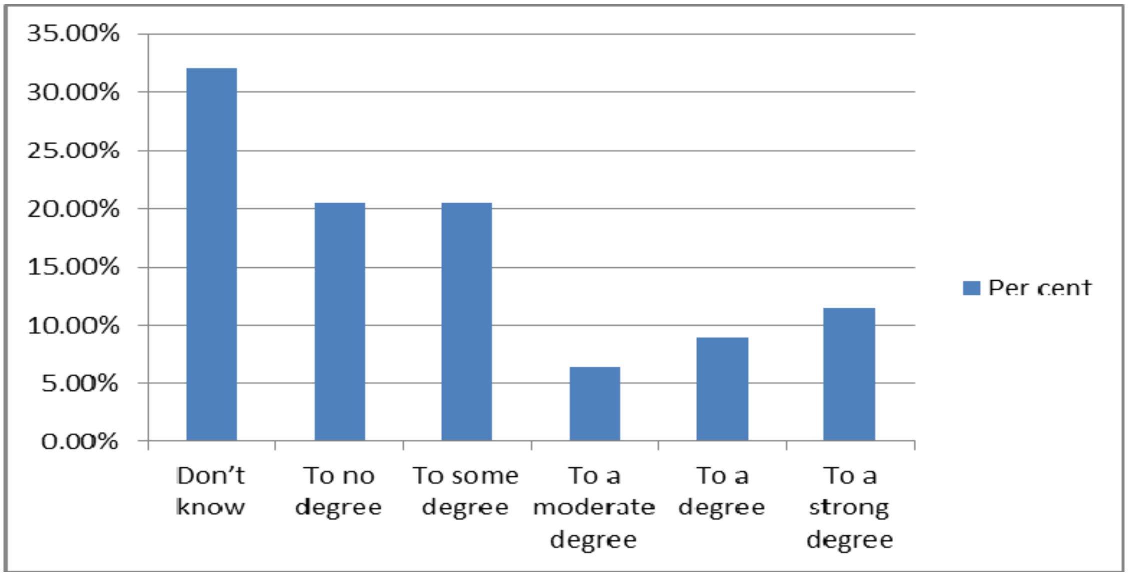


Figure 5-26 Influence of inadequate incentives and finance on energy management strategies

Various financing methods are available to organisations in order to increase the implementation of energy strategies (see section 3.2). These include bank loans, loans from suppliers of energy-efficiency equipment (via corporate sponsorships), government funding (via cash grants), and own funding. The research evaluated whether organisations made use of these funding methods when implementing energy management strategies. In Table 5-7, it can be seen that an average of 40% of the respondents were not sure which funding methods were used within their organisation. This might be due to the fact that they are not directly involved in the financial aspect of the organisation, as can be seen from the demographic information. Organisations could improve this percentage by communicating the overall energy strategy to all stakeholders. In Table 5-7, it can be seen that most organisations make use of their own funding (51.3%) in order to implement energy management strategies, with only 9% making use of bank loans, 3.9% making use of corporate sponsorships and 7.8% making use of government funding. It should be noted that more than 50% of the respondents indicated that their organisations did not make use of bank loans (51.3%), corporate sponsorships (59%) or government funding (52.6%) for the implementation of energy management strategies. The high percentage of respondents indicating no use of the various financing methods available might be due to the fact that awareness of the various options is generally low. This was also seen in responses on the previous question, where respondents indicated that inadequate finance and incentives influenced the decision regarding energy management strategies. Further research might be conducted on the various financing methods and the benefits that these have for organisations.

Table 5-7 Funding methods used for energy management strategies

	Don't know	**To no degree**	**To a degree**
Bank loans	39.7	51.3	9.0
Corporate sponsorships	37.2	59	3.9
Government funding	39.7	52.6	7.8
Own funding	34.6	14.1	51.3

The Department of Energy (2016) indicates that the high cost of energy-efficient appliances is one of the barriers to the implementation of an effective energy strategy. This was also a factor for the implementation of solar and wind energy, where the cost of hardware and installation is still relatively high. The high cost of energy technologies was one of the reasons why government introduced financial incentives for these various energy strategies (see section 3.2.1).

The present research investigated whether energy management strategies required high initial capital investments. According to the data, 67.9% of respondents indicated that the high initial capital investment influenced their implementation of energy management strategies, and 32.1% indicated that they did not know whether it had an influence, as seen in Figure 5-27. Of the 67.9% who indicated that high capital cost had an influence, 25.6% indicated that it had a strong influence, while 20.5% indicated that it had some degree of influence. One of the aspects that organisations could investigate is the various financing methods available to them in order to increase their implementation of energy strategies.

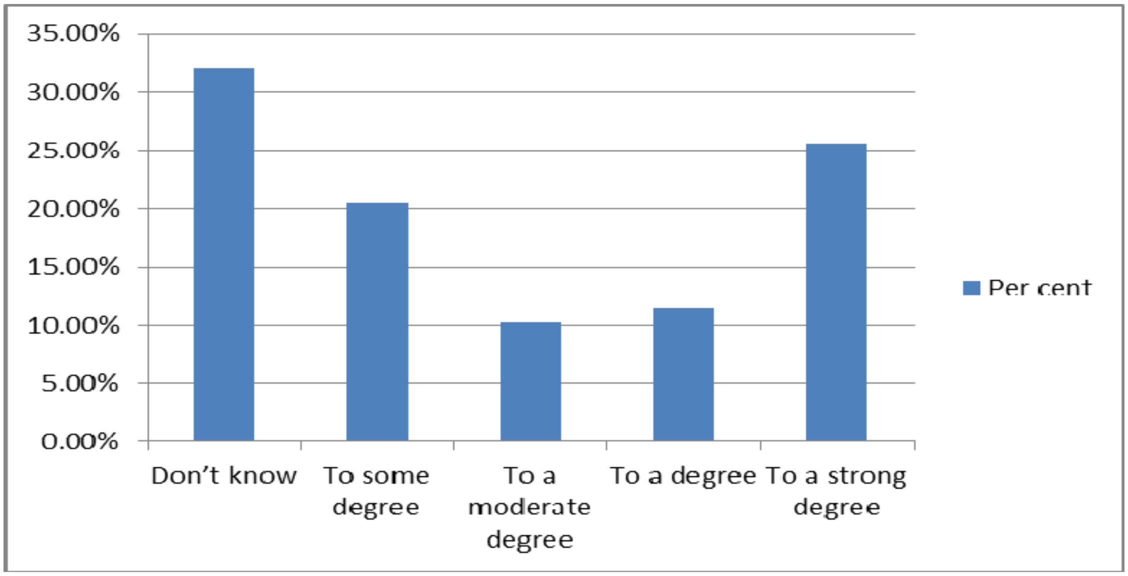


Figure 5-27 Influence of high initial capital investments on energy management strategies

One of the barriers to the implementation of energy strategies is the imperfect or incomplete information available when making decisions (see section 2.2). One of the objectives in the fourth goal of the White Paper on Renewable Energy (2003) is to promote the energy market by circulating information on the economy and the environment, and on the social and trade benefits of the various strategies (see section 2.4.2). Gopalakrishnan and Ramamoorthy (2014) also indicate that the setting of the baseline year depends on the availability of relevant energy information.

The last question in the finance section evaluated whether cost information regarding energy management strategies was difficult to obtain. According to the data obtained, 59% of respondents indicated that the information was difficult to obtain, with 28.2% saying that it was difficult to some degree and 3.8%, to a strong degree. Of the respondents, 37.2% indicated that they did not know and only 3.8% indicated that the information was not difficult to obtain, as indicated in Figure 5-28. Reasons for this high percentage under ‘do not know’ may be that, although the cost information is available, it is not easily accessible or organisations are simply unaware of where to find what they need.

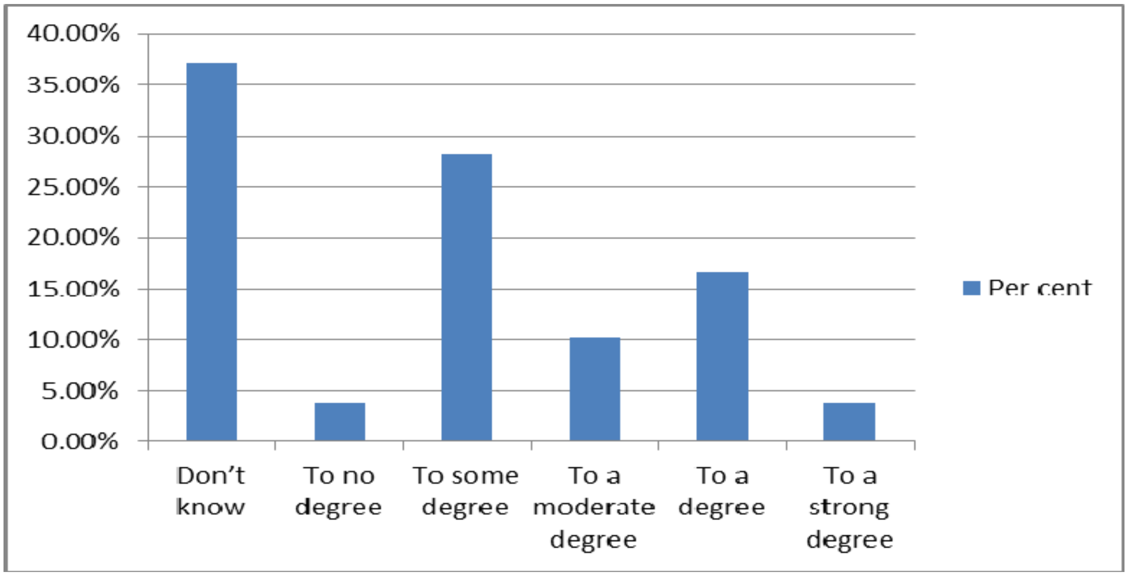


Figure 5-28 Cost information on energy management strategies is difficult to obtain

Tax rebates are one of the incentives introduced by government to increase investments in energy projects. According to the data, only 42.3% of the respondents indicated that the possibility of a tax rebate influenced the decision by the organisation to implement energy strategies. The reason for the low response might be the administrative burden involved or a lack of knowledge and understanding of the various options available. A decrease in operating costs is one of the benefits of implementing energy management strategies. This was evident from the data, with 69.2% of respondents indicating that this had an influence on the decision by the organisation regarding energy management strategies. Energy management strategies could assist organisations to decrease their overall operating costs by decreasing the energy costs of the organisation.

Inadequate incentives and finance (47.4%) had an influence on decisions by organisations regarding energy management strategies. Although various financing methods are available, such as bank loans, corporate sponsorships, government funding and tax rebates, most organisations (51.3%) still make use of own funding when implementing energy strategies. This might be due to the lack of awareness of the various methods available, which is an area for further research.

The high initial capital investment required for energy strategies influenced organisations regarding their implementation of energy strategies, as was evident from the research, with 67.9% of respondents indicating that this had an influence on their organisations. One of the methods that organisations could investigate is the various finance options available to them to increase their implementation without incurring high additional costs. Cost information regarding energy strategies is important for organisations when they set their baseline year, enabling them to monitor and evaluate their energy performance. This information is seen as difficult to obtain, with 59% of respondents indicating agreement. It might be that the information is available but not easily accessible or that organisations are simply unaware of where to find it.

5.2.6.1 Risks when implementing energy management strategies

This section will look at some of the risks that organisations need to consider when implementing energy management strategies.

