

# A critical evaluation of the extent to which sustainability was considered in the Medupi Power Station EIA

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## ABSTRACT

Sustainable development is described by the World Commission on Environment and Development as *“development that meets the needs of present without compromising the ability of future generations to meet their own needs”*. Sustainability assessments are an integrative process and framework for effective integration of social, economic and ecological considerations in significant decision-making processes. Sustainability is incorporated into South African legislation such as the Constitution of the Republic of South Africa (1996), the National Environmental Management Act (Act 107 of 1998), as well as Environmental Impact Assessment (EIA) Regulations. Despite the existence of such legislation, the challenge lies in the effective implementation of the EIA process, which has been identified as a useful tool in striving towards achieving sustainable development. This research uses Gibson’s eight sustainability principles and Gaudreau and Gibson’s sub-criteria to develop a case specific set of sustainability criteria for coal fired power stations in South Africa. The energy generation sector is a major source of social and environmental impacts. Coal power stations contribute to environmental degradation such as reduced air, water and land quality. This industrial process impacts on the environment and therefore needs to strive towards sustainable development by considering these criteria during the EIA process. The set of case specific sustainability criteria for power stations was then used to evaluate the EIA developed for Medupi Power Station in South Africa in order to assess, the extent to which sustainability was considered in the EIA process. The key finding is that sustainability is incorporated into South African legislation hence no change in legislation is required. Despite the existence of legislation, the challenge lies in the fact that it is not always effectively implemented. The EIA process is seen as a tool that can effectively deliver sustainability outcomes. However this process is not effectively utilised. In order for the EIA to consider sustainability the focus needs to be on the following criteria: Intragenerational Equity; Precaution and Adaptation for Resilience; as well as Immediate and Long term Integration, as these were recognised as weaknesses after the evaluation process. The recommendation is also to develop a set of case specific sustainability criteria for other large industries that have significant environmental impacts.

**Key words:** Sustainability, Sustainability Assessment Criteria, Sustainability assessment framework, Environmental Impact Assessment, Medupi Power Station, Adaptation for Resilience, coal fired power stations in South Africa.

## **DECLARATION**

I declare that this research report, apart from the contributions mentioned in the acknowledgement page and the references, is my own work. It is being submitted for the degree Master of Environmental Management at the North-West University, Potchefstroom Campus. This research has not been submitted before for any degree or examination at any other university.

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(Signature of candidate)

May 2015

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## **CHAPTER 1: INTRODUCTION**

### **1.1 Introduction**

Sustainable development was described by the Brundtland Commission in 1987 as “*development that meets the needs of present without compromising the ability of future generations to meet their own needs*” (WCED, 1987:43). This means that all countries (developed and developing) need to establish goals for economic, environmental and social development and these goals must be defined in terms of sustainability. South Africa entwined sustainability into the country’s legal framework, starting with the Constitution of the Republic of South Africa (1996) (Chapter 2, Section 24), which contains an assortment of specific provisions in observance with international sustainability principles. The next part of the legal framework that follows is the National Environmental Management Act (NEMA) 1998 (Act 107 of 1998). The NEMA principles are emphasized in Chapter 2 (Section 3) and entail three pillars namely: social, economic and environmental factors. These principles must be fused into the planning, implementation and decision making phases in order “to ensure that development gives effect to the environmental right” adopted in the Constitution along with key sustainability principles.

Environmental Impact Assessment (EIA) is recognised as one of the suite of tools identified by Sheate (2009) as having sustainability as a goal (Morrison-Saunders and Retief; 2012). This is done by conducting an EIA. EIAs are conducted in terms of NEMA.

There are various tools such as Environmental Management Plans, Environmental Management Systems etc. that can be managed to achieve sustainable development. However, the South African legislation focuses on EIAs as being the key tool to achieve sustainable development for all its citizens (Morrison-Saunders & Retief; 2012: 35). Both Abaza *et al.* (2004:115) and Slootweg *et al.* (2001:20) mention that EIA is the most successfully conventional assessment technique. They also mention that in many countries it is backed by legislation and institutional frameworks.

### **1.2 Purpose of the study**

Industries in general (for example, petroleum, mining, cement, energy generation industries etc.) have environmental impacts such as water, land and air pollution. South Africa consists of different energy mixes which are gas turbine, hydroelectric, nuclear, wind power, concentrated solar power, solar PV power, landfill gas power, biomass power and coal fired power stations. This research zooms into coal fired power stations. Eskom has the following coal fired power stations that consist of Lethabo Power Station; Arnot Power Station; Hendrina Power Station; Duvha Power Station; Kendal Power Station, Kriel Power Station; Majuba Power Station; Matimba Power Station; Matla Power Station; Tutuka Power Station

(the different mentioned power stations are the current operating power stations), Grootvlei Power Station; Camden Power Station; Komati Power Station (these power stations were mothballed but are now in operation), Kusile Power Station and Medupi Power Station (these 2 power stations were new builds). Power stations contribute to environmental degradation such as reduced air (due to the discharge of particulate matter, sulphur, carbon dioxide etc), water (use of a large quantity of water for the input process) and land quality with waste disposal, spillages and so forth as outputs in the process flow. Therefore this research will use a power station EIA as a case study to evaluate critically the extent to which sustainability was considered. Medupi was chosen as a case study instead of Kusile as it had more information available as it was further along in construction unlike Kusile. The construction of Medupi Power Station commenced in 2007. The planned operational life for Medupi Power Station is 50 years. The other reason is that Medupi was one of the biggest and most controversial energy generation projects in the history of South Africa.

Eskom generates almost 95% of the electricity that is used in South Africa and about 45% of all the electricity is produced on the African continent (Eskom Integrated Report: 2011). Therefore it is critical for Eskom to generate a reliable provision of electricity for industrial development together with related employment and sustainable development in South Africa. The demand for electricity has grown over the past few years, with an associated reduction in the surplus generating capacity. Energy storage is regarded as an issue despite there being technical solutions (such as renewable energy sources) demonstrating the economic viability of the option may be a challenge. Storage technologies are faced with high initial cost rates and are often not being able to meet the electricity grids needs (Kaldellis and Zafirakis; 2007). Hence electricity needs to be produced in harmony with its supply-demand requirements.

During 2008 South Africa was challenged with load shedding, previously a foreign concept for South Africa. In order to prevent load shedding, South Africa had to maintain a reserve margin of 15%. The current reserve margin is only 12%. This led to the new build programme, which entailed a need to create new coal fired power stations in order to adequately provide for the growing electricity demand that was identified through Eskom's process. Screening and feasibility studies were undertaken and thereafter the construction of Medupi Power Station commenced in the Lephalale area of Limpopo Province. (Lephalale was previously known as Ellisras.)

In accordance of the EIA Regulations published in terms of the NEMA (107/1998), Eskom Holdings Limited was required to obtain authorisation from the National Department of Environmental Affairs (DEA). This was done in consultation with the Limpopo Department of Economic Development, Environment and Tourism (L DEDET) – for the undertaking of the

building of the Medupi Coal Fired Power Station project. A comprehensive and an independent environmental study was undertaken in accord with the EIA Regulations in order to obtain authorisation for this project (EIA for Medupi Power Station, 2006).

In South Africa, EIA legislation allows for a broad sustainability focus as mentioned in the Constitution and NEMA. However it is not always clear that sustainability is fully considered in EIAs. Hence the purpose of this research study is to evaluate the extent to which sustainability issues were considered in the Medupi EIA.

### **1.3 Research questions**

From the above discussion, the challenges faced become evident. This research will focus on answering the questions below.

- Which sustainability criteria are relevant to the coal fired power generation sector in South Africa?
- To what extent was sustainability considered in the Medupi EIA?
- What recommendations can aid in enhancing sustainability in the coal fired power generation sector?

Chapter 2 will focus on the Research Design together with the Research Methodology and the Research Area.

Chapter 3 will look at what sustainability is and the justification for the use of Gibson's eight sustainability principles (Gibson, 2005) as the basis to develop further a set of sustainability criteria for the coal fired power generation sector in South Africa. The last part of Chapter 3 will focus on the different literature that was reviewed in order to come up with the sustainability criteria. The sustainability criteria will be tabulated at the end of this chapter.

Chapter 4 will consist of the data analysis and results. The set of case specific criteria that were developed in Chapter 3 (after considering Gibson's eight sustainability principles, Gaudrea and Gibson's sub-criteria as well as different literature) were used to evaluate the Medupi EIA. The results were tabulated.

Chapter 5 discusses the strengths and weaknesses identified in the EIA.

Chapter 6 concludes the research and also makes recommendations for further research.

This chapter introduced sustainability as well as the legislation that sustainability stems from. It also indicates the purpose of this study together with a list of the studies research questions. The next chapter will focus on the research methodology.

## **CHAPTER 2: RESEARCH METHODOLOGY**

Chapter 2 will focus on the research methodology that was followed in this research process. It will highlight the steps taken to answer the research questions indicated in Chapter 1.

### **2.1 Research design**

This research was done by analysing a single case study only. Willis (2014) mentions that the following are concerns of using a single case study, inter-related issues of methodological rigour, researcher subjectivity and external validity. However in this case the single case study is justifiable (Yin, 2014:51). Only 2 EIA's were conducted for a cold fired power station as the previous powers were constructed prior 1998 (before the EIA list notices were developed). From the 2 EIA's done, I choose Medupi power station as more information was available due to its construction commencement prior to Kusile power station.

### **2.2 Research method**

The section below will discuss a summary of the research method approach taken for the literature review and the documentation review in order to develop sustainability criteria for power stations.

#### **2.2.1 Literature review**

The first part of the research was to review different literature to develop a set of sustainability criteria for coal fired power generation stations by drawing on literature on sustainability generally, as well as on the sustainability impacts of power. South African literature was incorporated in order to specifically design the criteria for a power station in South Africa. In order to determine which sustainability criteria will be relevant, scanning of different sources of literature from different types of publications (such as journals, books, government documents and the internet) needed to be done. The scope of work was within the sustainability field (international view) and the impacts of large industries (South African context).

#### **2.2.2 Documentation review**

The next step of the research was to review the Medupi Power Station Environmental Impact Assessment report against the developed criteria. The documentation review will be limited to the EIA report. Note the importance of other tools such as EMS and the role of management commitments but that this was not included in the scope of this research.

In order to evaluate the Medupi EIA against the developed criteria, a robot indicator was used to indicate the extent to which the criterion was considered in the EIA. Three colour codings were used for this purpose and they are highlighted in the table 2-1 below:

**TABLE 2-1: LEGEND FOR THE ROBOT INDICATOR**

|          |                             |                                                                                                                                                                              |
|----------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A</b> | <b>Considered</b>           | <b>The criterion does consider all three areas viz. business, community and environmental perspective</b>                                                                    |
| <b>B</b> | <b>Partially considered</b> | <b>The criterion was considered partially by either one perspective example business, community and environmental perspective or partially covered by all 3 perspectives</b> |
| <b>C</b> | <b>Not considered</b>       | <b>The criterion does not consider any of the three areas viz. business, community or environmental perspective</b>                                                          |

#### **Partial consideration (indicated by B of the robot indicator)**

Partial consideration is when one or two areas were considered such as business and community could have been considered and environment not considered and vice versa or only environment could have been considered and business and community could have been left out.

## **2.3 Research study area**

### **2.3.1 Introduction**

Medupi Power Station is a dry-cooled coal fired power station and when completed will have 6 boilers each powering an 800 MW turbine, producing 4800 MW of power. Figure 2-1 below highlights the location of the Lephalale local municipality in South Africa.



**FIGURE 2-1: LOCATION OF THE LEPHALALE LOCAL MUNICIPALITY IN SOUTH AFRICA**

The power station will be installed with supercritical boilers to improve efficiency. This design will be a first for Eskom and will result in better use of water and coal resources, as well as reduced harmful emissions (Eskom Integrated Report, 2011). Figure 2-2 highlights the construction of Medupi Power Station in the Lephalale area.



**FIGURE 2-2: MEDUPI POWER STATION IN THE LEPHALALE AREA**

The word Medupi results from the northern Limpopo province where Lephalale is located. It means ***“rain that soaks parched lands, giving prosperity”***. Medupi’s official title discloses its contribution both to prosperity in the form of energy supply and to acid rain, coal mining,

and climate change, issues that strike at the heart of the “parched lands” of Lephalale and the people residing there (Rafey and Sovacool, 2011:1411).

### 2.3.2 Project location and study area delineation

The Medupi project falls within the Lephalale Local Municipality. This area is within the Waterberg District Municipality in the northern part of Limpopo Province. The Lephalale Local Municipality consists of 11 wards and contains an area of 19 605 km<sup>2</sup>. However the study area consists of three wards which are listed below:

- Ward 2, has an area of 77 km<sup>2</sup> and which includes Grootegeeluk Mine as well as the township of Marapong;
- Ward 3, is a much larger ward directly to the south of Ward 2. This ward has an area of 2047 km<sup>2</sup>;
- Ward 4, has an area of 16 km<sup>2</sup> and comprises of the town of Lephalale (which is formerly known as Ellisras).

Figure 2-3 below illustrates the location of these wards in comparison to the rest of the Lephalale Local Municipality. The dotted encircled area within Figure 2-3 is expanded in Figure 2-4 {this highlights the location and names of the farms selected for the power station and the dump during the scoping study} (EIA for Medupi Power Station, Eskom, 2006:418).