The present research investigated whether the risk management departments of organisations participated in setting the energy management strategies of the organisations. In the risk management process, the first stage is to set the context within the organisation. Organisations need to understand their internal environment and culture as well and have to evaluate their external environment (see section 3.4.1). It is important for risk management to form part of the overall energy management strategy in order to identify and evaluate the risks of the implementation of these strategies. Only 29.4% of respondents indicated that the risk management department participated in the setting of energy management strategies within their organisations. Of the respondents, 41% indicated that they did not know whether the risk management department was part of the process, which might be due to the fact that they were not directly involved in the risk management aspect, as can be seen in the section on demographic information of respondents. A further 29.5% indicated that the risk management department did not participate in the setting of the energy management strategy within the organisation, as indicated in Figure 5-29. This might be an area on which organisations should focus, as risk managers should be closely involved in energy management strategies in order to assist with the identification and evaluation of the various risks.

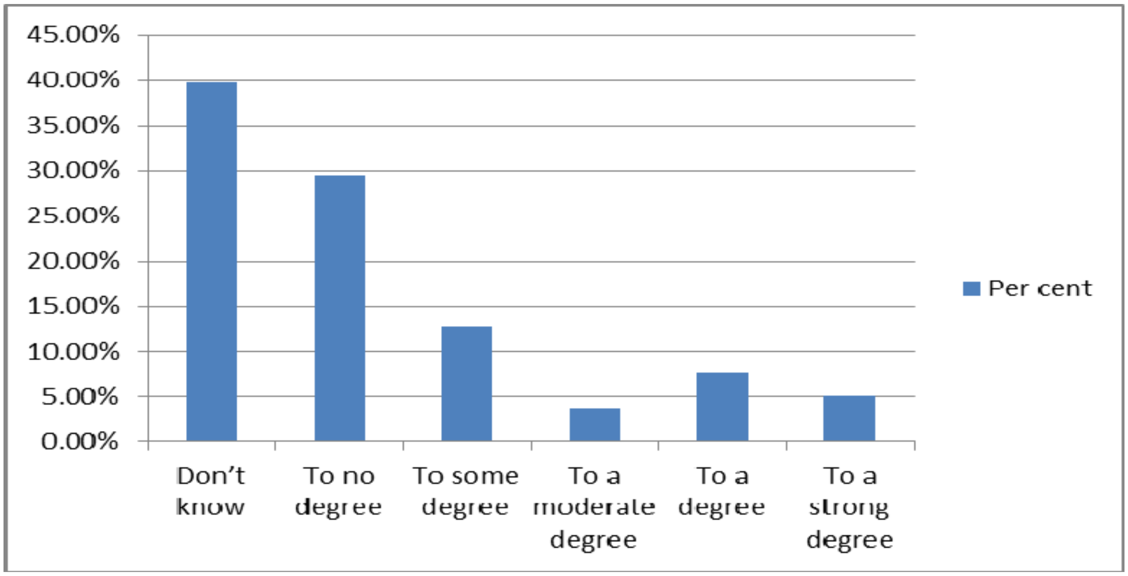


Figure 5-29 Risk management department sets energy management strategies

The setting of the context is the first stage in the risk management process. It is important for organisations to understand the environment within which they operate as well as the risks in which they will be involved. It is also important for risk managers to participate in setting the energy management strategies in order to identify the various risks within these strategies. According to the data obtained, only about 30% indicated that, at the time of this study, their risk management departments were involved in the setting of energy management strategies.

5.6.2.2 Influence of risks

This section deals with the various risks within organisations and the influence that these risks have on the setting of the energy management strategy.

In Table 5-8, it can be seen that most respondents indicated that the various risks had an influence on the setting of the energy management strategy. About 30% of respondents indicated that they did not know which risks had an influence. This might be due to the fact that they were not directly involved in the risk management aspect of the organisation, as was seen in the section on demographics, or that this information was not communicated effectively within the organisation. Around 20%

of respondents indicated that the various risks had no influence on their organisation when setting energy management strategies.

Table 5-8 Risk types in setting energy strategies

	Don't know	No degree	To a degree
Financial risk	28.2	24.4	47.4
Credit risk	32.1	35.9	32.0
Reputational risk	28.2	19.2	52.6
Market risk	29.5	29.5	41.0
Liquidity risk	29.5	37.2	33.3
Operational risk	29.5	19.2	51.3
Disaster risk	28.2	17.9	53.9
Regulatory risk	30.8	19.2	50.0
Strategic risk	29.5	20.5	50.0

An in-depth portrayal of the risks that influence the organisation is presented in Figure 5-30. From Figure 5-30, it is evident that 53.9% of respondents indicated that disaster risk (weather/environmental) had the greatest influence on the setting of the energy management strategy. In the present study, disaster risk was classified as the risk of loss due to external factors outside the control of the organisation. Business interruptions could occur due to extreme weather or other environmental events, which could have a negative effect on the turnover of the organisation. As this risk is outside the control of the organisation, special attention needs to be given to this aspect in order to manage the risk, should it arise.

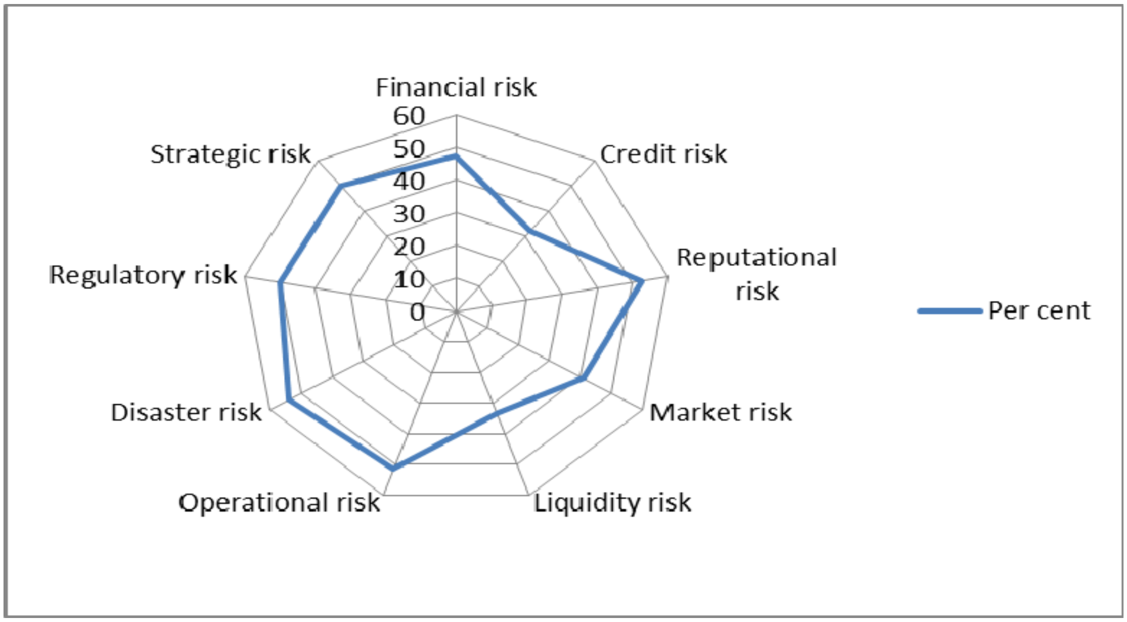


Figure 5-30 Risk types in energy management strategies

Secondly, reputational risk was a factor classified as the risk of loss due to damaging publicity and public image related to non-compliance to energy risk regulations. Of the respondents, 52.6% indicated that reputational risk had an influence on the energy strategy. In a study by AON (2015), reputational risk was ranked as the most important risk not only in the financial services sector but also in the overall economy, as seen in Table 3-2 and Table 3-3 respectively. Damage to reputation could decrease sales, harm the recruitment of high-level staff and business partners, and make financial packages more expensive for organisations (see section 1.2.2). However, the successful implementation of energy strategies could increase the reputation of organisations and decrease costs (see section 2.2).

The third risk was operational risk (identified by 51.3% of respondents), which was defined as the risk of loss, damage or failure due to inadequate internal processes, people, systems and external influences within the energy strategy. From the study done by AON (2015), failure to attract and retain top talent was ranked fifth, and business interruptions were ranked seventh among the most important risks (Table 3-2). Operational risk in energy management strategies therefore needs to be identified in order to assess and manage these risks effectively.

The fourth risk was regulatory and strategic risk. Regulatory risk (identified by 50.0% of respondents) was identified as risk related to the uncertainty of regulations for various transactions or a change in the regulatory environment of energy. Most organisations are exposed to regulatory risk due to changes in tax legislation, new taxes being implemented and changes in the subsidies and policies within the organisation and the country. These changes in taxes and policies could affect the profitability of an organisation. It is also difficult to account for this risk when making investment decisions (see section 3.4.2). Regulatory risk was ranked as the third most important risk in the study done by AON (2015) and the second most important risk for the financial services sector, as seen in Table 3-2 and Table 3-3 respectively.

Strategic risk (identified by 50.0% respondents) was classified as the risk that affected the viability of the organisation in terms of energy strategy. Organisations make various strategic decisions to increase their profitability, and the risk of making the wrong decision with regard to an energy strategy could result in substantial losses for the organisation.

The fifth risk as indicated by the respondents was financial risk (identified by 47.4% of respondents), which was defined as the risk of having insufficient access to capital to manage energy projects. According to the literature (see section 3.4.2), financial risk is the most important risk in energy projects due to the long-term nature of investments and the large capital outlay that is required to implement these strategies. The AON study (2015) ranked slow economy/slow recovery (part of financial risk) as the number two risk in 2015, and projected that this risk would stay in the top ten risks until 2018 (Table 3-2). Financial risk in energy strategies could have an adverse effect on the turnover of organisations, which will influence their planning, management and investment in energy strategies.

The three lowest rated risks were credit risk, liquidity risk and market risk, as seen in Figure 5-30. Market risk is the risk of loss due to changes in the market value of the underlying instrument related to energy projects, and comprises of interest rate risk, exchange rate risk and commodity price risk. According to the data, 41.0% of respondents indicated market risk as the sixth most important risk. Market risk (also known as ‘commodity price risk’) was ranked as the eleventh most important risk in the AON study (2015), as seen in Table 3-2. Market risk could have an adverse effect on the organisation if there are changes in the interest rate, exchange rate or commodity prices, all of which will have an influence on the turnover of the organisation.

Credit risk (identified by 32.0% of the respondents) was the lowest ranking risk and was defined as the risk that a counterparty will not fulfil its contractual obligations in terms of the financial loans related to energy strategy. Credit risk in energy projects is easily quantified and managed (see section 3.2.4) and is probably the reason why this was the lowest ranking risk. Credit risk in energy projects nonetheless needs to be identified and managed at an early stage in order to manage the risk accordingly.

Liquidity risk was ranked as the second lowest risk at 33.3%, and was defined as the risk that the organisation will not be able to make financial payments to the counterparty related to the energy strategies that had been employed. This risk was ranked as the twelfth most important risk in the study done by AON (2015). The literature (see section 3.2.4) indicated that liquidity risk is an important risk in energy strategies due to the large amount of capital and investment required to implement these strategies. One of the reasons why respondents might have ranked this risk so low is that most organisations currently make use of their own funding in the implementation of energy strategies. This risk might increase when organisations start to make use of more bank loans, corporate sponsorships and government grants.

5.3 Discussion of inferential statistics

In the present study, the statistics were compiled using SPSS software. The inferential statistics include ANOVA, correlation and regression analysis of the data.

5.3.1 Relationship between energy cost and implementation of energy strategies

To improve the analysis and interpretation, the energy cost as a percentage of operating cost, as presented in Figure 5-4, was recorded in two categories: less than 10% (47.4%) and more than 10% (16.7%). The data for 10–15%, 15–20% and more than 20% was very low and therefore was combined in order to evaluate the two groups with significant data points, as indicated in table 5-9.

Table 5-9 Recoding of energy cost as percentage of operating cost

		N	Mean	Standard deviation (SD)	Standard error (SE)
Energy conservation & efficiency strategies	Don't know	27	3.0000	1.56598	.30137
	Less than 10%	37	3.5243	1.34524	.22116
	Greater than 10%	13	4.1385	.76326	.21169
	Total	77	3.4442	1.39421	.15888
Renewable energy strategies	Don't know	27	.8704	.73173	.14082
	Less than 10%	37	1.3649	.77638	.12764
	Greater than 10%	13	1.7500	.55902	.15504
	Total	77	1.2565	.78637	.08962

To examine the research question of whether energy cost as a percentage of operating cost was related to the implementation of energy conservation and efficiency and renewable energy strategies, an analysis of variance (one-way ANOVA) was conducted, as indicated in Table 5-10.

There was a significant relationship between the energy cost as a percentage of operating cost and the implementation of energy conservation/efficiency strategies within the organisation, at the $p < .05$ level [$F(2,74) = 3.221$, $p = .046$]. Respondents revealed that energy conservation and efficiency strategies were likely to be implemented when the energy cost as a percentage of operating cost was greater than 10% ($M = 4.14$, $SD = 0.76$). The number for this category was higher than for those respondents who did not know whether energy cost had an influence on the implementation of energy strategies by their organisation ($M = 3.00$, $SD = 1.57$).

Table 5-10 ANOVA on energy cost as percentage of operating cost

		Sum of squares	df	Mean square	F	Sig.
Energy efficiency & conservation strategies	Between groups	11.831	2	5.915	3.221	.046
	Within groups	135.899	74	1.836		
	Total	147.730	76			
Renewable energy strategies	Between groups	7.626	2	3.813	7.167	.001
	Within groups	39.371	74	.532		
	Total	46.997	76			

Although there was an overall slightly significant difference between the groups, there was no significant difference between the pairs, as seen in the multiple comparisons in Table 5-11, where the level of significance was greater than 0.05.

There was a highly significant relationship between energy cost as a percentage of operating cost and the implementation of renewable energy strategies within organisations, at the $p < .05$ level [$F(2,74) = 7.17$, $p = .001$]. There was no real difference between the group which indicated that energy cost was less than 10% ($M = 1.36$, $SD = 0.78$) and the group which indicated that energy cost was greater than 10% ($M = 1.75$, $SD = 0.56$) with regard to the implementation of renewable energy strategies within the organisation. There was, however, a significant ($p = 0.033$) difference between the group that indicated 'don't know' ($M = 0.87$, $SD = 0.73$) and the group that indicated that energy costs were less than 10%. The 'don't know' group also differed significantly from the group that indicated costs as greater than 10% ($p = 0.003$), as indicated in Table 5-11.

Table 5-11 Multiple comparisons of groups

Dependent variable	(I) q2.1_recoded	(J) q2.1_recoded	Mean difference (I-J)	SE	Sig.
Energy conservation & efficiency strategies	Don't know	Less than 10%	-.52432	.34300	.317
		Greater than 10%	-1.13846	.45748	.051
	Less than 10%	Don't know	.52432	.34300	.317
		Greater than 10%	-.61414	.43692	.377
	Greater than 10%	Don't know	1.13846	.45748	.051
		Less than 10%	.61414	.43692	.377
Renewable energy strategies	Don't know	Less than 10%	-.49449*	.18462	.033
		Greater than 10%	-.87963*	.24623	.003
	Less than 10%	Don't know	.49449*	.18462	.033
		Greater than 10%	-.38514	.23517	.268
	Greater than 10%	Don't know	.87963*	.24623	.003
		Less than 10%	.38514	.23517	.268

Energy management is an important part of organisational strategy as it assists in decreasing energy costs and GHG emissions. Although organisations are not able to control energy costs, policy changes and the economy, they can improve the management of their own energy use by implementing energy management strategies. This was evident from the data, which indicated that energy costs have a significant influence on the implementation of energy conservation and energy efficiency strategies, especially when the energy cost as a percentage of operating cost is more than 10%. Although energy cost also has a significance influence on the implementation of renewable energy strategies, the respondents indicated that whether the energy cost was greater or less than 10% did not have an influence on the implementation of renewable energy projects.

5.3.2 Relationship between implementation of energy conservation/efficiency strategies and a decrease in energy cost

Pearson's product-moment correlation coefficient measures the strength and direction of the relationship between two variables. A Pearson's correlation was conducted to see whether there was a relationship between the implementation of energy strategies and a decrease in the energy cost of organisations. Pearson's correlation coefficient indicated a strong positive monotonic correlation between two variables ($p = 0.627$, $n = 71$, $p < 0.001$). Thus the implementation of energy strategies increases the probability that there will be a decrease in the energy cost of the organisation, as indicated in Table 5-12.

Table 5-12 Correlation of energy conservation/efficiency methods and decrease in energy cost

		The implementation of energy efficiency methods in your organisation has resulted in a reduction of energy costs.	Energy conservation and efficiency strategies
The implementation of energy efficiency methods in your organisation has resulted in a reduction of energy costs.	Pearson's correlation	1	.627**
	Sig. (2-tailed)		.000
	N	71	71
Energy conservation & efficiency strategies	Pearson's correlation	.627**	1
	Sig. (2-tailed)	.000	
	N	71	77

**. Correlation is significant at the 0.01 level (2-tailed).

It was evident from the strong positive correlation that the implementation of energy efficiency and conservation strategies indeed assisted organisations in decreasing their energy costs. This is in line with the literature, which showed that one of the benefits of implementing energy efficiency and conservation strategies is the decrease in energy costs.

5.3.3 Relationship between implementation of renewable energy and a decrease in energy cost

According to Pearson's correlation, there is a relationship between the implementation of renewable energy strategies and a decrease in the energy cost of the organisations. The coefficient indicates a positive monotonic correlation between the two variables ($p = 0.370$, $n=71$, $p < .002$), as indicated in Table 5-13. Thus, the implementation of renewable energy strategies increases the probability that there will be a decrease in the energy cost of organisations.

Table 5-13 Correlation of renewable energy strategies and a decrease in energy cost

		The implementation of energy efficiency methods in your organisation has resulted in a reduction of energy costs.	Renewable energy strategies
The implementation of energy efficiency methods in your organisation has resulted in a reduction of energy costs.	Pearson's correlation	1	.370**
	Sig. (2-tailed)		.002
	N	71	71
Renewable energy strategies	Pearson's correlation	.370**	1
	Sig. (2-tailed)	.002	
	N	71	77

**. Correlation is significant at the 0.01 level (2-tailed).

The literature showed that the implementation of renewable energy strategies does not only promote energy security but also assists organisations to decrease energy costs and carbon emissions. This was evident from the data, which showed a positive relationship between the implementation of renewable energy strategies and energy costs in organisations.

5.3.4 Relationship between years of experience in energy risk management and attitude towards risk management

To improve the analysis and interpretation, respondents' years of experience, as presented in Figure 5-3, were recorded in three categories: less than 1 year, between 1 and 5 years and more than 6 years, as indicated in Table 5-14. A one-way ANOVA was used to determine whether there was a significant difference between the groups in terms of risk management.

Table 5-14 Recoding of years' of experience

	N	Mean	SD
Less than 1 year	32	2.3893	.83475
1–5 years	15	2.5672	.75001
6 or more years	12	3.0036	.77913
Total	59	2.5595	.82470

The study did not demonstrate any relationship between number years of experience and attitude towards risk management [$F(2,56) = 2.551$, $p = 0.087$], as indicated in Table 5-15.

Table 5-15 ANOVA on years of experience and risk management

	Sum of squares	df	Mean square	F	Sig.
Between groups	3.294	2	1.647	2.551	.087
Within groups	36.154	56	.646		
Total	39.448	58			

The study did not find a relationship between years of experience and attitude towards risk management. There is therefore no relationship between the number of years of experience that respondents had within the organisation and how they answered the risk-related questions. Further research might be conducted to explore the factors which do have an influence of employees' decision-making related to risk management.

5.3.5 Relationship between years to reach energy target and implementation of energy strategies

To improve analysis and interpretation, the years set to reach energy targets were recorded in three categories: between 1 and 3 years, between 4 and 6 years and more than 7 years. There was no significant difference between these three groups with regard to the implementation of energy conservation/efficiency strategies [$F(2,74) = 152$, $p = .859$] and renewable energy strategies [$F(2,74) = 778$, $p = .463$] within the organisation, as indicated in Table 5-16.

Table 5-16 ANOVA on years set to reach energy target and implementation of energy strategies

		Sum of squares	df	Mean square	F	Sig.
Energy conservation & efficiency strategies	Between groups	.605	2	.302	.152	.859
	Within groups	147.125	74	1.988		
	Total	147.730	76			
Renewable energy strategies	Between groups	.968	2	.484	.778	.463
	Within groups	46.029	74	.622		
	Total	46.997	76			

Although the number of years that organisations set to reach their energy targets did not have a significant influence on the implementation, this is an area that might increase in future due to policy changes and the setting of more formal targets by government.

5.3.6 Regression on variables towards risk management

Multiple regression analysis was conducted to examine whether size of the organisation, years of experience, communication of energy efficiency, conservation and renewable energy projects, management and energy strategies had an effect on the risk management of organisations. The coefficient of determination (R^2) indicates how well the regression model fits the data. In this analysis, the R^2 value was 0.156, as indicated in Table 5-17. This shows that energy strategy explains 15.60% of variation in risk management, which was statistically significant, $F_{1,56} = 10.143$, $p < .002$ as indicated in Table 5-18.

Table 5-17 Summary of model

Model	R	R square	Adjusted R square	SE of the estimate
1	.395[a]	.156	.140	.75212

Table 5-18 ANOVA of model

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	5.738	1	5.738	10.143	.002[b]
	Residual	31.113	55	.566		
	Total	36.851	56			

An inspection of the individual predictors revealed that only communication of energy conservation and efficiency strategies (beta = .395, $p < .002$) were significant predictors of the risk management within the organisation, as indicated in Table 5-19. Higher levels of communication of energy conservation and efficiency strategies are associated with higher levels of risk management.

Table 5-19 Coefficients of communication and risk management

Model		Unstandardised coefficients		Standardised coefficients	t	Sig.
		B	SE	Beta		
1	(Constant)	1.861	.233		7.998	.000
	Your organisation communicates its energy conservation and efficiency strategies to employees in the organisation	.230	.072	.395	3.185	.002

Communication is one of the stages in the risk management process (Figure 3-1). It is also part of the structured approach to risk management (Figure 3-2), and should take place on a continuous basis. It is necessary for organisations to communicate all relevant decisions and processes to the stakeholders throughout the organisations. According to the data, communication is a significant predictor of risk management.

Size of the organisation, manager's years of experience, the communication of renewable energy strategies, management and energy strategies had no significant effect on risk management.

5.3.7 Regression analysis of variables on risk management

Multiple regression analysis was conducted to examine whether energy strategy, energy efficiency and conservation methods, renewable energy methods and management had an effect on the risk management of the organisation. The coefficient of determination (R^2) indicates how well the regression model fits the data. In the present research, the R^2 value was 0.149, as indicated in Table 5-20. This shows that energy strategy explains 14.90% of variation in risk management, which was revealed to be statistically significant [$F_{1,56} = 9.610$, $p < .05$], as indicated in Table 5-21.

Table 5-20 Summary of model on risk management

Model	R	R square	Adjusted R square	SE of the estimate
1	.386[a]	0.149	0.133	0.75522

Table 5-21 ANOVA of energy strategy and risk management

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	5.481	1	5.481	9.610	.003[b]
	Residual	31.370	55	0.570		
	Total	36.851	56			

An inspection of the individual predictors revealed that energy strategy (beta = 0.386, $p < .001$) is a significant predictor of risk management within the organisation, as seen in Table 5-22. Energy strategy in this research consisted of energy targets, the importance of risk management, CSR, knowledge and awareness, and top management's commitment. Higher levels of energy strategies are associated with higher levels of risk management. In the present research, energy efficiency and conservation strategies, renewable energy strategies and management had no significant effect on level of risk management.