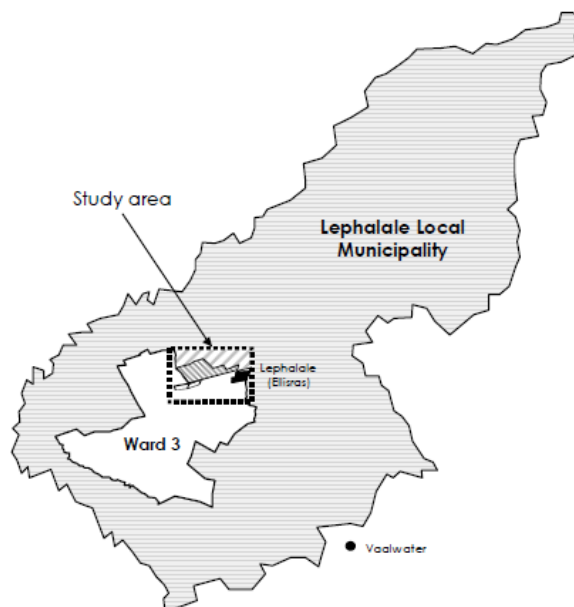


**FIGURE 2-3: THE REGIONAL CONTEXT OF THE STUDY AREA**

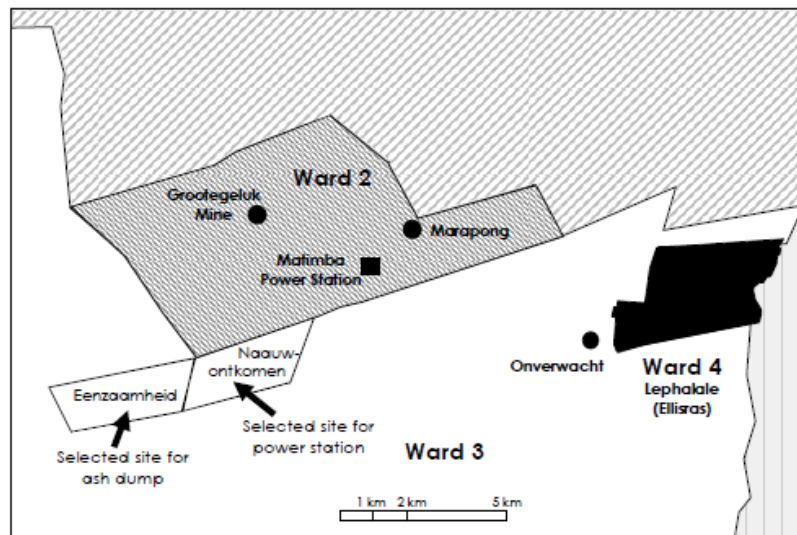


**FIGURE 2-4: OUTLINE OF THE STUDY AREA**

The total population of Lephalale Local Municipality is 100 000 people. Around 3000 people reside in the town of Lephalale. Primarily eight potential sites had been identified prior to the Scoping Phase: the farms Eenzaamheid, Kromdraai, Naauwontkomen, Nelsonskop, Appelvlakte, Kuipersbult, Zongezien and Droogeheuvel. Due to various specialists' studies conducted during the Scoping Phase, the farm Naauwontkomen was carefully chosen as the preferred site. The site was most preferable from a social point of view as the other sites were situated further north. The northern sites are relatively secluded from densely populated areas such as the township of Marapong and would have a higher probability of being negatively affected by construction activities, changes in air quality, increased noise and light pollution etc. (EIA for Medupi Power Station, Eskom, 2006:411).

This chapter's aim was to focus on the research methodology. It comprised of a research design of a case study as well as on the research method. The research method focused on both a literature review (which considered different literature sources to develop a set of sustainability criteria for coal fired power stations) whilst the next step of the research was to review the Medupi Power Station Environmental Impact Assessment report against the developed criteria. The chapter ended with a brief description of the study area. The next chapter is chapter 3 which focuses of the reviewing of literature on sustainability.

## **CHAPTER 3: LITERATURE REVIEW**

### **3.1 Introduction**

The research objective of the literature review is to establish which sustainability criteria will be relevant to the coal fired power generation sector in South Africa by drawing not just on the sustainability impacts of power stations but also literature on sustainability more generally. Furthermore, this chapter looks into the justification for the use of the selected criteria. After consideration of the literature searches the set of case specific sustainability criteria for the coal fired power generation sector will be finalised.

### **3.2 What is sustainability?**

Sustainable development was defined by the Brundtland Commission in 1987 as “development that meets the needs of present without compromising the ability of future generations to meet their own needs” (WCED, 1987:43). This definition encompasses two key concepts. The first is that of “needs”, in particular the vital need of the world’s poor, to which overriding precedence should be given. The second concept is the “idea of limitations” which is imposed by the state of technology and social organisation on the environment’s ability to meet present and future needs (WCED, 1987:37). As mentioned previously, this meant that all countries (developed or developing) need to develop goals for economic, environmental and social development and these goals must be defined in terms of sustainability. John Elkington (1997) considered the “father” of the triple bottom line concept, wrote a book entitled “*Cannibals with forks*” which focuses on the triple bottom line of the twenty first century business. Elkington in 1997 tried to figure out what sustainability meant and came up with the realisation that we need to consider the environment, as well as social and economic components. Gibson (2006:263) mentions that the three pillars approach often go together with an assumption that sustainability is about balancing. This contradicts both the key insights concerning the interdependence of factors and the need for mutually supporting advances on all fronts and it also encourages an emphasis on making trade-offs. However although the trade-offs may often be a necessity it should always be the last resort, not the assumed task, in sustainability assessment. Gibson (2006:266) also goes on to say that the remarkable part of the sustainability concept is its persistence on interconnections and interdependencies. It requires planning and decision-making searches for the links and seeks mutually strengthening gains on all fronts. It is about incorporating and evading trade-offs to the extent possible. By integrating the three pillars from the beginning to the end one may be able to achieve sustainability.

Gibson developed eight generic sustainability principles as set out in Table 3-1 below (Gibson *et al*, 2005). Gibson’s eight principles were used in the paper “Illustrating integrated

sustainability and resilience based assessments: a small-scale biodiesel project in Barbados” written by Gaudreau and Gibson (2010:233), to develop sub-criteria for the biodiesel project. The eight principles and the biodiesel sub-criteria were used to develop a set of more detailed and specific criteria for the power generation sector. This is very useful for this research as the argument is that these criteria are also applicable to a power station. This is a beginning point for the development of my own criteria that can be used for coal fired power generation stations. The sustainability assessment method built by Gibson *et al* (2005:234), focuses on how the interrelations of these requests can be addressed and how it can deliver mutually, multiple strengthening and lasting gains.

Gibson’s eight sustainability principles were chosen as basis for this analysis. Gibson’s eight sustainability principles have been widely applied in international research (e.g. Cravo & Partidario, 2011; Hacking & Guthrie, 2006; Peti, 2012; Weaver & Rotmans, 2006) and therefore seem to have a wide appeal within the impact assessment community (Morrison-Saunders & Retief, 2012:35). It is an integrated approach that specifically avoids break down into triple bottom line environmental, social and economic categories. NEMA (107/1998), often treats environmental, social and economic categories separately, therefore Gibson’s eight sustainability principles were chosen as basis for my analysis. In this regard the work of Gibson *et al* (2005) is particularly helpful as a baseline for the development of a set of sustainability criteria for coal fired powered stations.

Each of the eight sustainability principles in Table 3-1 as identified by Gibson *et al.* (2005) can be acknowledged within the South African EIA mandate. This is indicated in the paper “Walking the sustainability assessment talk – Progressing the practice of environmental impact assessment (EIA)” written by Morrison-Saunders and Retief (2012:36). Morrison-Saunders and Retief (2012:36) mention that some differences arguably are that NEMA often treats social, environmental and economic categories independently whereas Gibson *et al.* (2005) combines the ecological and social categories together. Morrison-Saunders and Retief (2012:36) add that adaptation through learning and feedback from experience is not explicitly promoted within NEMA and the consideration of integration is perhaps less explicit than Gibson *et al.* with respect to timeframes now and into the future.

The eight generic sustainability principles highlighted in Table 3-1 can be used for a wide range of applications of environmental assessments and planning. These cover a full set of crucial requirements for development in the direction of sustainability. It firstly stresses on the interrelations amid these requirements and secondly the potential for an upward spiral of positive feedbacks for mutually reinforcing gains is given. The generic categories have been defined to avoid the usual reductionist triple bottom line pillars of sustainability, in order to encourage integrated thinking, (Gibson *et al*, 2005).

**TABLE 3-1: GIBSON'S EIGHT SUSTAINABILITY PRINCIPLES (Source: compiled from Gibson, 2005:95-114)**

|                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Socio-ecological system integrity</b>                                                                                                                                                                                                                                                                                                                                                                        |
| Build human–ecological relations to establish and maintain the long term integrity of socio biophysical systems and protect the irreplaceable life support functions upon which human as well as ecological well-being depends.                                                                                                                                                                                    |
| <b>2. Livelihood sufficiency and opportunity</b>                                                                                                                                                                                                                                                                                                                                                                   |
| Ensure that everyone and every community has enough for a decent life and that everyone has opportunities to seek improvements in ways that do not compromise future generations' possibilities for sufficiency and opportunity.                                                                                                                                                                                   |
| <b>3. Intragenerational equity</b>                                                                                                                                                                                                                                                                                                                                                                                 |
| Ensure that sufficiency and effective choices for all are pursued in ways that reduce dangerous gaps in sufficiency and opportunity (and health, security, social recognition, political influence, etc.) between the rich and the poor.                                                                                                                                                                           |
| <b>4. Intergenerational equity</b>                                                                                                                                                                                                                                                                                                                                                                                 |
| Favour present options and actions that are most likely to preserve or enhance the opportunities and capabilities of future generations to live sustainably.                                                                                                                                                                                                                                                       |
| <b>5. Resource maintenance and efficiency</b>                                                                                                                                                                                                                                                                                                                                                                      |
| Provide a larger base for ensuring sustainable livelihoods for all while reducing threats to the long term integrity of socio-ecological systems by reducing extractive damage, avoiding waste and cutting overall material and energy use per unit of benefit.                                                                                                                                                    |
| <b>6. Socio-ecological civility and democratic governance</b>                                                                                                                                                                                                                                                                                                                                                      |
| Build the capacity, motivation and habitual inclination of individuals, communities and other collective, decision-making bodies to apply sustainability requirements through more open and better informed deliberations, greater attention to fostering reciprocal awareness and collective responsibility, and more integrated use of administrative, market, customary and personal decision-making practices. |
| <b>7. Precaution and adaptation</b>                                                                                                                                                                                                                                                                                                                                                                                |
| Respect uncertainty, avoid even poorly understood risks of serious or irreversible damage to the foundations for sustainability, plan to learn, design for surprise, and manage for                                                                                                                                                                                                                                |

adaptation.

### **8. Immediate and long term integration**

Apply all principles of sustainability at once, seeking mutually supportive benefits and multiple gains.

Sustainability is not about the traditional flow of thinking but an incorporation of unconventional thinking aligned to intertwining social, economic and environmental factors to meet the needs of the future generation, hence the focus is not only short term but also long term. Gibson *et al* (2005:59) mention that human and ecological well-being is effectively interdependent and that in order to move towards sustainability, interdependencies need to be respected. It is necessary to have a precautionary approach which will entail the avoidance of unnecessary risk, back up plans, and planning for reversibility (Gibson *et al*, 2005:59).

### **3.3 Legal context of sustainability in South Africa?**

In South Africa the sustainability legal framework starts with the Constitution of the Republic of South Africa (1996), which contains a variety of specific provisions in keeping with international sustainability principles. Chapter 2 (Section 24) of the Constitution mentions that:

*"Everyone has the right:*

*(a) To an environment that is not harmful to their health or well-being; and*

*(b) To have the environment protected, for the benefit of present and future generations through reasonable legislative and other measures that*

*(i) Prevent pollution and ecological degradation;*

*(ii) Promote conservation; and*

*(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*

Van der Linde (2006), Kidd (2008) and Richard (2010) state that there are two parts to the above constitutional right. The first alluding to Chapter 2 Section 24 (a) which is a vital human right, while the second part, highlighted in Chapter 2 Section 24 (b) is a directive principle to ensure that the state takes positive steps towards the realization of this right. This

right focuses on second generation rights so that the state secures the environmental rights by reasonable legislation and other measures (Kidd, 2005:22).

To give effect to this environmental right a framework act called the National Environmental Management Act, 107 of 1998 (NEMA) was promulgated. The importance of this act for environmental assessment is that it affords definitions for the terms “environment” and “sustainable development,” (which includes environmental assessment authorisations in terms of EIA regulations) and explicitly sets out objectives for environmental assessments.

In terms of the NEMA (Act 107 of 1998) the environment is defined as

*“the surroundings within which humans exist and that are made up of:*

*(i) the land water and atmosphere of the earth*

*(ii) micro-organisms, plant and animal life*

*(iii) any part or combination of (i) and (ii) and the interrelationships among and between them and*

*(iv) the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and well-being”.*

Sustainability is incorporated by integrating the environmental component with social and the economic component.

Government also established a National Framework for Sustainable Development (NFSD) that sets out a conceptual understanding as well as a vision and key principles, in a move towards implementation of sustainable development (DEAT, 2008). The NFSD supports a systems approach moves away from the concept of balancing the three pillars, economic environment, biophysical environment and social environment, as highlighted in Figure 3-1. It is within this legal context that sustainability is provided for in the constitution, NEMA and the NFSD. Figure 3-1 below represents a systems approach towards sustainability because the socio-political system, economic system and ecosystem are noted as being entrenched within each other and this in turn is integrated via the governance system which holds all other systems together within a regulatory framework.

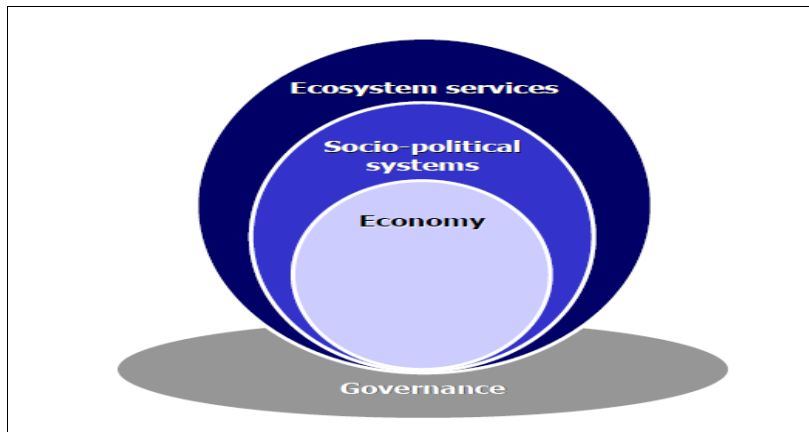


**FIGURE 3-1: SYSTEMS APPROACH TO SUSTAINABILITY IN SOUTH AFRICA (DEAT, 2008)**

Environmental assessment serves as a key policy implementation instrument within the governance system in South Africa (DEAT, 2008). Despite defining sustainability in legislation as discussed above, Morrison-Saunders and Retief (2012:36) mention that it does not ensure success in practise. This highlights an implementation gap in the legal framework. Gibson's eight sustainability principles link to the sustainability and the application in practice. As indicated by the legal framework above, government does cater for sustainability objectives within Figure 3-1. Morrison-Saunders and Retief (2012:36) conclude that the existing "EIA practise in South Africa can be extended through practise and implementation into an assessment tool that can deliver sustainable development without the need for a change in legislation". The eight generic sustainability principles developed by Gibson are exercised for a range of applications in environmental assessments and planning (as discussed earlier). These principles cover the full set of key requirements for progress towards sustainability and encourage integrated thinking.

### **3.4 EIA challenges**

As mentioned previously, there are various tools such as Environmental Management Plans, Environmental Management Systems etc. that can be used to attain sustainable development however the South African legislation focuses on EIAs as the key tool to achieve sustainable development for all its citizens (Morrison-Saunders & Retief, 2012:35). Roux and Du Plessis (2007); DEAT (2004) and Winter and Baumann (2005) further state that one of the objectives of the EIA is to guarantee that all significant actions environmental impacts should be evaluated prior to implementation to provide decision-makers with appropriate information that focuses on the potential positive and negative impacts of a proposed development as well as associated management actions. This is to ensure that informed decisions are made (either to approve or reject the development).

Steinemann (2001) mentions that the EIA on its own, has been labelled as having limitations. These limitations allude to late stage decision-making resulting in limited success during the evaluation of the EIA process. Hardcastle and Gerber (2010) state that in South Africa, the EIA has been accused of not contributing to sustainability outcomes as it mostly focuses on impact mitigation rather than the achievement of sustainable development.

### **3.5 Gaudreau and Gibson's sub-criteria**

The paper "Illustrating integrated sustainability and resilience based assessments: a small-scale biodiesel project in Barbados" written by Gaudreau and Gibson (2010:233) is very useful for this specific case study as these criteria are also applicable to a power station. This paper focuses on the development and application of a comprehensive set of evaluation criteria and sub-criteria which are bundled from the generic criteria – sustainability approach that was developed by Gibson *et al* (2005) – and the sustainability considerations of the Barbados project (Gaudreau & Gibson, 2010:233). The generic criteria were discussed earlier. Table 3-2 highlights the Gaudreau and Gibson criteria and sub-criteria that were used as a baseline for the development of a set of case specific sustainability criteria for power stations in South Africa (2010:238). The table also indicates which sub-criteria are deemed relevant or not (to the case specific sustainability criteria for power stations in South Africa) and a reason is given for the sub-criteria being irrelevant.

**TABLE 3-2: CASE SPECIFIC SUSTAINABILITY CRITERIA FOR THE BARBADOS BIODIESEL OPERATION (Gaudreau & Gibson, 2010:238)**

| <b>CRITERIA</b>                                             | <b>SUB-CRITERIA<br/>How does the operation affect:</b>                                                                                                                                                     | <b>RELEVANCE OF CRITERIA<br/>TO CURRENT STUDY</b> |
|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|
| <b>SOCIO-ECOLOGICAL SYSTEM<br/>INTEGRITY AND RESILIENCE</b> | the capacity of the local ecosystem to deliver valued ecosystem services reliably into the future (e.g. effects on water and air quality, and wildlife habitat)?                                           | YES                                               |
|                                                             | the capacity of national and global ecosystems and socio-ecosystems to deliver valued services reliably into the future (e.g. effects on regional pollution levels, energy sources and transport systems)? | YES                                               |
|                                                             | the resilience of local and national socio-ecosystems (including economic options, transportation, food and health systems, water and waste management)?                                                   | YES                                               |
|                                                             | longer term availability of non-renewable and renewable resources?                                                                                                                                         | YES                                               |
|                                                             |                                                                                                                                                                                                            |                                                   |

|                                               |                                                                                                                      |                                                                                                                                                                                                          |
|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>LIVELIHOOD SUFFICIENCY AND OPPORTUNITY</b> | opportunities for lasting employment?                                                                                | YES                                                                                                                                                                                                      |
|                                               | human health (including exposure to toxic substances and sanitation issues)?                                         | YES                                                                                                                                                                                                      |
|                                               | the availability of resources for others?                                                                            | YES                                                                                                                                                                                                      |
|                                               | learning and associated capacity building, including the indirect effects on education and training by other bodies? | YES                                                                                                                                                                                                      |
|                                               | potential for further investment and scale enlargement?                                                              | NO<br><br>Power stations do not increase the megawatt generation. The plant is designed for a specific output process. However the time duration of the decommissioning of the plant can be looked into. |
|                                               |                                                                                                                      |                                                                                                                                                                                                          |
| <b>INTRAGENERATIONAL EQUITY</b>               | the unequal distribution of wealth, access to resources, and influence on the island?                                | YES                                                                                                                                                                                                      |
|                                               | the equality of access to health, valued employment, respected knowledge and community security?                     | YES                                                                                                                                                                                                      |
|                                               | gender equality on the island?                                                                                       | YES                                                                                                                                                                                                      |

|                                 |                                                                                                                                                                            |                                                                                                                                                                                         |
|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                 | the distribution of wealth, influence and access to resources between advantaged and disadvantaged nations (including effects on revenue flows, dependency effects, etc.)? | YES                                                                                                                                                                                     |
|                                 | the material and energy intensity of consumer and other satisfactions for the wealthy?                                                                                     | NO<br><br>The generated electricity is distributed to the electricity grid and thereafter it is distributed to the consumers and this does not depend on satisfactions for the wealthy. |
|                                 | the well-being of non-human species (including effects on habitat, quality of ecosystem services and vulnerability to stresses)?                                           | YES                                                                                                                                                                                     |
|                                 |                                                                                                                                                                            |                                                                                                                                                                                         |
| <b>INTERGENERATIONAL EQUITY</b> | potential costs and benefits for future generations?                                                                                                                       | YES                                                                                                                                                                                     |
|                                 | transition towards a future energy supply?                                                                                                                                 | YES                                                                                                                                                                                     |
|                                 | legacy costs (e.g. storage of long-term wastes)?                                                                                                                           | YES                                                                                                                                                                                     |
|                                 |                                                                                                                                                                            |                                                                                                                                                                                         |
| <b>RESOURCE MAINTENANCE AND</b> | the severity of damage from resource extraction (over full life cycle, including                                                                                           | YES                                                                                                                                                                                     |

|                   |                                                                                                                                               |     |
|-------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>EFFICIENCY</b> | induced and cumulative effects) as compared to existing practices and to alternatives?                                                        |     |
|                   | the net use of energy, energy quality matching and the nature of energy sources (including any bridging to renewable and low impact sources)? | YES |
|                   | the net use of water (including effects on availability of water for ecosystem functions as well as human needs)?                             | YES |
|                   | the net use of other materials and resources, and the potential hazardousness of direct and embodied pollution and other wastes?              | YES |
|                   | the transition from non-renewable high impact energy and material sources to renewable and low impact sources?                                | YES |
|                   | the potential for rebound effects (e.g. savings from biodiesel efficiencies facilitating expansion of demands and adverse effects elsewhere)? | YES |
|                   | the potential for efficiencies that reduce desirable diversity, local suitability and redundancy?                                             | YES |
|                   |                                                                                                                                               |     |

|                                                                     |                                                                                                                                                                                                                                   |     |
|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
| <b>SOCIAL-ECOLOGICAL CIVILITY<br/>AND DEMOCRATIC<br/>GOVERNANCE</b> | the social awareness of citizens (including through involvement in framing problems and solutions, opportunities to create or strengthen social ties of mutual learning and assistance, and sensitivity to disadvantaged groups)? | YES |
|                                                                     | the ecological awareness of citizens (e.g. about ecosystem functions and capacities and associated values)?                                                                                                                       | YES |
|                                                                     | the social responsibility of market participants?                                                                                                                                                                                 | YES |
|                                                                     | the capacity of participants to be actively involved in deliberations and decision making on public issues?                                                                                                                       | YES |
|                                                                     |                                                                                                                                                                                                                                   |     |
| <b>PRECAUTION AND ADAPTATION<br/>FOR RESILIENCE</b>                 | risks of significant damage (e.g. high risk of minor damage, low or ill-understood risks of potentially significant problems) as compared to existing practices and to alternatives?                                              | YES |
|                                                                     | capacity for monitoring changes (e.g. by providing good baseline information on initial conditions)?                                                                                                                              | YES |
|                                                                     | the adaptive and precautionary qualities of the                                                                                                                                                                                   | YES |

|                                                |                                                                                                                                                                                                                    |     |
|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|
|                                                | island's waste and energy systems (including incorporation of qualities facilitating adaptation in the face of surprise: flexibility, reversibility, diversity, fall back options, and safe-fail characteristics)? |     |
|                                                | development of a context and culture of precaution and adaptation?                                                                                                                                                 | YES |
|                                                |                                                                                                                                                                                                                    |     |
| <b>IMMEDIATE AND LONG-TERM<br/>INTEGRATION</b> | the delivery or potential for positive feedbacks and mutual reinforcement of desirable effects from the project itself and from other current and reasonably anticipated activities and undertakings?              | YES |
|                                                | the capacity to enhance these positive effects?                                                                                                                                                                    | YES |
|                                                | the delivery or risk of negative feedbacks and mutually reinforcing adverse effects?                                                                                                                               | YES |
|                                                | the capacity to interrupt and reverse these negative effects?                                                                                                                                                      | YES |
|                                                |                                                                                                                                                                                                                    |     |

### 3.6 Impacts of power stations in South Africa

The Department of Energy has published the Integrated Resource Plan (IRP) that will guide the development of the future energy mix. The integrated resource plan sets out a path for South Africa's long term energy future, by introducing new players and diversifying the sources of electricity. The plan aims to balance affordability with the need to reduce carbon emissions and ensure security of supply. The department of Energy is proposing that coal contributes 46% to the energy mix by 2030, renewable energy 26%, nuclear 13%, open cycle gas turbines 8%, pumped storage 3%, combined cycle gas turbines 3%. SA has abundant coal reserves (reserves are estimated at 53 billion tonnes, with almost 200 years of supply left). There are advantages and disadvantages of coal fired power stations. The advantages are as follows, South Africa's infrastructure to generate electricity from coal is well established, they are reliable, the generation costs are relatively low. However on the contrary the disadvantages are coal stations emit sulphur and nitrogen oxides, organic compounds, heavy metals, radioactive elements, greenhouse gases and a lot of ash, building a coal-fired power station is a long and expensive process, South Africa's coal fields are concentrated in Mpumalanga and Limpopo, which limits the location options for power stations and it requires water to generate electricity (Doe, 2011).

It is clear that carbon constraints and climate change mean a change in the generation mix for South Africa and a move away from coal in favour of low-carbon technologies. Eskom is committed to reducing its carbon footprint and helping South Africa achieve its targets by transitioning to a cleaner energy mix by a transition from carbon-based to a low carbon environment which requires the combined effort of Eskom, industry and government to proactively address risks to the implementation of the IRP. Eskom has already made substantial progress to move to a more diversified and greener energy mix. Making the existing and new coal capacity cleaner, like establishment of renewable energy and supercritical technology (for Medupi and Kusile) (EIA for Medupi Power Station, Eskom, 2006).

As the basis for developing my set of case specific criteria, Gibson's eight sustainability principles were used (as depicted in Table 3-1). Thereafter the sustainability criteria as captured in the paper "Illustrating integrated sustainability and resilience based assessments: a small-scale biodiesel project in Barbados" (Gaudreau and Gibson, 2010:233) were also used.

After assessing the literature on sustainability impacts of power stations (discussed below as negative and positive impacts), further criteria will be added to ensure applicability to the power generation sector in South Africa. Not all of the sub-criteria (compiled by Gaudreau

and Gibson) are applicable to the power generation sector. Therefore Table 3-2 will focus on which sub-criteria are relevant and which are not. A lot of the literature used is sourced from the mining sector as sustainability in the mining sector is very similar to the sustainability in the power generation sector.

The impacts below are impacts that relate specifically to social issues at power stations in South Africa and that were documented from the literature and added to Gibson's sustainability principles. Gibson's sustainability principles contained sufficient information relating to the environment and the economic components, however social issues are prominent in South Africa and therefore this research will focus on adding the South African social component to the existing sustainability principles. Therefore there is a need to apply more social considerations to the sustainability criteria (which is a current gap in generic criteria and the criteria highlighted in Table 3-3).

This research will also consider "The Marikana massacre" which occurred on 16 August 2012 at Lonmin (mine) in the Marikana area, which is close to Rustenburg. The reason for the inclusion of "The Marikana massacre" is to highlight the issues that may arise if social sustainability concerns are not considered. During this period thirty four people were killed. Families were shattered by violence in which their loved ones were killed. The strike began over a wage dispute and was marred by intimidation and violence. Root causes of the Marikana strike stems much deeper than blaming the few people who pulled the triggers (Frankel, 2013). Frankel (2013) mentions that several South African failures can be attributed to this massacre.

These include failures in:

- Health and safety management;
- Security management;
- Mining management;
- Corporate social investment;
- Organised labour;
- Government practice; and
- Business culture.

Highlighted below in grey are areas used as examples of social issues that were catalysts for the strike. This will form part of relevant literature discussed below and will be used as supporting documentation for it. The impacts are divided into negative and positive social impacts.

### 3.6.1 Negative Impacts

The negative social impacts of power stations in South Africa generally relate to:

- Racism;
- Xenophobic attacks;
- Substance abuse;
- The spread of sexually transmitted diseases;
- The influx of job seekers and different cultures;
- Impacts on public safety;
- Impacts on quality living environment;
- Possible conflict between local residents and newcomers; and
- Increase in crime.

These negative impacts are discussed further, in the text below.

#### 3.6.1.1 Racism (added as criteria 6.5 in Table 3-4)

South Africa's apartheid laws, policies and practices were racist and provided for separate societies for blacks, whites, Indians and coloureds which led to land ownership being segregated and zoned living areas. Self-governing territories and homelands reinforced by pass laws for blacks; racial classification and the prohibition of marriage between whites and people of other races. It went on further to separate and unequal education systems, health services and public amenities and separate labour systems with job reservation for whites and wage differentiations between white and black and between the sexes. The disabled people were kept dependant by discriminatory legislative provisions. This history of systemic discrimination resulted in inequality and this entrenched disadvantage for (a majority) blacks, coloureds and Indians, women and the disabled (McGregor, 2011).