Table 5-22 Coefficients of energy strategy and risk management

Model		Unstandardised coefficients		Standardised coefficients	t	Sig.
		B	SE	Beta		
1	(Constant)	1.550	0.332		4.674	0.000
	Energy strategy	0.338	0.109	0.386	3.100	0.003

5.3.8 Regression analysis of variables on management

Multiple regression analysis was conducted to examine whether energy strategy, energy efficiency and conservation, and renewable energy methods had an effect on the management aspects of organisations. The coefficient of determination (R^2) indicated how well the regression model fitted the data. In the research, the R^2 value was 0.509, as indicated in Table 5-23. This shows that energy strategy and renewable energy methods explain 50.90% of variation in management, which was found to be statistically significant, $F_{2,61} = 30.564$, $p < .001$ as indicated in Table 5-24.

Table 5-23 Summary of model on management

Model	R	R square	Adjusted R square	SE of the estimate
1	.620[a]	0.384	0.374	1.03278
2	.713[b]	0.509	0.492	0.92982

Table 5-24 ANOVA of energy strategy, renewable energy and management

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	39.860	1	39.860	37.370	.000[b]
	Residual	63.998	60	1.067		
	Total	103.858	61			
2	Regression	52.849	2	26.425	30.564	.000[c]
	Residual	51.009	59	0.865		
	Total	103.858	61			

An inspection of the individual predictors revealed that energy strategy (beta = .487, $p < .0001$) and renewable energy (beta = .378, $p < .0001$) are significant predictors of the management of organisations (Table 5-25). Higher levels of energy efficiency and conservation and renewable energy strategies are associated with higher levels of management.

Table 5-25 Coefficients of energy strategy, renewable energy and management

Model		Unstandardised coefficients		Standardised coefficients	t	Sig.
		B	SE	Beta		
1	(Constant)	-0.227	0.443		-0.513	0.610
	Energy strategy	0.897	0.147	0.620	6.113	0.000
2	(Constant)	-0.787	0.424		-1.854	0.069
	Energy strategy	0.706	0.141	0.487	5.004	0.000
	Renewable energy	0.624	0.161	0.378	3.876	0.000

Energy efficiency and conservation methods had no significant effect on management.

5.3.9 Regression of variables on energy strategy

Multiple regression analysis was conducted to examine whether energy efficiency and conservation methods, renewable energy methods, management aspects and risk management had an effect on the energy strategies of the organisation. The coefficient of determination (R^2) indicated how well the regression model fitted the data. In the research, the R^2 value was 0.482, as indicated in Table 5-26. This indicates that management aspects and energy efficiency and conservation methods explain 48.20% of variation in energy strategies of the organisation, which was revealed to be statistically significant [$F_{2,56} = 25.090$, $p < .0001$], as shown in Table 5.27.

Table 5-26 Summary of model on energy strategy

Model	R	R square	Adjusted R square	SE of the estimate
1	.628[a]	0.395	0.384	0.72593
2	.694[b]	0.482	0.462	0.67803

Table 5-27 ANOVA of management, energy efficiency and conservation and energy strategy

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	18.911	1	18.911	35.885	.000[b]
	Residual	28.984	55	0.527		
	Total	47.894	56			
2	Regression	23.069	2	11.534	25.090	.000[c]
	Residual	24.825	54	0.460		
	Total	47.894	56			

An inspection of the individual predictors revealed that management aspects (beta = .388, $p < .003$) and energy efficiency and conservation methods (beta = .380, $p < .004$) were significant predictors of the energy strategy of organisations, as indicated in Table 5-28. Higher levels of management and energy efficiency and conservation strategies are associated with higher levels of energy strategies.

Table 5-28 Coefficients of management, energy efficiency and conservation and energy strategy

Model		Unstandardised coefficients		Standardised coefficients	t	Sig.
		B	SE	Beta		
1	(Constant)	1.846	0.200		9.224	0.000
	Management	0.436	0.073	0.628	5.990	0.000
2	(Constant)	1.073	0.318		3.374	0.001
	Management	0.269	0.088	0.388	3.071	0.003
	Energy efficiency and conservation	0.336	0.112	0.380	3.008	0.004

Renewable energy strategies and risk management had no significant effect on energy strategies.

5.3.10 Regression of variables related to energy conservation and efficiency methods in terms of reduction of energy costs

Multiple regression analysis was conducted to examine whether the implementation of energy efficiency and conservation methods, the communication of these strategies and the effectiveness of the strategies had an effect on the reduction of energy costs. The coefficient of determination (R^2) indicated how well the regression model fitted the data. In the research, the R^2 value was 0.757, as indicated in Table 5-29. This indicated that the implementation of energy efficiency and conservation methods, the communication of the strategies and the effectiveness of the strategies explained 75.7% of variation in the reduction of energy costs in the organisation, which was revealed to be statistically significant [$F_{2,66} = 99.514$, $p < .0001$], as indicated in Table 5-30.

Table 5-29 Summary of model on reduction in energy cost

Model	R	R square	Adjusted R square	SE of the estimate
1	.837[a]	.700	.695	.697
2	.870[b]	.757	.749	.632

Table 5-30 ANOVA of communication, energy efficiency and conservation methods and reduction in energy cost

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	73.637	1	73.637	151.673	.000[b]
	Residual	31.557	65	.485		
	Total	105.194	66			
2	Regression	79.598	2	39.799	99.514	.000[c]
	Residual	25.596	64	.400		
	Total	105.194	66			

An inspection of the individual predictors revealed that communication of the energy strategy (beta = .694, $p < .0001$) and energy efficiency and conservation strategies (beta = .278, $p < .0001$) are significant predictors of a reduction in energy costs in organisations, as indicated in Table 5-31. Higher levels of energy efficiency and conservation strategies and communication of the strategies are associated with higher levels of reduction in energy costs.

Table 5-31 Coefficients of communication, energy efficiency and conservation methods and reduction in energy cost

Model		Unstandardised coefficients B	Unstandardised coefficients SE	Standardised coefficients Beta	t	Sig.
1	(Constant)	.854	.206		4.148	.000
	Your organisation communicates its energy conservation and efficiency strategies to employees in the organisation	.774	.063	.837	12.316	
2	(Constant)	-.178	.326		-.545	.587
	Your organisation communicates its energy conservation and efficiency strategies to employees in the organisation	.642	.067	.694	9.644	.000
	Energy efficiency and conservation methods	.375	.097	.278	3.861	.000

The effectiveness of energy efficiency and conservation methods had no significant effect on a reduction of energy costs in organisations.

5.3.11 Regression of variables related to renewable energy methods on reduction of energy cost

Multiple regression analysis was conducted to examine whether the implementation of renewable energy methods, the communication of these strategies and the effectiveness of the strategies had an effect on the reduction of energy costs. The coefficient of determination (R^2) indicated how well the regression model fitted the data. In the research, the R^2 value was 0.790, as indicated in Table 5-32. This indicates that the implementation of renewable energy, the communication of the strategies and the effectiveness of the strategies explain 79.0% of variation in the reduction of energy costs in organisations, which was revealed to be statistically significant [$F_{1,56} = 207.003$, $p < .0001$], as indicated in Table 5-33.

Table 5-32 Summary of model on renewable energy and reduction of energy cost

Model	R	R square	Adjusted R square	SE of the estimate
1	.889[a]	.790	.786	.675

Table 5-33 ANOVA of communication of renewable energy methods and reduction in energy cost

Model		Sum of squares	df	Mean square	F	Sig.
1	Regression	94.227	1	94.227	207.003	.000[b]
	Residual	25.036	55	.455		
	Total	119.263	56			

An inspection of the individual predictors revealed that communication of the renewable energy strategy (beta = .889, $p < .0001$) is a significant predictor of a reduction in energy costs in organisations (Table5-34). Higher levels of renewable energy communication are associated with higher levels of reduction in energy costs.

Table 5-34 Coefficients of communication of renewable energy methods and reduction of energy cost

Model		Unstandardised coefficients		Standardised coefficients	t	Sig.
		B	SE	Beta		
1	(Constant)	.231	.173		1.333	.188
	Your organisation communicates its renewable energy strategies to employees in the organisation.	.864	.060	.889	14.388	.000

The renewable energy methods employed and the effectiveness of renewable energy methods had no significant effect on a reduction in energy costs of organisations.

5.4 Structured approach to energy risk management

Energy management has become a focal point of organisational strategy in order to decrease energy costs and GHG emissions. Energy risk management is an important responsibility of organisations due to increases in marketable energy and the costs of energy. Although organisations are unable to control energy costs, policy changes and the economy, they can improve the management of energy in their organisations by implementing sound energy risk management strategies. According to the data, 74.4% of respondents indicated that energy risk management played an important role in the overall business strategy of their organisation, with 60.5% of respondents indicating that, at the time of this research, their organisation had implemented an energy risk management structure. An energy risk management strategy is therefore an important task of the organisation for improving energy performance. The structured approach to energy risk management was discussed in the literature review of both ISO50001 (Figure 2-2) and ISO30001 (Figure 3-1), as shown in Figure 5-31. The structured approach to energy risk management will be further evaluated in terms of the data gathered and relevant literature.

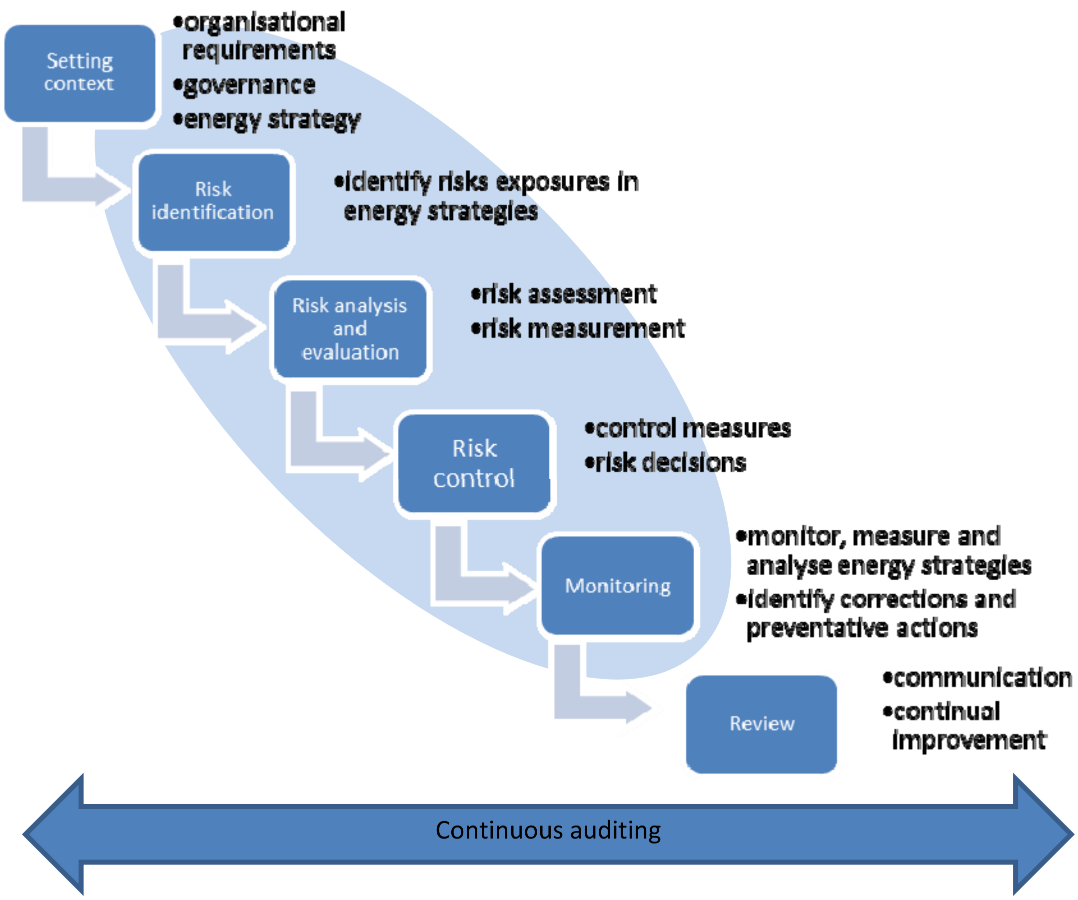


Figure 5-31 Structured approach to energy risk management

Source: Author

5.4.1 Setting context

The setting of the context is the first stage in the risk management process. It is important for organisations to understand the environment within which they operate and the risks in which they will be involved. It is important for risk managers to participate in setting the energy management strategies, so that they may identify the various risks within these strategies. According to the data, only about 30% of respondents indicated that, at the time of this research, their risk management departments were involved in the setting of energy management strategies. For organisations to establish their energy strategies within the risk management framework, attention needs to be given to organisational requirements, strategy, management and governance.

5.4.1.1 Organisational requirements

The study evaluate organisational requirements for energy risk management in terms of culture and corporate social responsibility, management and finance.

5.4.1.1.1 Culture and CSR

Culture plays an important role not only in risk management strategies but also in the setting of energy management strategies. A fair number of respondents (55.1%) indicated that energy management strategies played an important role in the culture of their organisation. This figure could be improved if organisations engage in awareness and communication campaigns on various energy strategies and the importance of their implementation to the overall organisational strategy. CSR forms part of the culture of an organisation, and is the commitment of the organisation towards environmental conservation. With the implementation of energy strategies, organisations are able to increase their CSR and their overall reputation. This was also evident from data obtained from the research, with 69.2% of respondents indicating that higher levels of CSR had an influence on the implementation of energy strategies by their organisation. Organisations need to evaluate their energy strategies in order to choose strategies that would assist them in increasing their CSR and reputation.

5.4.1.1.2 Management

Top management within organisations need to develop and implement energy strategies. Through the implementation of various energy strategies, management shows their commitment to continuous improvement of the energy performance of the organisation and to the environment. According to the data obtained from the research, 73.1% of respondents indicated that top management was committed to energy management strategies in their organisations. Management needs to realise that sustainable issues need to form part of the overall organisational strategy and that energy management strategy forms a core part of organisational strategy.

One of the first steps in setting an energy management strategy is the appointment of an energy manager and energy team. The role of the energy team is to set the energy targets and expectations of the organisation, to monitor energy performance and improve on the systems and behaviour regarding the use of energy. According to the data, only 21.8% indicated that an energy manager and energy team had been appointed in their organisations. This might be due to the fact that a very low percentage (37.2%) had adopted a formal energy policy and only 20.4% had implemented ISO50001. This might be an area that organisations could investigate further in order to set a more formal energy management strategy in their organisations.

5.4.1.2.3 Finance

Inadequate incentives and finance (47.4%) have an influence on the decision by an organisation to implement energy management strategies. Although various financing methods are available, such as bank loans, corporate sponsorships, government funding and tax rebates, at the time of the present research, most participating organisations (51.3%) made use of their own funding when implementing energy strategies. This might be due to a lack of awareness of the various methods available, presenting a possible area for further research. High initial capital investment in energy strategies influences organisations regarding the implementation of energy strategies, as was evident from the data obtained from the research, with 67.9% indicating that this had an influence on their organisations. Organisations need to investigate the various finance options available to them to increase their implementation without incurring high additional costs. One of these options is the tax rebate, which is an incentive introduced by government to increase investment in energy projects. According to the data, only 42.3% indicated that the possibility of a tax rebate influenced the decision by the organisation to implement energy strategies. The reason for the low response might be due to the administrative burden involved or a lack of knowledge and understanding of the various options available.

Cost information regarding energy strategies is important for setting baseline figures, which enable organisations to monitor and evaluate their energy performance. The information is also needed in order to make decisions on the various energy strategies and risks that are likely for the organisation. This information is considered difficult to obtain, with 59% of respondents indicating that information was difficult to obtain. It might be that the information is available but not easily accessible or that organisations are simply unaware of where to find what they need. The benefit of implementing energy strategies is a decrease in operating costs due to a decrease in energy costs. This was evident from the data, with 69.2% of respondents indicating that this aspect had an influence on the decision by the organisation regarding energy management strategies. It is therefore important for management within organisations to gather all relevant information in order to set the energy budget and evaluate the cost benefit of each energy strategy for their organisation.

5.4.1.2 Governance

Energy policy is an important part of the energy strategy of an organisation as it shows management's commitment to the overall energy performance of the organisation. The energy policy is developed by management in order to assist in the improvement of the overall management of the organisation. Management needs to evaluate all the relevant external policies related to energy strategies, including the White Paper on Energy Policy (1998), the White Paper on Renewable Energy Policy (2003), the National Energy Act (No. 34 of 2008), the Integrated Energy Plan (2003) and the NEES (2005), in order to set a framework for action that would assist the organisation to set relevant targets and objectives. This was also seen in the data, with 67.9% of respondents indicating that the setting of an energy policy was important for energy risk management. Although respondents indicated that it was important to have a formal energy policy, only 37.2% indicated that their organisations had adopted such a policy. This needs to be improved upon. The function of the formal energy policy is to assist organisations in setting energy targets and objectives. Only 47.4% of the respondents indicated that the policy assisted in setting these targets. The low figure may well be related to the fact that so few had adopted such a policy at the time of this research.

5.4.1.3 Energy strategy

The energy strategy involves an analysis of the various energy methods available to the organisation. These include the use of energy conservation and efficiency, and renewable energy methods. Energy conservation and efficiency methods are low-cost and relatively easy to implement. These methods are switching off lights when not in use, making use of energy-saving light bulbs, installing timers on lights, re-setting the central heating and cooling systems and restricting the use of portable heating and cooling systems. According to data obtained from the research, most respondents indicated that their organisation implemented these strategies to some extent and that most were effective, having a reducing effect on operational costs.

Renewable energy methods are more costly than energy conservation and efficiency strategies. These are the use of solar energy, wind turbines and biomass. As these are costly methods to implement, most respondents indicated that they were not used within their organisations at the time of the research. The respondents who were using some form of renewable energy, regarded these strategies as effective in decreasing the energy costs of the organisation.

5.4.2 Risk identification

Risk identification requires organisations to take a holistic view of all the requirements of the organisation, including legal and regulatory requirements and economic aspects. Organisations needs to identify all the relevant sources of risk involved in a current or proposed energy strategy, and its consequences for the achievement of the targets and objectives of the organisation. From the literature and research, the following risks were identified as having an influence on energy strategies:

a) disaster risk – risk of loss due to external factors outside the control of the organisation;
b) reputational risk – the risk of loss due to negative publicity relating to energy strategies;
c) operational risk – risk of loss due to damage of infrastructure, inadequate processes, procedures and external influences in energy strategies;
d) regulatory risk – risk of loss due to changes in tax legislation and policies related to energy strategies;
e) strategic risk – risk of loss due to viability of the organisation in terms of energy strategies;

f) financial risk – risk of loss in terms of the profitability of the organisation due to the implementation of energy strategies;
g) market risk – risk of loss due to changes in the market value of the underlying instruments related to energy strategies;
h) liquidity risk – risk that the organisation will not be able to make financial payments to the counterparties related to energy strategies; and
i) credit risk – risk that the counterparty will not be able to fulfil its contractual obligations related to the energy strategies.

It is important for organisations to identify all the risk exposures related to its energy strategy in order to analyse, evaluate and monitor the strategy in accordance with the set criteria and targets.

5.4.3 Risk analysis and evaluation

In the risk analysis stage, organisations need to decide on the likelihood that the identified risks will occur, and to establish possible responses in order to manage adverse effects, should the events occur. With a proper understanding of the various risks in their energy strategy, management could use the analysis stage as input to evaluate whether the various risks should be accepted or treated.

The risk evaluation will then assist management in making decisions, based on the outcome of the analysis. At this stage, the various risks will be compared to the pre-set criteria within the organisation. Management assigns a quantifiable value to the various risks in order to establish the financial outcome of each risk on the overall operations of the organisation.

5.4.4 Risk control

During the risk control stage, organisations establish a proper response and plan, in order to manage any unacceptable risks, and find opportunities for the organisation to achieve its objectives. Organisations need to develop a cost-effective plan in order to treat risks by avoiding, reducing, transferring or retaining each identified risk. The risk control stage did not form part of the scope of the present research and could be an area for further research in order to investigate the methods of which organisations make use to treat the risks associated with energy projects.

5.4.5 Monitoring

The monitoring stage takes place when organisations monitor the various risks of the energy strategy. Organisations need to review previous decisions and identify new and emerging risks associated with the energy strategy. They need to identify corrective actions and implement preventative measures to manage the energy risk optimally.

5.4.6 Review

Communication needs to be done on a continuous basis in order to inform all relevant stakeholders of the energy strategy and the risks involved in the strategy. Communication will assist organisations to implement improvement plans more effectively.

5.4.6.1 Communication

It is the responsibility of management to make sure that all employees are competent through training and awareness campaigns on the energy goals and strategy. A lack of knowledge and awareness had an influence on participating organisations regarding their implementation of energy strategies (70.8%). This is also evident from the literature, which indicated that a lack of knowledge, awareness and education was one of the key barriers for the implementation of appropriate strategies. Government aims to promote knowledge sharing and best practice through the NEES. Although most respondents (71.8%) indicated that there was some form of communication of energy strategies in their organisations, this figure could be improved, and the level of awareness could be raised by strategic awareness campaigns and training of staff on the benefits of the energy conservation and efficiency and the use of renewable energy.

5.4.6.2 Continual improvements

The energy data needs to be reviewed regularly in order to find opportunities for more savings and to improve on current energy strategies. Responses showed that 43.6% of participating organisations reviewed their data. This indicates that many organisations were failing to review their data and missing opportunities for improvements and costs savings. The implementation of ISO50001 was very low among respondents, at only 20.4%. ISO50001 was introduced to assist organisations with developing systems and processes to improve energy performance, use and consumption. This might be an area for organisations to investigate in order to implement a more formal energy strategy.

5.4.7 Internal auditing

Internal auditing affecting energy strategies is done throughout the process. During auditing, organisations monitor, measure and analyse the various activities of their energy strategies, evaluating compliance with the relevant energy policy as well as their own targets and objectives. During the audit, non-compliance is identified and corrective action implemented.

5.5 Conclusion

According to the data obtained throughout the present research and the literature, it is clear that the implementation of a structured approach to energy risk management is an important consideration for organisations. Organisations should implement a structured approach to energy risk, starting with reviewing their own context. This will involve examining their culture, their level of CSR, the commitment of managers and employees to environmental conservation, and the financial benefits that energy strategies might have for the organisation. Organisations then have to identify the risks involved in the implementation of an energy strategy and analyse and monitor these, so that they are prepared with relevant control measures. The energy strategies need to be implemented and continuously monitored in order to identify possible weaknesses, and corrections and preventative measures should be implemented. Communication forms part of this process, and needs to be ongoing, vigorous and clear. Through regular communication and awareness campaigns, the organisation could show the benefits of energy strategies not only for the profitability of the organisation but also for the environment. The next chapter will provide a general conclusion on the structured approach to energy risk management as well as a discussion on the outcomes of the various research objectives for this study.