Joe Slovo in 1976 argued: *‘Yet for all the overt signs of race as a mechanism of domination, the legal and institutional domination of the white minority over black majority has its origin in, and is perpetuated by economic exploitation’*. He went on to say that *‘race discrimination is the mechanism of this exploitation and functional to it ... and the struggle to destroy white supremacy is ultimately bound up with the very destruction of capitalism itself’* (Masondo, 2007:74).

The Employment Equity Act (EEA)<sup>1</sup> in South Africa, recognises that “as a result of apartheid and other discriminatory laws and practices” disparities in employment, income and

occupation within the labour market existed. These disparities then shaped distinct disadvantages for black people, women and people with disabilities. The EEA thus clearly expresses that the discriminatory system of apartheid together with other laws and practices that also existed, basically triggered economic disadvantage to blacks, women and the disabled in the workplace (McGregor, 2011:117).

The case study below in the Marikana incident highlights the impact of racism in a large construction company.

Although black mine managers are increasing in number, ownership outside the junior staff managers remains predominately white capital. Black miners found racial integration a notion beyond their experience precisely because their superiors remain white and because class still continued to reinforce race divisions (Frankel, 2013:70).

Power stations in South Africa subscribe to the legal mandate for employment set by government. There are target settings that are incorporated into the power stations key performance areas. The power station KPI consists of three categories, namely:

- Competency Management – which consists of staff with skills audit assessment completed;
- Learner Pipeline – which consists of the number of learner technicians, number of learner engineers and number of learner artisans/operators; and
- Employment Equity – This consists of the percentage of appointments within professional and middle management.

### **3.6.1.2 Xenophobic attacks (added as criteria 6.5 in Table 3-4)**

According to Steenkamp (2009:440), xenophobia refers to “the irrational fear of the unknown, or specifically, as the fear or hatred of those with a different nationality”. It depends on the spread of stereotypes and myths about foreigners. In South Africa, foreigners are typically accused of committing crimes; bringing disease such as HIV/Aids, ‘stealing’ employment and swamping social services. Foreigners who influx into South Africa due to the potential job opportunities have rapidly been blamed for the continuing social and economic ills facing many South Africans. This is highlighted by the events that occurred on May 2008. This event revealed the perseverance of high levels of distrust in the South African society (especially between black Africans). The incident resulted in violence which began its journey on the 11 May 2008 in Alexandra (which is a township outside Johannesburg). The mob

invaded a disused factory (that was allegedly colonised by Zimbabweans) and they chased the inhabitants into the township whilst looting shops, setting shacks alight and killing two people in the process. This violence spread to other townships (such as the East Rand, inner-city Johannesburg and Soweto and then further afield towards the provinces of KwaZulu-Natal, Mpumalanga and eventually it reached Cape Town and surrounding areas). The common theme of distrust emanated in various contexts such as between South Africans and foreigners; amongst South Africans; between locals and the state and between foreigners and the state. This did not bode well for socio-economic development and democratic consolidation (Steenkamp, 2009:440).

Construction of power stations will create employment opportunities and this will steer towards an influx of foreigners into the area. Events like the one above can become a reality in the power generation sector as well.

#### **3.6.1.3 Substance abuse (added as criteria 6.6 in Table 3-4)**

In South Africa, alcohol continues to be the most frequent abused drug. This is then followed by dagga (cannabis), the next being dagga and Mandrax (white pipe) combination (Freek *et al*, 2013:6). South Africans indulge in consumption of alcoholic beverages well over five billion litres per year. The overall prevalence of alcohol misuse in South Africa is likely to be as high as 30% amongst certain groups and as low as about 5% in others, and can be dependent on factors such as age, gender, socio-economic status, and degree of urbanisation (Freek *et al*, 2013:6). The young people (especially males) binge drinking is in excess of 25% in many communities. This high alcohol level misuse has occurred amongst persons involved in certain occupations, for example, mining, farming, and amongst residents of disadvantaged communities. The alcohol misuse unfolds itself in the form of increased violence during the weekends after payday, health problems, risk of rape (risk of transmission of HIV) as well as stress due to the lack of money after a period of bingeing (Freek *et al*, 2013:6).

Vanclay (2002:199) states that this substance abuse can have serious influences on the economic and social well-being of the community, which can result in social tension. From the above discussion one can assume tension can arise in the community areas where employees influx into the area for job opportunities at the power station.

#### **3.6.1.4 The spread of sexually transmitted diseases (added as criteria 6.7 in Table 3-4)**

From a South African population of 48 million, around 5.5 million (11%) are HIV positive. The Department of Public Works (DPW) (2004), has indicated that the construction industry is reflected to be the most affected by the epidemic, followed by mining and the transport

sector. However the Bureau for Economic Research (BER)/South African Business Coalition on HIV/AIDS (SABCOHA) (2004) stipulates that the construction industry is the least responsive (in terms of mitigation for the epidemic). Bowen *et al.*, (2010:827) mention that the risk of infection is enlarged through either increasing exposure to the virus or by when having sex with an infected partner. Businesses most seriously affected by HIV/AIDS will be those dependent on migrant labour (Whiteside & Sunter, 2000) as HIV prevalence rates are considerably higher in those who travel for employment (ICAD, 2004).

Haupt *et al.* (2005) highlights that, 60% of the construction workforce is engaged on an informal employment basis which results in sexual activity. This unravels in the less educated demographic not protecting themselves against HIV transmission (Barnett & Whiteside, 2002). This risky sexual behaviour increases the probability of transmission of HIV infection in the migrant labourer, who becomes is vulnerable to this behaviour. This makes the South African mining migrant labourer an agent for transmission of the virus, both in the receiving and the sending communities. Lost days of work among construction workers are a major concern for the industry (Haupt *et al.*, 2003). According to recent studies, South African businesses lose up to a month's work per employee per year due to HIV-related absenteeism and this associates to a loss of over R2 billion per annum (Moodley, 2005). Prior studies in 2003 projected that 40 % of the private industry would experience a reduction in productivity (both skilled and unskilled) workers sick with AIDS (Ellis *et al.*, 2003).

Figure 3-2 below shows the comparison of HIV-prevalence which was estimated by province between 2005 and 2008. The three highest HIV prevalence areas mentioned in order were KwaZulu-Natal, Mpumalanga and the Free State. However there was an exception for 2012, when the Free State prevalence increased to the level of prevalence in Mpumalanga. The lowest HIV prevalence was in the Western Cape (however there was an increase in the province from 1.9% in 2005 to 5.0% in 2012). In the Eastern Cape the HIV prevalence remained stable since 2005 however an increase was detected from 9.0% in 2008 to 12.2% in 2012, which was similar to that of the levels of prevalence found in Gauteng and the North West (as highlighted in Figure 3-2). A similar increase is observed in Gauteng (Shisana, *et al.*, 2014:37).

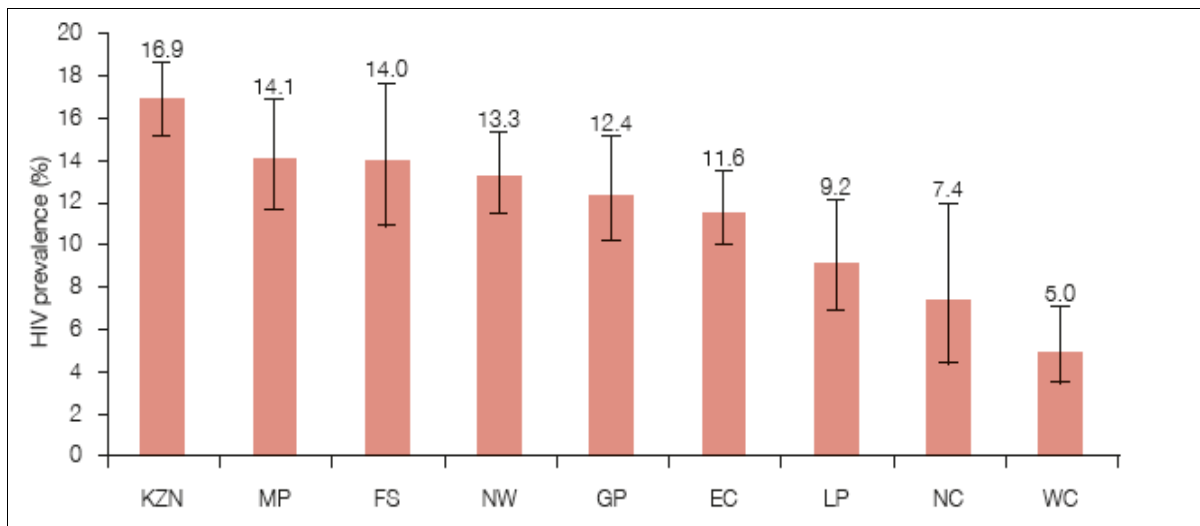


**FIGURE 3-2: HIV PREVALENCE BY PROVINCE, SOUTH AFRICA 2012**

### **3.6.1.5 The influx of job seekers and different cultures (added as criteria 6.8 in Table 3 -4)**

In the report it was noted that conflict between local residents and newcomers may arise if the construction workers are not sourced locally and if they were housed close to the site. If the area experiences an influx of job seekers, competition over scarce employment opportunities may also lead to conflict with locals (EIA for Medupi Power Station, Eskom, 2006:414).

Vanclay (2002: 188) mentions that proposed developments (during its construction and operation) will lead to an increase in job opportunities and ultimately leading to an increase of the population in the area. This increase in population can cause an increase in ethnic or racial diversity, relocation, presence of temporary workers and/or seasonal residents which can lead to several social impacts such as loss of community cohesion, fear and uncertainty amongst residents, fluctuating real estate (property) values as well as shortage of housing etc. However he also noted that if these social impacts are managed properly then the demographic changes might not create such impacts. This was confirmed by Cronje *et al* (2013:3) who mentioned that mining communities throughout the SADC region (which included South Africa) was characterised by poor social conditions, such as poverty, prostitution, unemployment, a high influx of unaccompanied migrant labour and poor housing and infrastructure. The migration of labourers (both within borders and outside the South African borders) has contributed to a significant role in the spread of HIV, initially. This can be linked further to the earlier discussion on “The spread of sexually transmitted diseases”.

In the Marikana experience, majority of the big companies (around Marikana) dishonoured the principle agreement with the traditional authorities. This agreement stated that workers should originate within 50 kms of the shafts however around 40% of the workers came from

the Marikana area and this aided to the allegations of collusion between mine management, labour brokers and corrupt brokers-cum-traditional chiefs who asked “*why there is no questions in the provision of workers*” (Freek *et al*, 2013:14). As mentioned above by Vanclay, “*if these variables are managed properly then the demographic changes might not create impacts*”, such as that of the Marikana incident (Freek *et al*, 2013:14).

### **3.6.1.6 Impacts on public safety (added as criteria 6.9 in Table 3-4)**

Vanclay (2002: 188) mentions that many construction activities may alter patterns of daily life that expose people to risk (e.g. project increases the volume of traffic in a neighbourhood) that creates danger to the community as some of the workers may also belong to the local community. This was supported by Cronje *et al* (2013:1) who highlighted that mining activities all over the SADC had impacted on the safety and health of mining communities for numerous decades. In spite of the economic contribution that mining created to surrounding communities it also contributed to huge amounts of environmental and social harm. Warhurst (1998:2) also supplemented Cronje’s statement by mentioning that mining companies have contributed on the one hand towards improved social development (by providing jobs, paying taxes, building an industrial base, enhancing efficiency, earning foreign exchange and transferring technology) however on the other hand, they have been related publicly to meddling in sovereign affairs, deepening disparities in wealth, poor labour conditions, corruption, transfer pricing, health and safety failings, pollution incidents, as well as disrespect of human rights. The first platinum study in was conducted 2006 and 2007 and a follow-up was done around 14 August 2012, Policy Gap 6 Report was released (The Bench Marks Foundation 2012 and this became a standard referencing work after the Marikana tragedy (highlighted below), which occurred in August 2012. Cronje *et al* (2013:1) concluded that the mining operations that he studied all represented potential disaster situations for communities that lived in close proximity to the mines. These disaster situations ranged from explosions and road accidents, potential tailings failure, seismic events, to respiratory problems, TB, HIV and other health problems. He also went on to say that in all of the mine cases, health and safety (within the mine and community), could be improved through improved community involvement in disaster management.

Many of those on the veld at Marikana cannot “live safely” as mine leadership admonishes, because everybody on the mine, their peers, shift bosses and even managers are prisoners of a production mania in which the preservation of human life is not necessarily the primary component. Many things have changed since the “old days” including the costs of being unsafe. It is estimated that a single death costs a mining house a conservative R6 million in direct and indirect costs. This excludes the costs of industrial injuries and a lack of wellness among miners who are eventually killed in large numbers by occupational illness. There is

both a strong business and moral case for less hazardous extraction activity bearing in mind that well over 70 000 people have been killed in and within African mining since its inception on a large scale. Around 300 injuries, many leading to permanent disability, still occur each day and unmeasured millions of men are continually boarded off and being sent home dying of HIV/AIDS, tuberculosis, silicosis and other respiratory ailments (Freek *et al*, 2013:20).

#### **3.6.1.7 Impacts on quality living environment (added as criteria 6.10 in Table 3-4)**

Another impact that Vanclay (2002: 203) mentioned, is that of “quality of the living environment”. This includes exposure to noise, exposure to dust, exposure to artificial light and exposure to odours. He discovered when working on housing projects, that many resettled people found their new house was not ‘home’ anymore despite even though the physical quality of houses may have improved. This could be also one of the reasons why people are unwilling to relocate, in spite of generous compensation packages.