CHAPTER 6 GENERAL CONCLUSION AND DISCUSSION

6.1 Introduction

The purpose of this study was to establish a structured approach to the management of energy risk, to ensure maximum efficiency for the energy strategies of organisations for the overall benefit of the environment. The study involved an extensive literature review on risk and energy management in order to identify the various criteria required for a structured approach to energy risk management. Empirical research was conducted by means of a questionnaire that was sent to managers in the financial services sector in order to evaluate the importance of these criteria for the organisations. This chapter summarises the thesis, discusses the various findings and contributions, points out the limitations of the current study and outlines suggestions for future research.

6.2 Literature

Energy conservation, efficiency and renewable energy clearly comprise an important topic and one that is frequently raised in everyday life and business. Wallace (2011) highlights the value of an energy strategy for businesses, pointing out the environmental benefits and possible cost savings for organisations as two of its main benefits. ISO50001 was introduced in 2011 with the main goal of enabling companies to increase energy efficiency and decrease costs. Increases in marketable energy and the costs associated with energy highlight the importance of energy management and energy risk management in organisations. Although total energy usage in the commerce sector is fairly low at less than 10% of the total consumption of the country in 2014 (IEA 2014), there are still considerable opportunities for this sector to improve its overall energy usage, both for benefits to the country and for the individual organisations themselves.

According to data obtained from the research, it was evident that most respondents felt that energy risk management played an important part in their implementation of energy strategies. It was encouraging that more than half of the respondents (60.5%) were already implementing some form of energy risk management in their organisations. There are, however, many areas in which organisations could improve regarding the structured approach to energy risk management. In many cases, a formal energy policy was entirely lacking, and the presence of a dedicated energy team and manager was the exception rather than the rule. With only 20% adopting ISO50001, there is much room for improvement. The ISO50001 is a fundamental document for the initiation of a proper policy and strategy within organisations. Reviews need to be undertaken on a continuous basis in order for strategies not to become outworn and outdated, and for weaknesses not to be carried over from year to year. Similarly, without vigorous communication of all energy-related strategies, such strategies are unable to gain traction and become an integral part of organisational culture and mind-set.

6.3 Findings with regard to the research objectives

6.3.1 Sub-objective 01: *Evaluate the current definitions of energy risk within organisations*

Energy risk was defined by the literature as the risk associated with energy strategies (energy conservation, efficiency and renewable energy) and investment in energy strategies (see section 1.2.2). Risks in energy projects are financial risks (market, credit and liquidity risk) and non-financial risks (operational, reputational, disaster, strategic and regulatory risk).

6.3.2 Sub-objective 02: *Determine the various energy risk management processes*

No clear definition for energy risk management was available from the literature. Most of the previous studies on the management of energy risks focussed on the energy market and not on the commercial sector (see section 3.3). For the purpose of this study, the definitions of risk management and energy management were evaluated in order to establish a definition for energy risk management. Energy risk management was therefore defined as the process of identifying, evaluating, measuring and managing energy strategies (including energy conservation, efficiency and renewable energy) to improve the energy performance of an organisation.

6.3.3 Sub-objective 03: *Determine the criteria to be considered for effective energy risk management*

From the literature, the following criteria were determined and then evaluated through empirical research:

- Energy strategy (organisational context): the understanding of energy costs and energy targets within the organisation, the culture and CSR of the organisation, the knowledge and understanding of the organisation regarding energy strategies, and the commitment of top management towards the improvement of energy performance and the development and implementation of energy strategies.
- Energy planning (conservation, efficiency and renewable energy): the planning of the energy strategy, looking at energy conservation and efficiency and options for renewable energy. According to data obtained from the research, it was evident that most organisations had implemented some form of energy conservation and efficiency. A small percentage made use of renewable energy sources, as these still require larger capital outlays than other energy strategies.
- Management: the understanding of the importance of the energy policy and its adoption in organisations, using the energy policy to set the targets and objectives regarding energy, and reviewing and monitoring these in order to identify areas for improvement. ISO50001 is a guideline for the management of energy systems and could assist organisations in their implementation of an energy strategy. Management includes appointing a dedicated energy manager and energy team to set targets, monitor, communicate with and train employees.
- Finance: inadequate incentives and finance constitute a barrier for most organisations in their implementation of energy strategies; yet, the implementation of these strategies could reduce operating costs by reducing energy costs. Various finance options are available (bank loans, corporate sponsorships, government funding, tax rebates and own funding). Most

organisations make use of own funding but the possibility of a tax rebate has some influence on their decisions regarding energy strategies.

- Risk management: the risk management department should form part of the energy team in order to identify the various risks associated with energy strategies and be prepared to manage these accordingly. Energy strategy risks include financial risk, credit risk, reputational risk, market risk, liquidity risk, operational risk, disaster risk, regulatory risk and strategic risk.

6.3.4 Sub-objective 04: *Determine the perceived success of energy strategies within organisations*

Energy strategy forms an important part of organisational strategy as was evident from the literature and the research conducted. From the respondents who indicated 'to some degree' or 'to a strong degree' for the statements regarding success of energy strategies, we can rank the issues in order of important considerations for the organisation as follows:

- making energy risk management part of the overall business strategy;
- top management's commitment to energy management strategies;
- a lack of knowledge, awareness and education;
- increasing the CSR; and
- implementing the energy risk management strategy.

As organisations are unable to control energy costs, policy changes and the economy, the role of energy risk management has increased. Energy risk management plays an important part in organisational strategy as it could assist in decreasing not only energy costs but also total GHG emissions. In most large organisations, top management has started to realised that sustainable environmental issues need to form part of the overall strategy of the organisation (see section 2.1). One of the responsibilities of management is a commitment to the continuous improvement of energy management strategies within their organisations (see section 2.5.1). The commitment of top management was found to be an important aspect of energy strategy implementation. It is the responsibility of management to develop the relevant energy strategies in order to incorporate sustainability issues in the organisational strategy.

Winkler and Van Es (2007), Harnisch (2009) and Pegels (2010) indicate that one of the barriers for the implementation of energy strategies is a lack of knowledge, understanding and awareness (see section 2.2.3.2). A lack of knowledge and awareness regarding energy strategies is still a major barrier for organisations, as was indicated in this research. This can be overcome through proper communication and through government's NEES, which promotes knowledge sharing and best practice to increase investment in energy strategies (see section 2.4.5). One of the benefits of the implementation of energy management strategies is the possibility of an increase in overall CSR (Altan 2010; Prindle & De Fontaine 2009). Through CSR, organisations could show a positive contribution to environmental conservation and increase their reputation with the public (see section 2.2.3.1). It was found in the research that an increase in CSR had an influence on decisions by organisations to implement energy strategies. Most had already implemented an energy risk management strategy, which could nonetheless be improved through various awareness campaigns and a more structured approach to the risks involved.

6.3.5 Sub-objective 05: *Evaluate the perceived success of energy conservation, efficiency and renewable energy methods within organisations*

Energy conservation and efficiency methods include switching off lights when not in use, using energy-saving light bulbs, installing timers on lights, re-setting central heating/cooling systems and restricting the use of portable heating/cooling systems (see section 2.2). Most respondents indicated that their organisations implemented the various energy conservation and efficiency methods and that these were relatively effective in decreasing the costs of energy (see section 5.2.3). In this study, renewable energy sources included solar heating, wind turbines and biomass (see section 2.2). At the time of this research, very few of the respondents indicated that their organisations made use of renewable energy (less than 25%), although it was seen as an effective strategy in decreasing energy costs within the organisation.

Energy management is an important part of organisational strategy as it assists in decreasing energy costs and GHG emissions. Organisations cannot control energy cost, policy changes and the economy, but they can improve the management of their energy by implementing energy management strategies. This was evident from the data obtained during the present research, which indicated that energy costs had a significant influence on the implementation of energy conservation and energy efficiency strategies – especially when energy costs were over 10% of total operating costs. Although energy costs had a significant influence on the implementation of renewable energy strategies, the respondents indicated that whether the percentage of energy costs was greater or less than 10% of total operating costs did not have an influence on the implementation of these strategies.

It was evident from the data that the implementation of energy efficiency, conservation and renewable energy strategies assisted organisations to decrease their energy costs. This is in line with the literature (Department of Energy 2013; Energy Star 2005b; ISO 2011; Piñero 2009; PSEE 2015), which indicated that energy strategies could assist organisations to decrease energy costs. Although the number of years that organisations set to reach their energy targets did not influence their implementation of energy strategies, this might change in future, when more formal energy targets are set by international and domestic bodies, to which organisations will need to adhere.

According to data obtained from the research, it was evident that the communication of energy efficiency and conservation strategies, as well as the overall energy strategy is a predictor of a reduction in cost. Higher levels of communication are associated with a higher level of reduction in energy costs. It is therefore important for organisations not to neglect communicating their energy strategies to employees, as this has an effect on the energy cost of the organisation.

6.3.6 Sub-objective 06: *Determine the management criteria for effective energy risk management*

The management section of the research evaluated the energy policy, the reviewing of data, the implementation of ISO50001, the culture and the presence of a dedicated energy team in organisations. The energy policy is a formal statement that is made by management in order to show their commitment to the improvement of the energy performance of the organisation (see section 2.5.1). The function of the energy policy is to set the framework for action within the organisation. Organisations will use this framework to set the relevant targets and objectives. Most respondents indicated that a formal energy policy was important for the implementation of energy strategies, although more than half (62.8%) had not yet adopted a formal energy policy within their own organisations. As the energy policy sets the formal framework for action, it is important for organisations to develop such a policy in order to show their commitment to improving overall energy performance. The energy policy also assists organisations in setting the energy targets and objectives. More than half the respondents (52.6%) indicated that the energy policy did not serve as a guideline for targets and objectives. This might be due to the fact that they had not adopted a formal energy policy. It is certainly an area to which organisations could pay attention. Another management aspect that was identified was the reviewing of energy data. The reviewing of energy data is an important management function in order to change the energy policy, adapt energy targets and objectives, and evaluate the resources used in the energy management system (Antunes *et al.* 2014; Gopalakrishnan & Ramamoorthy 2014). Fewer than half of the respondents (43.6%) indicated that the energy data was reviewed and used to identify opportunities for improvement. This is an area for organisations to improve on when implementing energy risk management strategies.

ISO50001 was introduced in 2011 in order to promote energy efficiency and decrease GHG emissions. This standard is not compulsory for organisations but could add value to their management of energy strategies. According to data obtained during the present research, it was evident that, at the time of the research, only 20% of organisations had adopted ISO50001. This might be an area for organisations to consider in order to improve their energy management.

Culture in organisations plays a decisive role in how they make decisions and implement energy strategies. Organisations need to understand both their external and internal environments in order to make relevant and effective decisions regarding energy. This includes acknowledging their own internal culture (see section 2.2.3.2). More than half the respondents (55.1%) indicated that culture had an influence on the energy management strategies of their organisations. This percentage might be increased through the implementation of a formal energy policy and appointment of a dedicated energy team. The appointment of the energy team and energy managers is the responsibility of top management. The function of the team is to set the relevant targets and objectives, train employees and communicate the various strategies to all stakeholders. At the time of the research, most organisations did not have a dedicated energy manager and energy team, which is related to the fact that they had not yet adopted a formal energy policy. This is an area that they could investigate in order to improve their energy management.

According to data obtained from the research, it was evident that higher levels of energy strategies are associated with higher levels of management. Although energy conservation and efficiency methods did not have an influence on management aspects of the organisations under study, they still formed an important part of the overall energy strategy to enable a holistic overview of energy performance within the organisation.