Stephens & Ahern (2001:30) reveal that mining activities can impact on the health of communities related to mine operations at various levels. Cronjé & Chenga (2007) mention that health effects results from environmental exposure to air, water, soil and noise pollution and there are also non-environmental exposure and events such as pit closures, poverty, mining disasters, migration trends, unemployment and poor infrastructure (which affect mining communities both indirectly and directly at different levels). This is further supported by a case study is highlighted within the cement industry. This industry is a major source of particulate matter, SO<sub>x</sub>, NO<sub>x</sub> and CO<sub>2</sub> emissions. Baby *et al.*(2008) indicates that cement dust contains heavy metals like nickel, chromium, lead, cobalt and mercury pollutants, which are hazardous to the environment and has an additional impact on animal and human health. Aydin *et al.* (2010) and Zelke *et al.* (2010) suggest that cement dust may cause decreased antioxidant capacity, carcinogenesis and causes acute respiratory symptoms and acute ventilator effects. Mehraj *et al.* (2004:1044) highlights that the World Health Organisation (WHO) estimates that due to health effects caused by the lack of clean air, around two million people every year die prematurely. Air is the basic necessity of human life however the quality of air is deteriorating constantly and it is continuously polluted from different sources. This impacts on the quality of living negatively (as highlighted by the discussion above).

#### **3.6.1.8 Possible conflict between local residents and newcomers (added as criteria 6.11 in Table 3-4)**

Vanclay (2002:199) refers to segregation as “*the process of creation of social difference within a community*”, which can lead to social disintegration which is “*the dissolving or loss of social capital, the falling apart of social, cultural and kinship networks and abandonment and*

*lack of relevance of cultural practises.*” He mentions that cultural differentiation talk to the traditions, rituals, language, rise in the differences or perceived differences, between various groups in a community based on cultural values, traditional skills, etc., which is seen as “other” and creates division within a community (eg. many projects lead to an increase in prostitution services by local women (and men)). The social change processes can also aggravate biophysical changes which can also have effects on disease organisms or disease vectors that lead to health impacts (Vanclay; 2002: 192). An example from the South African context is the Marikana incident, as discussed above in the paragraph on “The influx of job seekers and different cultures”.

#### **3.6.1.9 Increase in crime (added as criteria 6.12 in Table 3-4)**

Kilian (2008:22) remarks that “surrounding communities generally develop around a mine and become dependent on the economic opportunities generated by it, especially within isolated rural areas. Apart from these dependencies and economic impacts, the social impacts are usually felt even more, i.e. squatting and low living standards, social ills, disruption of traditional lifestyles and livelihood systems, increase in violence and crime, idleness and a disregard for traditional culture”. This remark is validated by the book written by Frankel (2013:10), where he states that “digging deeper into the sociology of the communities on the barren veld new Rustenburg, reveals that what happened there some months ago is less than abnormal by the standards of a country that currently has an estimated 150 rapes per hour, somewhere short of 20 000 murders per year, a fifth of the population living on or below the starvation line and almost 300 accidents per day in the mining industry.

#### **3.6.2 Positive Impacts**

The positive impacts that were looked into were within the social labour plans sector.

##### **3.6.2.1 Promotion of long term development (added as criteria 8.3 in Table 3-4)**

Kilian (2008:22) highlights that Social and Labour Plans (SLPs), should emphasis on endorsing the long term development of employee households, their workforces, communities and regions. This stemmed forward because once the mines close, the social impacts on employee households, communities and regions are mostly severe which is long term.

##### **3.6.2.2 Proper planning and rehabilitation (added as criteria 8.4 in Table 3-4)**

Focus needs to be on proper planning and rehabilitation. The resultant of lack of proper planning in the beginning is unproductive land that is disturbed land. This hinders the productive use of economically valuable land for the socio-economic development of

communities over the long term. Previously the same occurred with power stations. Ash dumps and waste disposal sites were abandoned. These sites were disturbed and also unproductive.

### **3.6.2.3 Development and implementation of Social Labour Plans (added as criteria 8.5 in Table 3-4)**

In order to avoid such socioeconomic marginalisation by mining companies, the government of South Africa requires mining companies to develop and implement social development plans. Recent legislation in South Africa, such as the Broad Based Socio-Economic Empowerment Charter (BBSEEC) for the Mining Industry and the Mineral and Petroleum Resources Development Act (MPRDA) have confirmed the requirement for mining companies to assess the social impacts of their activities from start to closure, and beyond. Unless a mining operation has considered the social impact and documented it, the Department of Minerals & Energy (DME) will not issue a mining right to the applicant (MPRDA Regulations, 2002). Mining companies also have to compile and implement a Social and Labour Plan (SLP) to promote socio-economic development in their affected communities and to prevent or lessen negative social impacts (Kilian, 2008:22). The same should be the requirement for power stations then socioeconomic marginalisation will be avoided by power stations as well.

## **3.7 Case Specific Sustainability Criteria**

Table 3-3 below highlights both the negative and positive impacts of a power station. These impacts were derived from the different literature that was discussed in section 3.6.1 and 3.6.2. The negative impacts are social impacts and can be incorporated into Gibson's 2<sup>nd</sup>, 3<sup>rd</sup> and 6<sup>th</sup> criterion which is the *"Livelihood sufficiency and opportunity"*, *"Intragenerational Equity"* and *"Socio-ecological civility and democratic governance"*. The positive impact can be incorporated into Gibson's 8<sup>th</sup> criterion which is the *"Immediate and long term integration"*.

**TABLE 3-3: NEGATIVE AND THE POSITIVE IMPACT DERIVED FROM DIFFERENT LITERATURE SOURCES**

| NEGATIVE IMPACTS                                           | POSITIVE IMPACT                                          |
|------------------------------------------------------------|----------------------------------------------------------|
| 1. Racism                                                  | 1. Promotion of long term development                    |
| 2. Xenophobic attacks                                      | 2. Proper planning and rehabilitation                    |
| 3. Substance abuse                                         | 3. Development and implementation of social labour plans |
| 4. The spread of sexually transmitted diseases             |                                                          |
| 5. The influx of job seekers and different cultures        |                                                          |
| 6. Impacts on public safety                                |                                                          |
| 7. Impacts on quality living environment                   |                                                          |
| 8. Possible conflict between local residents and newcomers |                                                          |
| 9. Increase in crime                                       |                                                          |

Table 3-4 below is the holistic table that incorporates Gibson's eight criteria followed by the sub-criteria taken from the paper "Illustrating integrated sustainability and resilience based assessments: a small-scale biodiesel project in Barbados" (Gaudreau & Gibson, 2010:233). Table 3-3 above, is also added in as sub-criteria (these are referenced accordingly as they are new sub-criteria added to make the criteria more specific). This list was added as sub-criteria onto the criteria of "*Livelihood sufficiency and opportunity*", "*Intragenerational Equity*", "*Social-ecological civility and democratic governance*" and "*Immediate and long term integration*".

The reason why these sub-criteria were added was because the South African literature focussed a lot on social issues. It is believed that these additions will assist in achieving sustainable considerations from a South African perspective in environmental assessments.

**TABLE 3-4: CASE SPECIFIC SUSTAINABILITY CRITERIA**

Table 3-4 indicates the case specific sustainability criteria that were developed for power stations in South Africa using Gibson's eight criteria integrated with sub-criteria based on South African literature.

| CRITERIA                                             | SUB-CRITERIA                                                                                                                                 | REFERENCE                      |
|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
|                                                      |                                                                                                                                              |                                |
| 1. Socio-ecological system integrity and resilience. | 1.1 Did the EIA identify and evaluate potential impacts on ecosystem services (e.g. effects on water and air quality, and wildlife habitat)? | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                      |                                                                                                                                              |                                |
|                                                      | 1.1.1 water                                                                                                                                  | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                      | 1.1.2 air quality                                                                                                                            | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                      | 1.1.3 biodiversity                                                                                                                           | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                      |                                                                                                                                              |                                |
|                                                      | 1.2. Did the EIA identify and evaluate the potential capacity of the broader communities' infrastructure?                                    |                                |
|                                                      | 1.2.1 effects on regional pollution levels                                                                                                   | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                      | 1.2.2 energy sources and                                                                                                                     | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                      | 1.2.3 transport systems                                                                                                                      | GAUDREAU, K & GIBSON, R.B:2010 |

|                                                            |                                                                                                                                   |                                |
|------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
|                                                            |                                                                                                                                   |                                |
|                                                            | 1.3. Did the EIA identify and evaluate potential impact on the resilience of local and national socio-ecosystems?                 |                                |
|                                                            | 1.3.1 economic options                                                                                                            | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                            | 1.3.2 transportation                                                                                                              | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                            | 1.3.3 food                                                                                                                        | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                            | 1.3.4 health systems                                                                                                              | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                            | 1.3.5 water                                                                                                                       | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                            | 1.3.6 waste management                                                                                                            | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                            |                                                                                                                                   |                                |
|                                                            | 1.4. Did the EIA identify and evaluate potential impact on the longer term availability of non-renewable and renewable resources? | GAUDREAU, K & GIBSON, R.B:2010 |
| 2. Livelihood sufficiency and opportunity.<br>How does the | 2.1. Did the EIA identify opportunities for lasting employment?                                                                   | GAUDREAU, K & GIBSON, R.B:2010 |
|                                                            |                                                                                                                                   |                                |
|                                                            | 2.2. Did the EIA identify human health issues and did it evaluate:                                                                |                                |
|                                                            | 2.2.1 exposure to toxic substances?                                                                                               | GAUDREAU, K & GIBSON, R.B:2010 |

|                                    |                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|------------------------------------|--------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| power station<br>operation affect: | 2.2.2 sanitation issues?                                                                                     | GAUDREAU, K & GIBSON, R.B:2010                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                    | 2.2.3 the possibility of xenophobic attacks on individuals who move into the area to seek job opportunities? | STEENKAMP, C:2009                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|                                    | 2.2.4 the possibility of substance abuse?                                                                    | CRONJE, F., REYNEKE, S. & VAN WYK, D:2013                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                    | 2.2.5 the possibility of the spread of sexually transmitted diseases?                                        | DEPARTMENT OF PUBLIC WORKS: 2004<br>SABCOHA (South African Business Coalition on HIV & AIDS): 2004<br>BOWEN, P., DORRINGTON, R., DISTILLER, G., LAKE, H. & BESSER, S:2010<br>WHITESIDE, A. & SUNTER, C:2000<br>ICAD:2004<br>DEACON, C. & SMALLWOOD, J:2003<br>FOURIE, P. & SCHONTEICH, M:2002<br>HAUPT, T.C., MUNSHI, M. and SMALLWOOD, J:2005<br>BARNETT, T. & WHITESIDE, A:2002<br>HAUPT, T.C. and SMALLWOOD, J:2003<br>MOODLEY, N:2005<br>ELLIS, L.L., SMIT, B.W. & |

|  |                                                                        |                                                                                                                                                                                                                                                                                                                                                                        |
|--|------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                                                                        | <p>LAUBSCHER, P:2003</p> <p>SHISANA, O, REHLE, T, SIMBAYI, L.C, ZUMA, K, JOOSTE, S, ZUNGU, N, LABADARIOS, D, ONOYA, D et al.:2014</p>                                                                                                                                                                                                                                  |
|  | 2.2.6 the possibility of impacts on public safety?                     | <p>VANCLAY, F: 2002</p> <p>EIA for Medupi Power Station:2006</p> <p>CRONJE, F., REYNEKE, S. &amp; VAN WYK, D:2013</p> <p>FRANKEL, P.H:2013</p>                                                                                                                                                                                                                         |
|  | 2.2.7 the possibility of impacts on quality of the living environment? | <p>VANCLAY, F:2002CRONJE, F., REYNEKE, S. &amp; VAN WYK, D:2013STEPHENS, C. &amp; AHERN, M:2001</p> <p>CRONJE, J.F. &amp; CHENGA, C.SI: 2007</p> <p>BABY, S., SINGH, N.A., SHRIVASTAVA, P., NATH, S.R., KUMAR, S.S., SINGH, D. &amp; VIVEK, K:2008</p> <p>AYDIN, S., CROTEAU, G., SAHIN, I. &amp; CITIL, S:2010</p> <p>ZELEKE, Z., MOEN, B. &amp; BRATVEIT, M:2010</p> |

|                                                                                 |                                                                                                                                                             |                                                                         |
|---------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
|                                                                                 |                                                                                                                                                             | <b>MEHRAJ, S.S., BHAT, G.A.,<br/>MEHRAJ BALKI, H. &amp; GUL, T:2013</b> |
|                                                                                 |                                                                                                                                                             |                                                                         |
|                                                                                 | 2.3. Did the EIA identify and evaluate the availability of resources for others?                                                                            | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b>                               |
|                                                                                 |                                                                                                                                                             |                                                                         |
|                                                                                 | 2.4. Did the EIA identify and evaluate learning and associated capacity building, including the indirect effects on education and training by other bodies? | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b>                               |
|                                                                                 |                                                                                                                                                             |                                                                         |
|                                                                                 | 2.5. Did the EIA identify and evaluate potential for further investment and scale enlargement?                                                              | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b>                               |
| 3.<br>Intragenerational equity.<br>How does the power station operation affect: |                                                                                                                                                             |                                                                         |
|                                                                                 | 3.1. Did the EIA identify and evaluate the unequal distribution of wealth, access to resources and influence on the power station?                          | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b>                               |
|                                                                                 |                                                                                                                                                             |                                                                         |
|                                                                                 | 3.2. Did the EIA identify and evaluate the equality of access to health, valued employment, respected knowledge and community security?                     | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b>                               |
|                                                                                 |                                                                                                                                                             |                                                                         |
|                                                                                 | 3.3. Did the EIA identify and evaluate gender equality?                                                                                                     | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b>                               |

|                                   |                                                                                                                                                                                                                   |                                                           |
|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
|                                   |                                                                                                                                                                                                                   |                                                           |
|                                   | 3.4. Was racism discussed and were mechanisms looked at to prevent racism from occurring?                                                                                                                         | McGREGOR, M:2011<br>MASANDO, D:2007<br>FRANKEL, P.H: 2013 |
|                                   |                                                                                                                                                                                                                   |                                                           |
|                                   | 3.5. Did the EIA identify and evaluate the distribution of wealth, influence and access to resources between advantaged and disadvantaged nations (including effects on revenue flows, dependency effects, etc.)? | GAUDREAU, K & GIBSON, R.B:2010                            |
|                                   |                                                                                                                                                                                                                   |                                                           |
|                                   | 3.6. Did the EIA identify and evaluate the material and energy intensity of consumer and other satisfactions for the wealthy?                                                                                     | GAUDREAU, K & GIBSON, R.B:2010                            |
|                                   |                                                                                                                                                                                                                   |                                                           |
|                                   | 3.7. Did the EIA identify and evaluate the well-being of non-human species (including effects on habitat, quality of ecosystem services and vulnerability to stresses)?                                           | GAUDREAU, K & GIBSON, R.B:2010                            |
|                                   |                                                                                                                                                                                                                   |                                                           |
| 4.<br>Intergenerational<br>equity | 4.1. Did the EIA identify and evaluate potential costs and benefits for future generations?                                                                                                                       | GAUDREAU, K & GIBSON, R.B:2010                            |
|                                   |                                                                                                                                                                                                                   |                                                           |
|                                   | 4.2. Did the EIA identify and evaluate transition towards a future energy supply?                                                                                                                                 | GAUDREAU, K & GIBSON, R.B:2010                            |

|                                                                                         |                                                                                                                                                                              |                                           |
|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
|                                                                                         |                                                                                                                                                                              |                                           |
|                                                                                         | 4.3. Did the EIA identify and evaluate legacy costs (e.g. storage of long term wastes)?                                                                                      | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
| 5. Resource maintenance and efficiency.<br>How does the power station operation affect: | 5.1. the severity of damage from resource extraction (over full life cycle, including induced and cumulative effects) as compared to existing practices and to alternatives? | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                         |                                                                                                                                                                              |                                           |
|                                                                                         | 5.2. the net use of energy, energy quality matching and the nature of energy sources (including any bridging to renewable and low impact sources)?                           | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                         |                                                                                                                                                                              |                                           |
|                                                                                         | 5.3. the net use of water (including effects on availability of water for ecosystem functions as well as human needs)?                                                       | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                         |                                                                                                                                                                              |                                           |
|                                                                                         | 5.4. the net use of other materials and resources, and the potential hazardousness of direct and embodied pollution and other wastes?                                        | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                         |                                                                                                                                                                              |                                           |
|                                                                                         | 5.5. the transition from non-renewable high impact energy and material sources to renewable and low impact sources?                                                          | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                         |                                                                                                                                                                              |                                           |

|                                                                                                                         |                                                                                                                                                                                                                                        |                                           |
|-------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
|                                                                                                                         | 5.6 the potential for rebound effects (e.g. savings from power station efficiencies facilitating expansion of demands and adverse effects elsewhere)?                                                                                  | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                                                         |                                                                                                                                                                                                                                        |                                           |
|                                                                                                                         | 5.7. the potential for efficiencies that reduce desirable diversity, local suitability and redundancy?                                                                                                                                 | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                                                         |                                                                                                                                                                                                                                        |                                           |
| 6. Social–<br>ecological civility<br>and democratic<br>governance<br>How does the<br>power station<br>operation affect: | 6.1. the social awareness of citizens (including through involvement in framing problems and solutions, opportunities to create or strengthen social ties of mutual learning and assistance, and sensitivity to disadvantaged groups)? | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                                                         |                                                                                                                                                                                                                                        |                                           |
|                                                                                                                         | 6.2. the ecological awareness of citizens (e.g. about ecosystem functions and capacities and associated values)?                                                                                                                       | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                                                         |                                                                                                                                                                                                                                        |                                           |
|                                                                                                                         | 6.3. the social responsibility of market participants?                                                                                                                                                                                 | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                                                         |                                                                                                                                                                                                                                        |                                           |
|                                                                                                                         | 6.4. the capacity of participants to be actively involved in deliberations and decision making on public issues?                                                                                                                       | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                                                         |                                                                                                                                                                                                                                        |                                           |

|                                                                                                           |                                                                                                                                                                                                                                          |                                                                            |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|
|                                                                                                           | 6.5. the possibility of influx of job seekers and different cultures into the area?                                                                                                                                                      | VANCLAY, F:2002<br>CRONJE <i>et al.</i> :2013<br>FRANKEL, P.H: 2013        |
|                                                                                                           |                                                                                                                                                                                                                                          |                                                                            |
|                                                                                                           | 6.6. the possible conflict between local residents and newcomers?                                                                                                                                                                        | EIA for Medupi Power Station:2006<br>VANCLAY, F:2002<br>FRANKEL, P.H: 2013 |
|                                                                                                           |                                                                                                                                                                                                                                          |                                                                            |
|                                                                                                           | 6.7. the possibility of an increase in crime?                                                                                                                                                                                            | KILIAN, J-M:2005<br>FRANKEL, P.H: 2013                                     |
|                                                                                                           |                                                                                                                                                                                                                                          |                                                                            |
| <b>7. Precaution and adaptation for resilience</b><br><b>How does the power station operation affect:</b> | 7.1. risks of significant damage (e.g. high risk of minor damage, low or ill-understood risks of potentially significant problems) as compared to existing practices and to alternatives?                                                | GAUDREAU, K & GIBSON, R.B:2010                                             |
|                                                                                                           |                                                                                                                                                                                                                                          |                                                                            |
|                                                                                                           | 7.2. capacity for monitoring changes (e.g. by providing good baseline information on initial conditions)?                                                                                                                                | GAUDREAU, K & GIBSON, R.B:2010                                             |
|                                                                                                           |                                                                                                                                                                                                                                          |                                                                            |
|                                                                                                           | 7.3. the adaptive and precautionary qualities of the industries waste and energy systems (including incorporation of qualities facilitating adaptation in the face of surprise: flexibility, reversibility, diversity, fallback options, | GAUDREAU, K & GIBSON, R.B:2010                                             |

|                                                                                                                                            |                                                                                                                                                                                                            |                                           |
|--------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|
|                                                                                                                                            | and safe-fail characteristics)?                                                                                                                                                                            |                                           |
|                                                                                                                                            |                                                                                                                                                                                                            |                                           |
|                                                                                                                                            | 7.4. development of a context and culture of precaution and adaptation?                                                                                                                                    | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                                                                            |                                                                                                                                                                                                            |                                           |
| <b>8. Immediate and long term integration</b><br><b>How do the interrelations among the power station's operation's effects influence:</b> | 8.1. the delivery or potential for positive feedbacks and mutual reinforcement of desirable effects from the project itself and from other current and reasonably anticipated activities and undertakings? | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                                                                            |                                                                                                                                                                                                            |                                           |
|                                                                                                                                            | 8.2. the capacity to enhance these positive effects?                                                                                                                                                       | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|                                                                                                                                            |                                                                                                                                                                                                            |                                           |
|                                                                                                                                            | 8.3. the promotion of long term development on the workforce, employee households and the region?                                                                                                          | <b>KILIAN, J-M:2005</b>                   |
|                                                                                                                                            |                                                                                                                                                                                                            |                                           |
|                                                                                                                                            | 8.4. the proper planning and rehabilitation of the power station infrastructure land and waste dumps in considering the future social and economic impact on communities and development for the region?   | <b>KILIAN, J-M:2005</b>                   |
|                                                                                                                                            |                                                                                                                                                                                                            |                                           |
|                                                                                                                                            | 8.5. the development and Implementation of social labour plans to promote socio-economic development in the                                                                                                | <b>KILIAN, J-M:2005</b>                   |

|  |                                                                                           |                                           |
|--|-------------------------------------------------------------------------------------------|-------------------------------------------|
|  | affected communities and to prevent or lessen negative social impacts?                    |                                           |
|  |                                                                                           |                                           |
|  | 8.6. the delivery or risk of negative feedbacks and mutually reinforcing adverse effects? | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |
|  |                                                                                           |                                           |
|  | 8.7. the capacity to interrupt and reverse these negative effects?                        | <b>GAUDREAU, K &amp; GIBSON, R.B:2010</b> |

This chapter is on reviewing of literature on sustainability, Gibson's eight sustainability principles (Gibson, 2005) as well as different literature on industries in order to develop a set of sustainability criteria for the coal fired power generation sector in South Africa. This set of sustainability criteria was then tabulated. Chapter 4 is the next chapter that follows and it discusses data evaluation.

## CHAPTER 4: DATA EVALUATION

### 4.1 Introduction

This chapter will consist of evaluating the EIA against the case specific sustainability criteria developed for power stations.

### 4.2 Evaluation

The set of case specific criteria that were developed in Chapter 3 (after considering Gibson's eight sustainability principles, Gaudreau and Gibson's sub-criteria, as well as literature relating to sustainability) will be used to evaluate the Medupi EIA. The results are tabulated in Table 4-1. The legend of Table 4-1 is as follows:

**TABLE 2-1: LEGEND FOR THE ROBOT INDICATOR**

|          |                             |                                                                                                                                                                              |
|----------|-----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>A</b> | <b>Considered</b>           | <b>The criterion does consider all three areas viz. business, community and environmental perspective</b>                                                                    |
| <b>B</b> | <b>Partially considered</b> | <b>The criterion was considered partially by either one perspective example business, community and environmental perspective or partially covered by all 3 perspectives</b> |
| <b>C</b> | <b>Not considered</b>       | <b>The criterion does not consider any of the three areas viz. business, community or environmental perspective</b>                                                          |

**TABLE 4-1: SUSTAINABILITY CRITERIA EVALUATION AGAINST MEDUPI EIA**

| CRITERIA                                           | SUB-CRITERIA                                                                                                                                 | ROBOT INDICATOR | JUSTIFICATION                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                    |                                                                                                                                              |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 1.Socio-ecological system integrity and resilience | 1.1 Did the EIA identify and evaluate potential impacts on ecosystem services (e.g. effects on water and air quality, and wildlife habitat)? | B               | Eg. Comprised of:<br>A=6<br>B=6<br>C=1Therefore I took a precautionary approach and allocated a B                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                    | 1.1.1 Water                                                                                                                                  | B               | <p>The EIA does consider the impacts of the ash dump on the surface water. It also discusses monitoring of the water. The supply of additional water from the already stressed catchment is likely to have an impact on the downstream surface water users.</p> <p><b>EIA for Medupi Power Station: Surface - Chapter 6: Sect. 6.5 pages 82-92</b></p> <p>The EIA does mention that there will be groundwater contamination from the sewage plant, but it does not consider the ecological impact on groundwater. The</p> |

|  |                   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
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|  |                   |   | <p>sewage plant is covered from a business perspective and not discussed further on a community level impact or environmental impact on groundwater. Since it does not discuss the ecological impact on the surface water and groundwater, a B was allocated.</p> <p><b>EIA for Medupi Power Station: Sewage on groundwater - Chapter 6: Sect. 6.7.1 pages 85-103</b></p>                                                                                                                                                                                                                                                                                                                                                |
|  | 1.1.2 Air quality | A | <p>The following are considered in the EIA:</p> <ul style="list-style-type: none"> <li>• human health,</li> <li>• vegetation exposure,</li> <li>• fugitive emissions,</li> <li>• sewage plant,</li> <li>• household fuel burning, veld burning, vehicle exhaust emissions).</li> </ul> <p>From a business perspective, dispersion models, wind roses and existing sources of emissions and baseline quantities based on Matimba's statistics were identified. This was also done to check for compliance to legal requirements.</p> <p>From a health perspective, the following pollutants were identified as having health risks:</p> <ul style="list-style-type: none"> <li>• suspended particulate matter,</li> </ul> |

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|  |                    |   | <ul style="list-style-type: none"> <li>• sulphur dioxide,</li> <li>• oxides of nitrogen,</li> <li>• carbon monoxide,</li> <li>• dust deposition.</li> </ul> <p>From an environmental perspective atmospheric stability and mixing depth, monitoring, vegetation injury and corrosion, as well as contribution to greenhouse gas emissions were the focus.</p> <p>This component scored an A rating, as air quality was considered.</p> <p><b>EIA for Medupi Power Station: Air Quality: Chapter 9: page 1 to page 144</b></p> |
|  | 1.1.3 Biodiversity | A | <p>The EIA considered the following:</p> <ul style="list-style-type: none"> <li>• 7.3.6 Ecological Impact Evaluation (page 131),</li> <li>• 7.5 Flora of Study Area (page 137),</li> <li>• 7.6 Fauna of study Area (page 148).</li> </ul> <p>An A was allocated, as the EIA covered the impacts of the Power Station on biodiversity.</p> <p><b>EIA for Medupi Power Station: Biodiversity - Chapter 7: Sect. 7.3.1 General Floristic Attributes pages 126 -148</b></p>                                                       |
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|  | 1.2. Did the EIA identify and evaluate the potential capacity of the broader communities' infrastructure? | B                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|  | 1.2.1 effects on regional pollution levels                                                                | <p>A</p> <p>B</p> <p>C</p> | <p><b>Air</b></p> <p>Regional pollution levels: (human health, vegetation exposure, fugitive emissions, sewage plant, household fuel burning, veld burning, vehicle exhaust emissions) and dispersion modelling were discussed. Ambient air quality of the area's surrounding site and dominant wind direction, as well as impacts of the plumes are also discussed at a regional level.</p> <p><b>EIA for Medupi Power Station: Air Quality: Chapter 9: page 1 to page 144 and Social Impact Assessment: Chapter 15: page 423</b></p> <p><b>Water</b></p> <p>The EIA discussed the assurance of water supply and did not delve into the regional pollution of water.</p> <p><b>EIA for Medupi Power Station: Surface - Chapter 6: Sect. 6.5 pages 82-92</b></p> |

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|  |                           |   | <p><b>Land</b></p> <p>The EIA discussed the local issue of the ash dump having an impact on the land media. It did not discuss the regional pollution on the domestic or hazardous waste dump site.</p>                                                                                                                                                                                                                                                                                                                                                                                                                     |
|  | 1.2.2 energy sources, and | B | <p><i>“Approximately 70% of households in Lephalale Local Municipality have electricity for household lighting, while the remainder use candles. In Ward 2 (Marapong), this figure is slightly higher (75%), and in Ward 3 it is still higher (85%). Virtually all households in the town of Lephalale have access to electricity.”</i></p> <p>The issue of energy sources was partially covered. Sources of energy, for example cooking, was not discussed under Housing and Services hence a B was allocated.</p> <p><b>EIA for Medupi Power Station: Social Impact Assessment: Chapter 15: Sect. 15.4.3 page 422</b></p> |
|  | 1.2.3 transport systems   | B | <p>Chapter 15 (Social Impact Assessment): Sect. 15.4.3 page 422 (small sector). The most common methods of travelling to work and school were discussed. However no further details were given for transportation of the community.</p> <p><b>EIA for Medupi Power Station: Social Impact</b></p>                                                                                                                                                                                                                                                                                                                           |