6.3.7 Sub-objective 07: *Determine the influence of finance on the implementation of energy strategies*

One of the barriers to the implementation of energy strategies is inadequate finance and incentives (Dahle & Neumayer 2001; Harnisch 2009). Although various finance options are available to organisations in order to implement energy strategies (see section 3.2), most respondents still made use of own funding when implementing energy projects. Tax rebates were implemented by government in order to increase investments in energy strategies. Fewer than half of the respondents (42.3%) indicated that this had an influence on the decisions made by management. This might be due to a lack of knowledge or awareness of how the tax rebate process works. The high initial capital required for energy projects is still a barrier for organisations in terms of the implementation of strategies, although the strategies do assist organisations to decrease their energy costs. Organisations might investigate the various finance options available in order to increase their investment in energy strategies and decrease their overall costs.

6.3.8 Sub-objective 08: *Identify the effect of energy strategies on organisations*

According to data obtained from the research, it was evident that high levels of management and energy conservation and efficiency methods are associated with comprehensive energy strategies. Therefore, an increase in management aspects (energy policy, culture and energy team) will have a positive effect on the CSR, energy awareness within the organisation and the commitment of top managers. This is also true of the implementation of energy conservation and efficiency methods, which will have a positive effect on the variables of the energy strategy. Communication is an important aspect for the implementation of energy strategies. It was evident from data obtained from the current research that a high level of both energy strategy and communication regarding energy strategies was associated with a high level of risk management. Energy strategies included setting energy targets, recognising the importance of risk management, overall CSR, general knowledge and awareness, and top management's commitment to energy strategies (all of which constitutes organisational context).

6.3.9 Sub-objective 09: *Develop a structured approach for the implementation of energy risk management*

The structured approach to energy risk management was developed through a literature review on energy and risk management as indicated in Figure 5-31 and reiterated in Figure 6-1 below. The criteria within the structure were then tested by means of a questionnaire sent to managers in the financial services sector.

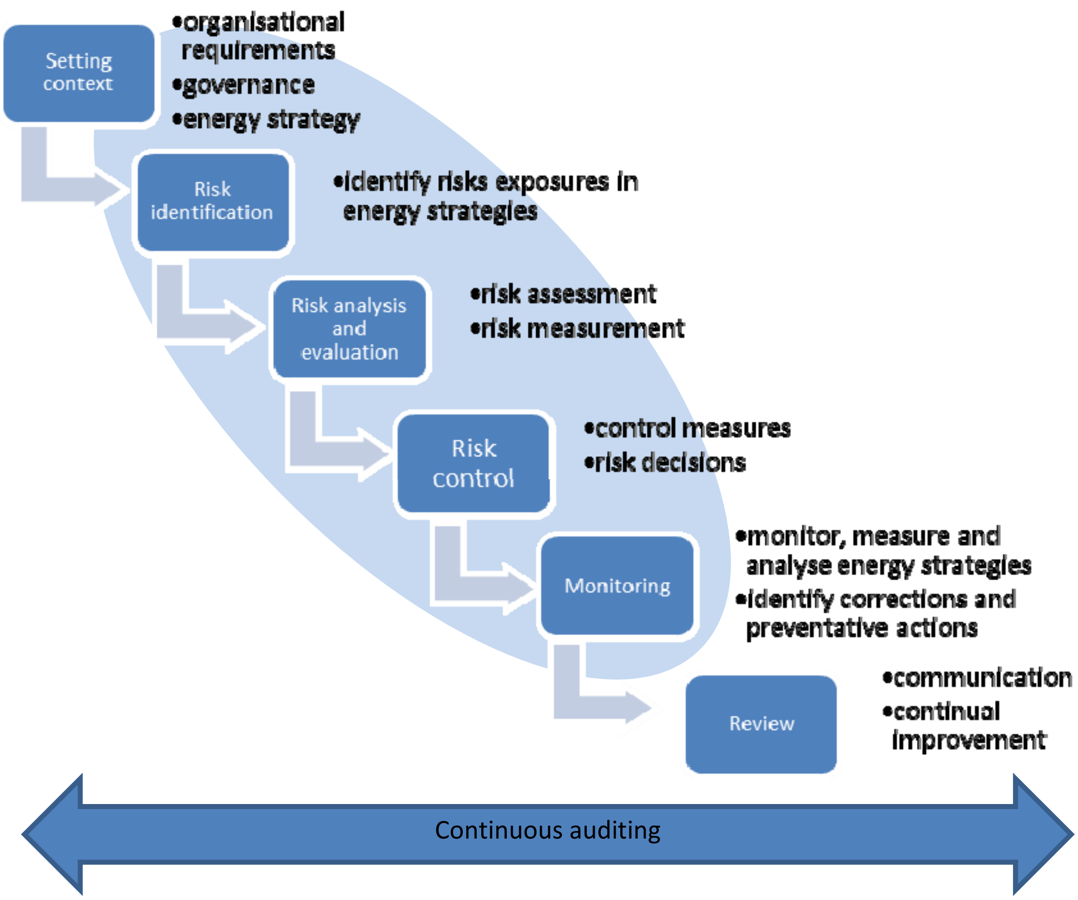


Figure 6-1 Structured approach to energy risk management

Source: Author

According to the research, it is evident that communication regarding energy planning and strategies plays a vital role in the success of the energy risk management strategy. Communication should be done on a continuous basis and should insist on continual improvements in the various strategies implemented by organisations. This falls under the review stage of the structured approach to energy risk management, and forms part of all aspects of the strategy. As was indicated in the research, an increase in the energy strategy has a positive influence on the risk management of the organisation. It is therefore important for organisations to evaluate the context within which their organisations operate. They need to examine critically their culture and possible increases in their CSR, various management aspects of their organisation and the various finance options available. Following that, organisations will need to pay attention to the policies and regulatory requirements in order to set a formal energy policy to guide the organisation in setting its targets and objectives. The last part in this stage will be energy planning, where management evaluate and identify the various energy methods that would best suit their organisations.

The next stage is to identify all the relevant risk exposures related to the various energy strategies. The identified risks are then analysed and evaluated in order to control the risk exposure of the organisation. Following this step, the various risks and energy strategies are be monitored in order to identify corrective actions and preventative measures, and to use the data in order to make changes to the policies, targets and objectives.

6.4 Limitations of the research

A limitation of the research concerns the sample used. A non-probability sampling method was used to draw a sample of managers from the financial services sector. The research results can therefore not be generalised to the entire population of the business community but are relevant only in terms of the financial services sector. This is an area for further research, where the evaluation of a structured approach to energy risk management could be tested in other sectors of the SA economy as well as comparisons with international implementation.

6.5 Suggestions for further research

This study focussed mainly on a structured approach to energy risk management within the financial services sector of South Africa. An important direction for future research in this field could refer to the outcome of the structured approach to energy risk management within other sectors of the SA economy as well as the implementation and evaluation of the approach in international organisations. Future research, related to energy risk management, could include energy conservation and efficiency methods, which were identified as areas of concern during the empirical analysis.

- Energy conservation and efficiency methods

According to the data gathered, it was evident that most organisations implemented various energy efficiency and conservation methods. Although some of the energy methods were implemented by the organisations, not all were seen as being ineffective in decreasing energy costs. This might be due to a lack of knowledge and awareness of costs associated with this strategy or a resistance to change. Further research could be done on the cost implications of the various strategies, as well as other strategies that are available, such as factors that might increase the success of these strategies.

- Energy policy

The energy policy is a formal statement made by management in order to show their commitment to improve overall energy performance. According to the data, 67.9% of the respondents indicated that an energy policy was an important part of energy risk management, although 62.8% indicated that their organisation had not adopted a formal energy policy yet. The reasons why this is so might constitute an area for further research.

- Finance

According to the data, 47.4% of respondents indicated that inadequate incentives and finance had an influence on the decision by the organisations regarding energy strategies. Various financing methods are available to organisations including bank loans, loans from suppliers of energy-efficiency equipment, cash grants and tax incentives. Most respondents (51.3%) made use of own funding for the implementation of energy management strategies. Further research can be conducted on the various finance options available to organisations, the benefits that these methods might have and possible reasons why organisations are not making use of the various financing methods available.

6.6 Conclusion

Risk management should form part of the energy management strategies of the organisation to enable them to identify the various risks involved in the various energy strategies. According to data obtained from the research, it was evident that, at the time of this research, risk management departments did not participate in the setting of energy strategies. The research showed that energy risk management plays an important role in the overall business strategy and that the vast majority of financial services organisations have already implemented some form of energy risk management. It is the responsibility of top management to show their commitment towards energy and sustainability issues through the development of relevant and sound energy strategies within their organisation. Furthermore, organisations need to promote knowledge sharing and best practices of various energy strategies and risks within these energy strategies to increase not only the investment in energy strategies but also the communication and acceptance by employees within the organisation. Energy strategies could assist organisations to increase their CSR by showing a positive attitude towards energy and environmental conservation.

The structured approach to energy risk management was developed as a tool to assist organisations with their energy strategies and risk management processes. It is important for organisations to set a formal energy policy in order to indicate their commitment to the improvement of energy performances within their organisations. Such a policy will in turn assist the organisation to set realistic targets and objectives related to their energy management, and supply the organisation with relevant energy data that could be reviewed and monitored to identify opportunities for improvement. Culture and communication are crucial factors to consider when decisions are made regarding energy strategies. It is imperative for organisations to establish clear communication guidelines during the strategic energy management process within the framework of the business culture of the organisation.

It is envisaged that the structured approach to energy risk management could serve as an approach for the SA financial services sector and be applied as a platform for international organisations during their strategic planning processes. Apart from the potential topics for further research identified by this study, the study could also serve as a general contribution towards the effective management of energy, which is fast becoming a crucial factor in the sustainability projects of the world.

Appendix A Diagnostic questionnaire

Introduction: Kindly complete the survey in order to evaluate the diagnostic statements below.

Diagnostic survey on energy risk management

Please circle the number which represents your opinion about the questionnaire on energy risk management.	**Strongly Disagree**	**Disagree**	**No opinion**	**Agree**	**Strongly Agree**
1. The objective of the survey is clear.	**1**	**2**	**3**	**4**	**5**
2. The survey was comprehensive in the risk criteria for energy management within an organisation.	**1**	**2**	**3**	**4**	**5**
3. The instructions to complete the survey are clear.	**1**	**2**	**3**	**4**	**5**
4. The survey is structured in a logical manner.	**1**	**2**	**3**	**4**	**5**
5. The statements are easy to understand.	**1**	**2**	**3**	**4**	**5**
6. The scale of the survey is appropriate.	**1**	**2**	**3**	**4**	**5**
7. The questions cover issues that may affect energy risk management within an organisation.	**1**	**2**	**3**	**4**	**5**
8. The time in minutes required to complete the survey was …	**0-5**	**5-10**	**10-15**	**15-20**	**20>**
9. Are there any questions that you wish to add to the survey?				**Yes**	**No**
If Yes please indicate below					

Appendix B Questionnaire

SURVEY ON ENERGY RISK MANAGEMENT

A STRUCTURED APPROACH TO ENERGY RISK MANAGEMENT STRATEGIES FOR THE SOUTH AFRICAN FINANCIAL SERVICES SECTOR

INTRODUCTION

Research is being conducted on the criteria required for an energy risk management strategy within the South African Financial Services Sector.

The purpose of this survey is to confirm the criteria for a structured approach to energy risk management for organisations in South Africa. This is to ensure the maximum efficiency of the organisational risk management processes and to contribute to the environment. Your participation in the survey is voluntary, but your input into the research, by completing this survey, will be greatly appreciated.

The survey will mostly consist of a 5-point scale where you will be required to indicate whether you agree or disagree with the statements provided. The online survey will take approximately 10-15 minutes of your time.