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|  |                                                  |   | <p><b>Assessment: Chapter 15: Sect. 15.4.3 page 422</b></p> <p>Transport systems were discussed in detail from a business perspective, in terms of the Traffic and Transport situation and in terms of transportation of employees during the operational phase. It also discusses Coal and Ash transportation. Hence a B was allocated as the scoring system for this component.</p> <p><b>EIA for Medupi Power Station: Traffic and Transport: Chapter 13: Sect 13.3 (Traffic/Transport Impact) page 385</b></p> <p><b>Traffic and Transport: Chapter 13: Sect. 13.3.4 Transport of Employees (Operational Traffic) page 391</b></p> <p><b>Traffic and Transport: Chapter 13: (Coal supply Transportation): Sect. 13.3.5 page 392</b></p> <p><b>Traffic and Transport: Chapter 13: (Ash Transportation): Sect. 13.3.6 page 393</b></p> |
|  |                                                  |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|  | 1.3. Did the EIA identify and evaluate potential | B |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

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|  | impact on the resilience of local and national socio-ecosystems? |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|  | 1.3.1 economic options                                           | A | <p>Employment creation during the construction phase, employment creation during operation (which will assist on a positive economic note), change in local infrastructure (access roads, water, sanitation, housing, health care and schools) were elaborated as requiring funds.</p> <p><b>EIA for Medupi Power Station: Social Impact Assessment: Chapter 15: Sect. 15.5.1 (Employment Creation) page 427</b></p> <p>The effect of acid rain as a result of air pollution was also discussed. Several farmers claimed that air pollution from the current power station greatly accelerates the rate at which metal (such as the wire of boundary fences) rusts.</p> <p><b>EIA for Medupi Power Station: Social Impact Assessment: Chapter 15: Sect. 15.5.6 (Effects on local farm owners and residents) page 434</b></p> |

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|  |                      |   | <p>The negative effect that the proximity of the power station will have on their farms' sense of place – which, in turn, may make them less attractive destinations for hunters. As was mentioned in Section 15.4.5 of the EIA, some landowners have built lodges on their farms to house guests during hunting expeditions. A decline in hunting activities could result in a loss of revenue for the owners of these lodges.</p> <p>The possibility that the aforementioned factors might have a negative effect on property values was highlighted. An A was allocated as economic options were considered and discussed.</p> <p><b>EIA for Medupi Power Station: Social Impact Assessment: Chapter 15: Sect. 15.5.6 (Effects on local farm owners and residents) page 435</b></p> |
|  | 1.3.2 transportation | A | <p>The EIA discusses the Traffic and Transport situation in terms of transportation of employees during the operational phase. It also discusses the transportation of Coal and Ash.</p> <p><b>EIA for Medupi Power Station: Chapter 13 (Traffic and Transport): Sect 13.3 (Traffic/Transport Impact) page 385</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

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|  |                      |          | <p><b>Chapter 13 (Traffic and Transport):Sect. 13.3.4 Transport of Employees (Operational Traffic) page 391, (Coal supply Transportation): Sect. 13.3.5 page 392</b></p> <p><b>Chapter 13 (Traffic and Transport): (Ash Transportation): Sect. 13.3.6 page 393</b></p>                                                                                                                                                                                                                                                                                            |
|  | 1.3.3 food           | <b>C</b> | <p>The EIA does not identify and evaluate the potential impact on the resilience of local and national socio-ecosystems on food. The only information mention of food in the EIA is highlighted as <i>“Indirect employment creation in the informal sector may also occur, for instance in terms of food stalls for the convenience of construction workers.”</i> This information is not applicable, hence it was rated as C.</p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.1 page 427 (Employment creation)</b></p> |
|  | 1.3.4 health systems | <b>B</b> | <p><i>“It is foreseen that it will be necessary to establish at least one more clinic to service the local population.”.</i></p> <p>Minimal information available in the EIA, hence it was rated as B.</p>                                                                                                                                                                                                                                                                                                                                                        |

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|  |             |   | <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.4 page 431 (Change in local Infrastructure requirements) Health Care</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|  | 1.3.5 water | A | <p>There will be a change in local infrastructure (water etc.). Therefore water will be provided to the community by an upgrade of the local infrastructure.</p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.4 page 432 (Change in local infrastructure requirements)</b></p> <p><i>“On a larger scale different options were being looked at as the catchment was recognised as being stressed. Within the provisions of the National Water Act (Act 36 of 1998) as stipulated in the National Water Resources Strategy, there is a need to meet the water requirements of the Reserve (Basic Human needs and Ecological requirements) in terms of both water quantity and quality. When this requirement is determined and imposed on the current water supply system, presently there would be insufficient water to maintain the required balance. DWAF will be required to provide an assured water supply.”</i></p> |

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|  |                        |          | <p><b>EIA for Medupi Power Station: Water Resources: Chapter 6: Sect. 6.5.1: Current surface water supply, page 85</b></p> <p>Hence an A was allocated</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|  | 1.3.6 waste management | <b>B</b> | <p>The Council's water treatment plant will have to be enlarged and several new pump stations will have to be installed. The Power Station will have a sewage plant and a water treatment plant. Minimal information was provided regarding the domestic and hazardous waste streams.</p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.4 page 432 (Change in local infrastructure requirements)</b></p> <p>Both windblown dust from the Ash Dump and the addition of brine to fly ash for deposition on the ash dump was discussed, hence a B was allocated.</p> <p><b>EIA for Medupi Power Station: Air Quality: Chapter 9: Air Quality existing sources of emission and baseline air quality (a)Windblown dust from the Ash Dump, page 232</b></p> |
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|  | 1.4. Did the EIA identify and evaluate potential impact on the longer term availability of non-renewable and renewable resources? | B |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|  | 1.4.1 Coal                                                                                                                        | C | <p>The EIA does not identify the impact on a longer term availability of coal, hence it was rated as a C. The EIA does make of the likelihood of expanding operations.</p> <p><i>“It is likely that Kumba Resources would expand their current operations in order to supply coal to the proposed power station. It is expected that these mining operations will create a similar number of additional employment opportunities.”</i></p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.1 page 428 (Employment creation)</b></p> <p><i>“The construction of a power station and infrastructure on these coal deposits may have economic implications, as these coal deposits will become sterilised.”</i></p> <p>Hence a C was allocated as it was not addressed.</p> |

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|  |             |          | <b>EIA for Medupi Power Station: Chapter 8 (Geology, Soils and Agricultural Potential): Sect. 8.1.2 page 173 (The Grooteegeluk Coal Deposits)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|  | 1.4.2 Water | <b>C</b> | <p><i>“The estimated water requirement for the proposed power station is 4 – 6 million cubic meter of water for the first 2400MW installed then ramping up to 8 to 12 million cubic metres of water for a 4800 MW power station.”</i></p> <p>The EIA defines the different options as being:<br/> Option 1: Augmentation from Crocodile West/Marico Catchment<br/> Option 2: Raising the Mokolo Dam wall<br/> Option 3: Development of borehole fields</p> <p>However it does not evaluate the potential impact on the longer term non-renewable resources. Hence a C was allocated.</p> <p><b>EIA for Medupi Power Station: Water Quality: Chapter 6: 6.5.3. (Possible water augmentation sources) page 91</b></p> |
|  | 1.4.3 Air   | <b>A</b> | Specialist investigations were conducted as part of an air quality assessment and it comprised of two                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |

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|  |            |          | <p>components, namely the baseline study and an air quality impact and compliance assessment study. The baseline study included the review of the site-specific atmospheric dispersion potential, relevant air quality guidelines and limits and existing ambient air quality in the region. The impact assessment comprised of the establishment of an emissions inventory for the proposed development, the simulation of ambient air pollutant concentrations and dustfall rates occurring due to project development and operation and the evaluation of the resultant potential for impacts and noncompliance.</p> <p>The EIA considered the two technology alternatives as well. These technologies will assist in reducing pollution and assist in the long term process. Pollutants which are controlled include, fly-ash (particulates), sulphur dioxide and oxides of nitrogen. Hence an A was allocated.</p> <p><b>EIA for Medupi Power Station: Air Quality:<br/>Chapter 9</b></p> |
|  | 1.4.4 Land | <b>C</b> | Although the EIA did evaluate the impacts of the power station's activities, it did not evaluate the                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

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|                                                                                                      |                                                                 |   | potential impact on the longer term availability of renewable resources such as land and it did not address post land closure. Hence a C was considered.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <p>2. Livelihood sufficiency and opportunity</p> <p>How does the power station operation affect:</p> | 2.1. Did the EIA identify opportunities for lasting employment? | B | <p>Employment creation during the construction phase and employment creation during operation is discussed further in the EIA as stated below:</p> <p>The total number of permanent staff required for the proposed power station will be 180 and it will be broken down into the following positions:</p> <p>Management 15<br/> Operating 50<br/> Maintenance 50<br/> Engineering 40<br/> Services 25</p> <p><i>“The mine would have to expand its current operations to meet the increased demand. This, in turn, would necessitate an expansion in its labour force, thereby impacting on the social environment through the creation of additional job opportunities. When considered in conjunction with the employment opportunities that would be created by the proposed</i></p> |

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|  |                                                                    |          | <p><i>power station, it is evident that this effect represents a cumulative impact.”</i></p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.1 page 427 (Employment creation); Sect. 15.2 page 412 (Scope and Limitations) and Sect. 15.3.3 page 414 (Assessment of social impacts)</b></p> <p>The EIA did identify employment for construction workers and for the operational phase. The same was prevalent for the mine. There was no mention of skills transfer in the EIA and the above did not consider lasting employment, therefore it was rated a B.</p> |
|  |                                                                    |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|  | 2.2. Did the EIA identify human health issues and did it evaluate: | <b>B</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|  | 2.2.1 exposure to toxic substances?                                | <b>A</b> | <p><b>Air</b></p> <p>The EIA did identify health risks related to air pollutants that emanated from a power station.</p> <p><b>EIA for Medupi Power Station: Air Quality: Chapter 9: page 1 to page 144</b></p>                                                                                                                                                                                                                                                                                                                                                                                         |

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|  |                                                                                                              | <b>C</b> | <p><b>Water</b></p> <p>The EIA did not identify health risks related to water pollutants.</p> <p><b>Land</b></p> <p>The EIA did not identify health risks related to waste, spillages etc. that would impact that land media, except on the fugitive emissions from the ash dump, which relates back to air pollutants.</p> <p>Exposure to toxic substances was rated a B due to limited information on the water and land component, in the EIA.</p> |
|  | 2.2.2 sanitation issues?                                                                                     | <b>C</b> | <p>The EIA did not identify health risks related to sanitation issues, however it did mention ablution facilities to be built. Hence it was rated a C.</p>                                                                                                                                                                                                                                                                                            |
|  | 2.2.3 the possibility of xenophobic attacks on individuals who move into the area to seek job opportunities? | <b>A</b> | <p>The EIA mentioned that there might be possible conflict between local residents and newcomers if construction workers are not sourced locally, and are housed close to the site. This may give rise to conflict between local residents and newcomers. If the area experiences an influx of job seekers, competition over scarce employment opportunities may also lead to</p>                                                                     |

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|  |                                                                       |   | <p>conflict with locals.</p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.3.3 page 414 (Assessment of social impacts)</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|  | 2.2.4 the possibility of substance abuse?                             | A | <p>The EIA mentioned that another possibility is that a population influx will contribute to alcoholism in the local population. According to a representative of Lephalale Local Municipality (see Erasmus, 2006, personal communication), alcoholism and (more recently) drug abuse are among the most significant social problems that have been attributed to the existing Matimba Power Station. Alcoholism in particular has left its scars on the community due to some families being abused.</p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.3 page 430 (Social problems arising from population influx)</b></p> <p>This was rated as an A, as it was identified and due to the mitigation initiative that was created.</p> |
|  | 2.2.5 the possibility of the spread of sexually transmitted diseases? | A | <p>Another possibility is that a population influx will contribute to the spread of sexually transmitted diseases in the local population. This was rated as an</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

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|  |                                                                        |   | <p>A, as it was identified with mitigation. HIV Aids is a huge issue in South Africa.</p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.3 page 430 (Social problems arising from population influx)</b></p>                                                                                                                                                                                                                                                                                                                                |
|  | 2.2.6 the possibility of impacts on public safety?                     | B | <p>This was rated as a B as it was determined that the construction and operation of the power station are likely to result in an increase in traffic volumes. This could lead to damage to local roads and increased speeding through town, thereby impacting on the safety and daily movement patterns of residents in surrounding communities. However other public safety impacts were not considered and discussed further.</p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.8 page 437 (Safety and daily movement patterns)</b></p> |
|  | 2.2.7 the possibility of impacts on quality of the living environment? | A | <p>Exposure to dust, exposure to noise, exposure to artificial light, exposure to odours, and similar issues could all be given as individual impacts but have been grouped under this single heading, "Quality of the living environment". At the community level, the adequacy of infrastructure, both physical and social,</p>                                                                                                                                                                                                                                                  |

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|  |                                                                                         |                 | <p>is a major area for potential impacts. Population growth, especially rapid growth, in a community can mean that the physical limits of existing infrastructure are reached. Town water supplies and the local sewerage system may not be able to cope with the increased demand. Social services and social facilities, too, may not be able to cope. This was addressed in the EIA, hence an A was allocated.</p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.3.3 page 414 (Assessment of social impacts)</b></p> |
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|  | <p>2.3. Did the EIA identify and evaluate the availability of resources for others?</p> | <p><b>B</b></p> | <p>The EIA mentioned that DWAF was tasked to look at the reserves for water users and the ecological component, it also mentioned that ambient monitoring and dispersion modelling was done for air pollution however it did not cater for the availability for land and air resources for others.</p> <p><b>EIA for Medupi Power Station: Surface - Chapter 6: Sect. 6.5 page 82-92</b></p> <p>The EIA mentioned that social investment initiatives be planned in close collaboration with local</p>                                                         |