CONFIDENTIALITY

Your answers will be treated as strictly confidential and anonymous. Neither the names of the respondents nor the organisation/institution of the respondent will be disclosed.

SURVEY

1.	**GENERAL ORGANISATIONAL INFORMATION** (kindly circle your answer in the space provided)		**Response**
1.1	Indicate the estimated number of people employed by your organisation	Less than 100	**1**
		101 - 250	**2**
		251 - 500	**3**
		501 - 1000	**4**
		1000 >	**5**
1.2	Indicate in which province your organisation is located	Gauteng	**1**
		North West	**2**

		Limpopo	**3**
		Mpumalanga	**4**
		Free State	**5**
		KwaZulu-Natal	**6**
		Eastern Cape	**7**
		Western Cape	**8**
		Northern Cape	**9**
1.3	Indicate the industry of your organisation	Banking	**1**
		Insurance	**2**
		Investments	**3**
		Asset Management	**4**
		Other	**5**
1.4	Indicate your current position within your organisation	Energy manager	**1**
		Risk manager	**2**
		Financial manager	**3**
		Business manager	**4**
		Internal audit	**5**
		Other (name)	**6**
1.5	To what extent are you involved in energy management within your organisation	To no degree	**1**
		To some degree	**2**
		To a moderate degree	**3**
		To a strong degree	**4**

		To a very strong degree	**5**
1.6	How many years of experience do you have in energy risk management?	Less than 1 year	**1**
		1 - 5 years	**2**
		6 - 10 years	**3**
		More than 10 years	**4**
2.	**ENERGY STRATEGY** (kindly circle your answer in the space provided)		**Respons e**
2.1	According to your understanding what is the organisation's energy cost as a percentage of operating cost?	Don't know	**0**
		Less than 10%	**1**
		Between 10% and 15%	**2**
		Between 15% and 20%	**3**
		Greater than 20%	**4**
2.2	According to your understanding what is the organisation's energy saving target as a percentage of energy cost?	Don't know	**0**
		Between 0% and 3%	**1**
		Between 3% and 6%	**2**
		Between 6% and 9%	**3**
		Greater than 9%	**4**
2.3	According to your understanding how long does the organisation have to reach its energy saving target?	Between 1 and 3 years	**1**
		Between 4 and 6 years	**2**
		Between 7 and 9 years	**3**
		More than 10 years	**4**

	Please circle the number which represents your opinion regarding energy risk management in your organisation	Don't know	To no degree	To some degree	To a moderate	To a degree	To a strong degree
2.4	An energy risk management strategy plays an important role in the overall business strategy of the organisations.	0	1	2	3	4	5
2.5	The increase in corporate social responsibility influences your organisation to implement energy management strategies.	0	1	2	3	4	5
2.6	The limited knowledge and awareness on different energy management strategies influence its implementation within your organisation.	0	1	2	3	4	5
2.7	Your organisation implemented an energy risk management strategy.	0	1	2	3	4	5
2.8	Top management is committed to the energy management strategies within your organisation.	0	1	2	3	4	5
3	**ENERGY EFFICIENCY AND CONSERVATION**						
3.1	Your organisation implements the following energy conservation and efficiency methods:						
	1. switching off lights when not in use	0	1	2	3	4	5
	2. Energy saving light bulbs	0	1	2	3	4	5
	3. Timers on lights	0	1	2	3	4	5
	4. Re-setting of central heating and cooling systems	0	1	2	3	4	5
	5. Restrict the use of portable heating and cooling systems	0	1	2	3	4	5
3.2	Your organisation communicates the energy conservation and efficiency strategies employed to the employees within the organisation.	0	1	2	3	4	5
3.3	The implementation of the following energy conservation and efficiency methods in your organisation is effective:	0	1	2	3	4	5
	1. switching of lights when not in use	0	1	2	3	4	5

	Please circle the number which represents your opinion regarding energy risk management in your organisation	**Don't know**	**To no degree**	**To some degree**	**To a moderate**	**To a degree**	**To a strong degree**
	2. Energy saving light bulbs	**0**	**1**	**2**	**3**	**4**	**5**
	3. Timers of lights	**0**	**1**	**2**	**3**	**4**	**5**
	4. Re-setting of central heating and cooling systems	**0**	**1**	**2**	**3**	**4**	**5**
	5. Restrict the use of portable heating and cooling systems	**0**	**1**	**2**	**3**	**4**	**5**
3.4	The implementation of energy conservation and efficiency methods in your organisation resulted in a reduction of energy costs.	**0**	**1**	**2**	**3**	**4**	**5**
4	**RENEWABLE ENERGY**						
4.1	Your organisation uses the following renewable energy sources:						
	1. Solar energy	**0**	**1**	**2**	**3**	**4**	**5**
	2. Wind turbines	**0**	**1**	**2**	**3**	**4**	**5**
	3. Biomass	**0**	**1**	**2**	**3**	**4**	**5**
	4. None	**0**	**1**	**2**	**3**	**4**	**5**
4.2	Your organisation communicates the renewable energy strategies employed to the employees within the organisation.	**0**	**1**	**2**	**3**	**4**	**5**
4.3	The implementation of the following renewable energy methods in your organisation is effective:	**0**	**1**	**2**	**3**	**4**	**5**
	1. Solar energy	**0**	**1**	**2**	**3**	**4**	**5**
	2. Wind turbines	**0**	**1**	**2**	**3**	**4**	**5**
	3. Biomass	**0**	**1**	**2**	**3**	**4**	**5**
	4. None	**0**	**1**	**2**	**3**	**4**	**5**
4.4	The implementation of renewable energy methods in your organisation resulted in a reduction of energy costs.	**0**	**1**	**2**	**3**	**4**	**5**

	Please circle the number which represents your opinion regarding energy risk management in your organisation	**Don't know**	**To no degree**	**To some degree**	**To a moderate**	**To a degree**	**To a strong degree**
5	**MANAGEMENT**						
5.1	An energy policy is important for energy risk management within your organisation.	**0**	**1**	**2**	**3**	**4**	**5**
5.2	Your organisation adopted a formal energy policy.	**0**	**1**	**2**	**3**	**4**	**5**
5.3	The energy policy within your organisation serves as a guideline for the setting of energy targets and objectives for your organisation.	**0**	**1**	**2**	**3**	**4**	**5**
5.4	Your organisation reviews energy data and identifies opportunities for improvement on a continuous basis.	**0**	**1**	**2**	**3**	**4**	**5**
5.5	Your organisation implemented the International Standard Organisations ISO50001 relating to Energy management systems – requirements with guidance to use.	**0**	**1**	**2**	**3**	**4**	**5**
5.6	Energy management strategies play an important role in the culture of your organisation.	**0**	**1**	**2**	**3**	**4**	**5**
5.7	Your organisation adheres to the appointment of an energy manager and energy management team to set objectives and targets within the organisation.	**0**	**1**	**2**	**3**	**4**	**5**
6	**FINANCE**						
6.1	The possibility of a tax rebate influences your organisation's decision to implement energy management strategies.	**0**	**1**	**2**	**3**	**4**	**5**
6.2	The possibility of a decrease in the operating cost of the organisation influences your organisation's decision to implement energy management strategies.	**0**	**1**	**2**	**3**	**4**	**5**
6.3	The inadequate incentives and finances influence the implementation of energy management strategies within your organisation.	**0**	**1**	**2**	**3**	**4**	**5**
6.4	Your organisation funds energy management strategies through the following:						

Please circle the number which represents your opinion regarding energy risk management in your organisation		Don't know	To no degree	To some degree	To a moderate	To a degree	To a strong degree
	1. Bank loans	**0**	**1**	**2**	**3**	**4**	**5**
	2. Corporate sponsorship	**0**	**1**	**2**	**3**	**4**	**5**
	3. Government funding	**0**	**1**	**2**	**3**	**4**	**5**
	4. Own funding	**0**	**1**	**2**	**3**	**4**	**5**
6.5	Energy management strategies require high initial capital investments.	**0**	**1**	**2**	**3**	**4**	**5**
6.6	Cost information regarding energy management strategies are difficult to obtain.	**0**	**1**	**2**	**3**	**4**	**5**
7	**RISK MANAGEMENT**						
7.1	The risk management department participate in setting the energy management strategy for your organisation.	**0**	**1**	**2**	**3**	**4**	**5**
7.2	The following risk types influence the setting of the energy management strategy of your organisation:						
	1. Financial risk (risk of having insufficient access to capital in order to manage energy projects)	**0**	**1**	**2**	**3**	**4**	**5**
	2. Credit risk (the risk that a counterparty will not fulfil the contractual obligation in terms of financial loans related to energy strategies)	**0**	**1**	**2**	**3**	**4**	**5**
	3. Reputational risk (risk of loss due to damaging publicity and public image related to non-compliance to energy risk regulations)	**0**	**1**	**2**	**3**	**4**	**5**
	4. Market risk (risk of loss due change in market value of the underlying instruments used in energy related strategies)	**0**	**1**	**2**	**3**	**4**	**5**
	5. Liquidity risk (risk that the organisation will not be able to make the financial payments to the counterparty related to the energy strategies employed)	**0**	**1**	**2**	**3**	**4**	**5**
	6. Operational risk (risk of loss, damage or failure due to inadequate internal processes, people, systems and external influences within the energy strategies)	**0**	**1**	**2**	**3**	**4**	**5**
	7. Disaster risk (weather/environmental) (risk of loss due to external factors outside the control of the organisation, e.g. natural disasters)	**0**	**1**	**2**	**3**	**4**	**5**

Please circle the number which represents your opinion regarding energy risk management in your organisation

	Don't know	To no degree	To some degree	To a moderate	To a degree	To a strong degree
8. Regulatory risk (risk related to the uncertainty of regulation of various transactions or a change in the regulatory environment of energy)	**0**	**1**	**2**	**3**	**4**	**5**
9. Strategic risk (risk that affect the viability of the organisation in terms of energy strategies)	**0**	**1**	**2**	**3**	**4**	**5**

END

THANK YOU FOR YOUR PARTICIPATION

Appendix C
Ethics

UNISA university of south africa

FINANCE, RISK MANAGEMENT & BANKING RESEARCH ETHICS REVIEW COMMITTEE

14 August 2015

Ref #: 2015/CEMS/FRM&B/002
Name of applicant: Ms Erika Botha
Student #: **3532-580-1**
Supervisor: Prof J Young
Staff #: 90074904

Dear Ms Botha,

Decision: Ethics Approval

Name: Ms Erika Botha, bothae2@unisa.ac.za, 012 429 4466

Supervisor: Prof J. Young, youngj@unisa.ac.za, 012 429 3010

Proposal: A structured approach to renewable energy risk management for South African corporate organisations

Qualification: DCom in Business Management

Thank you for the application for research ethics clearance by the Department of Finance, Risk management and Banking Research Ethics Review Committee for the above mentioned research. Final approval is granted for the duration of the project.

For full approval: The application was reviewed in compliance with the Unisa Policy on Research Ethics by the DFRB RERC on 13 August 2015.

The proposed research may now commence with the proviso that:

1) The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.
2) Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the department of Finance, Risk Management and Banking Ethics Review Committee. An amended application could be requested if

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there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.

3) The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.

Note:

The reference number 2015/CEMS/FRM&B/002 should be clearly indicated on all forms of communication [e.g. Webmail, E-mail messages, letters] with the intended research participants, as well as with the [add unit/sub unit name] RERC.

Kind regards,

Mutezo

Ashley Mutezo
Chairperson: DFRB Research Ethics Review Committee
0124294595/muteza@unisa.ac.za

Prof Raphael Mpofu
Acting Executive Dean: CEMS

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