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|    |                                                                                                                                                             |   | <p>community structures (such as the Marapong Development Association) as well as with representatives of the local municipality that are involved with Local Economic Development (LED). The consultation with communities would assist with their needs being considered. The EIA also mentioned that careful coordination with other, existing initiatives must be done in order to avoid fragmentation and overlap of efforts.</p> <p><b>EIA for Medupi Power Station: Chapter 2 (Description of the proposed project): Sect. 2.2.1 page 10 (The 'Do Nothing' Alternative)</b></p> |
|    |                                                                                                                                                             |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|    | 2.4. Did the EIA identify and evaluate learning and associated capacity building, including the indirect effects on education and training by other bodies? | C | The EIA did not identify skills development and capacity building.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| 3. |                                                                                                                                                             |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|    | 3.1. Did the EIA identify and evaluate the unequal                                                                                                          | C | The EIA did not identify equity issues such as distribution of wealth and access to resources. Hence                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |

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| <p>Intragenerational equity</p> <p>How does the power station operation affect:</p> | distribution of wealth, access to resources and influence on the power station?                                                         |   | a C was allocated.                                                                                                                                                                                                                                                                                                                                                                                            |
|                                                                                     |                                                                                                                                         |   |                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                     | 3.2. Did the EIA identify and evaluate the equality of access to health, valued employment, respected knowledge and community security? | C | The EIA did not identify equity of access to health, valued employment, respected knowledge and community security. Hence a C was allocated.                                                                                                                                                                                                                                                                  |
|                                                                                     |                                                                                                                                         |   |                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                     | 3.3. Did the EIA identify and evaluate gender equality?                                                                                 | C | <p>The information in the EIA relates to the number of individuals in an age category per ward group, but it does not inform one of the gender equity that would be affected in the operation of the power station. Hence a C was allocated.</p> <p><b>EIA for Medupi Power Station: Chapter 5 (General description of the study area environment): Sect. 5.7.3 page 59 (Age and gender distribution)</b></p> |
|                                                                                     |                                                                                                                                         |   |                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                     | 3.4. Was racism discussed and were                                                                                                      | C | The EIA did not identify how the power station operation would affect racism and how to try and                                                                                                                                                                                                                                                                                                               |

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|  | mechanisms looked at to prevent racism from occurring?                                                                                                                                                            |   | prevent it. Hence a C was considered.                                                                                                                                                                                                                                                                                                                                                                                  |
|  |                                                                                                                                                                                                                   |   |                                                                                                                                                                                                                                                                                                                                                                                                                        |
|  | 3.5. Did the EIA identify and evaluate the distribution of wealth, influence and access to resources between advantaged and disadvantaged nations (including effects on revenue flows, dependency effects, etc.)? | C | <p>The EIA identified what currently exists as well as the shortage of houses, services, transportation, access to electricity but it did not dwell into the distribution of the above. Hence a C was allocated.</p> <p><b>EIA for Medupi Power Station: Chapter 5 (General description of the study area environment): Sect. 5.7.6 (Income) page 60 , Sect. 5.7.7 (Housing) page 61, 5.7.8 (Services) page 61</b></p> |
|  |                                                                                                                                                                                                                   |   |                                                                                                                                                                                                                                                                                                                                                                                                                        |
|  | 3.6. Did the EIA identify and evaluate the well-being of non-human species (including effects on habitat, quality of ecosystem services and vulnerability to stresses)?                                           | A | The ecological studies were considered for water, air and biodiversity and were stipulated in 1.1.1; 1.1.2 and 1.1.3. The EIA did cater for the ecological studies. Hence an A was considered                                                                                                                                                                                                                          |

| <p>4.</p> <p>Intergenerational equity</p> | 4.1. Did the EIA identify and evaluate potential costs and benefits for future generations? | B | <p>The electricity demand in South Africa is placing increasing pressure on Eskom's existing power generation capacity. South Africa required additional peaking capacity in 2007 and base load capacity in 2010 (these demands are determined by the average growth rate). This has put pressure on the existing installed capacity to be able to meet the energy demands into the future. The 'do nothing' option will, therefore, result in these electricity demands not being met in the short term. This has serious short- to medium-term implications for socio-economic development in South Africa. The benefit is that the future generations will not suffer the consequences of an energy crisis.</p> <p><b>EIA for Medupi Power Station: Chapter 2 (Description of the proposed project): Sect. 2.2.1 page 10 (The 'Do Nothing' Alternative)</b></p> |
|-------------------------------------------|---------------------------------------------------------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                           |                                                                                             |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                           | 4.2. Did the EIA identify and evaluate transition towards a future energy supply?           | B | <p>The future energy supply will comprise combined cycle gas turbine, regional hydro power, researching and demonstrating renewable energy (e.g. solar thermal plants) and long term nuclear energy supply.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

|  |                                                                                                |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|--|------------------------------------------------------------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                                                                                                |                 | <p>This new energy mix will assist in reducing the current environmental impacts.</p> <p><b>EIA for Medupi Power Station: Chapter 2 (Description of the proposed project): Sect. 2.2.1 page 10 (The 'Do Nothing' Alternative)</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|  |                                                                                                |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|  | <p>4.3. Did the EIA identify and evaluate legacy costs (e.g. storage of long term wastes)?</p> | <p><b>C</b></p> | <p>Air quality relates to climate change and affects the future generation. The EIA identified cleaner technology to reduce emissions. With over 90% of South Africa's electricity generated from coal, the country emits approximately 510 million tonnes of CO<sub>2</sub> per year. However it was not discussed as a legacy cost.</p> <p><b>EIA for Medupi Power Station: Air Quality: Chapter 9: page 1 to page 144.</b></p> <p>In the water sector the EIA did not discuss assurance for long term supply of water. DWAF was requested to look into it. It was not discussed as a legacy cost.</p> <p><b>EIA for Medupi Power Station: Water Quality: Chapter 6: 6.5.3. (Possible water augmentation sources) page 91.</b></p> <p>In the land sector the ash dump disposal on land was</p> |

|                                                                                                           |                                                                                                                                                                              |          |                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                           |                                                                                                                                                                              |          | discussed however recycling initiatives were not discussed as this could have assisted with increasing the open space in landfill sites as waste will be reused. It was not discussed as a legacy cost.<br><br>HIV was discussed but not as a legacy cost. Hence a C was allocated for legacy cost.                                                                           |
|                                                                                                           |                                                                                                                                                                              |          |                                                                                                                                                                                                                                                                                                                                                                               |
| <b>5. Resource maintenance and efficiency.</b><br><br><b>How does the power station operation affect:</b> | 5.1. the severity of damage from resource extraction (over full life cycle, including induced and cumulative effects) as compared to existing practices and to alternatives? | <b>C</b> | <p>This was not identified in the EIA. The resource that was discussed was water efficiencies. This included technology for dry cooled versus wet cooled. The only other energy sources that were discussed are mentioned in 4.2 above.</p> <p><b>EIA for Medupi Power Station: Chapter 9 (Air Quality Impact Assessment): Sect. 9.1.2 page 186 (Project description)</b></p> |
|                                                                                                           |                                                                                                                                                                              |          |                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                                                           | 5.2. the net use of energy, energy quality matching and the nature of energy sources (including any bridging to renewable and low impact sources)?                           | <b>B</b> | <p>The proposed power station is a dry cooled, pulverised fuel (PF) supercritical station with a thermal efficiency of up to 40% Hence it was rated a B.</p> <p><b>EIA for Medupi Power Station: Chapter 9 (Air Quality Impact Assessment): Sect. 9.1.2 page 186 (Project description)</b></p>                                                                                |

|  |                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|--|------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  |                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|  | 5.3. the net use of water (including effects on availability of water for ecosystem functions as well as human needs)? | <p><b>B</b></p> <p>The most efficient technology for water reduction was research and the alternatives were discussed in the EIA. This is mention as:</p> <p><i>“Water consumption values for a typical 3 pack power station for effectively reducing SO<sub>2</sub> emissions indicate that the dry FGD process uses 35 % less water than the wet process, with a wet FGD system consuming approximately 0.147 l/kWh and a dry FGD system consuming approximately 0.055 l/kWh, hence a water consumption differential of approximately 0.092 l/kWh between a wet and a dry FGD system.”</i></p> <p>DWAF still had to determine the reserve that was required for the ecological functioning and then determine the quantity required for power station use.</p> <p><b>EIA for Medupi Power Station: Chapter 2 (Description of the proposed project): Sect. 2.5.4 page 19 (Emissions Control Technologies)</b></p> |
|  | 5.4. the net use of other materials and resources,                                                                     | <p><b>B</b></p> <p>The materials used as input into the process include, water and coal. Due to the output materials,</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |

|  |                                                                                                                     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--|---------------------------------------------------------------------------------------------------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | and the potential hazardousness of direct and embodied pollution and other wastes?                                  |   | <p>hazardous materials will be used to reduce the emissions at the power station. The most suitable flue gas desulphurisation (FGD) technologies for the proposed power station include the use of wet or dry (semi-wet) scrubbers. These technologies allow for the introduction of calcium (Ca), which removes the SO<sub>2</sub> through the formation of calcium sulphite (CaSO<sub>3</sub>) or calcium sulphate (CaSO<sub>4</sub>). Wet and semi-dry technologies are commercially proven to remove in excess of 90% of SO<sub>2</sub> on a scale of 700MWe unit sizing and above. Minimal information was given in the EIA regarding dumping of waste on land.</p> <p><b>EIA for Medupi Power Station: Chapter 2 (Description of the proposed project): Sect. 2.5.4 page 18 (Emissions Control Technologies)</b></p> |
|  |                                                                                                                     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|  | 5.5. the transition from non-renewable high impact energy and material sources to renewable and low impact sources? | C | <p>The identification of alternative sources within production was not identified in the EIA. Hence a C was allocated.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|  |                                                                                                                     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

|                                          |                                                                                                                                                       |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                          | 5.6 the potential for rebound effects (e.g. savings from power station efficiencies facilitating expansion of demands and adverse effects elsewhere)? | B | <p>The proposed power station is thus a dry cooled, pulverised fuel (PF) supercritical station with a thermal efficiency of up to 40 %. The efficiency will be calculated in terms of saving of auxiliary power. This was rated a B as efficiency was considered, however more efficiencies could have been considered.</p> <p><b>EIA for Medupi Power Station: Chapter 9 (Air Quality Impact Assessment): Sect. 9.1.2 page 186 (Project description)</b></p> |
|                                          |                                                                                                                                                       |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                          | 5.7. the potential for efficiencies that reduce desirable diversity, local suitability and redundancy?                                                | B | <p>Dry cooled efficiency related to water was looked at in the EIA. Lephalale is a water scarce town. The efficiencies for coal were not focused on in the EIA. This was rated a B as efficiency was considered, however more efficiencies could have been considered.</p>                                                                                                                                                                                    |
| 6. Social–<br>ecological<br>civility and |                                                                                                                                                       |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                          | 6.1. the social awareness of citizens (including through involvement in framing problems and solutions, opportunities to create or strengthen         | B | <p>The public participation was compensated for in the EIA however opportunities for mutual learning can be improved. Hence a B was allocated.</p> <p><b>EIA for Medupi Power Station: Appendix AE – Minutes –Key Stakeholder Workshop</b></p>                                                                                                                                                                                                                |

|                                                                                              |                                                                                                                  |   |                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>democratic<br/>governance</p> <p>How does the<br/>power station<br/>operation affect:</p> | social ties of mutual learning and assistance, and sensitivity to disadvantaged groups)?                         |   |                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                                              |                                                                                                                  |   |                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                                              | 6.2. the ecological awareness of citizens (e.g. about ecosystem functions and capacities and associated values)? | A | This was considered in the EIA as specialist studies. The EIA was provided to all the registered interested and affected parties.                                                                                                                                                                                                                                                  |
|                                                                                              |                                                                                                                  |   |                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                                              | 6.3. the social responsibility of market participants?                                                           | C | This was not considered in the EIA.                                                                                                                                                                                                                                                                                                                                                |
|                                                                                              |                                                                                                                  |   |                                                                                                                                                                                                                                                                                                                                                                                    |
|                                                                                              | 6.4. the capacity of participants to be actively involved in deliberations and decision making on public issues? | A | <p>The EIA did cater for a public participation process according to the requirements of the environmental impact assessment process. The interested and affected parties were allowed during this process to voice their opinions regarding the potential impacts of the project.</p> <p><b>EIA for Medupi Power Station: Appendix AE – Minutes –Key Stakeholder Workshop</b></p> |

|  |                                                                                     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
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|  |                                                                                     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|  | 6.5. the possibility of influx of job seekers and different cultures into the area? | A | <p><i>“As news regarding the proposed project spreads, expectations regarding possible employment opportunities may take root. Consequently, the area surrounding the site will experience an influx of job seekers. Available data indicates that Marapong is already experiencing a significant influx of people looking for work (Mmoya, 2006, personal communication), and it is likely that this will increase once construction activities commence”.</i></p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.3.3 page 414 &amp; 428 (Assessment of social impacts)</b></p> |
|  |                                                                                     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|  | 6.6. possible conflict between local residents and newcomers?                       | A | <p><i>“If construction workers are not sourced locally but are housed close to the site, this may give rise to conflict between local residents and newcomers. If the area experiences an influx of job seekers, competition over scarce employment opportunities may also lead to conflict with locals”.</i></p> <p>This was considered in the EIA hence an A was allocated.</p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social</b></p>                                                                                                                                                                      |

|                                                    |                                                                                                                                                |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|----------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                    |                                                                                                                                                |   | <b>Impact Assessment): Sect. 15.3.3 page 414 (Assessment of social impacts)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                    |                                                                                                                                                |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|                                                    | 6.7. possibility of an increase in crime?                                                                                                      | A | <p><i>“An influx of construction workers and job seekers might be accompanied by an increase in crime. Even if particular instances of crime are not as a result of the newcomers, they may still be attributed to them by local communities. Mitigation: Meet with residents’ associations and local Community Policing Forum to identify effective strategy for combating crime in the area.”</i></p> <p>The issues and mitigation was discussed in the EIA hence an A was allocated.</p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.3 page 430 (Social problems arising from population influx)</b></p> |
|                                                    |                                                                                                                                                |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>7. Precaution and adaptation for resilience</b> | 7.1. risks of significant damage (e.g. high risk of minor damage, low or ill-understood risks of potentially significant problems) as compared | B | <p>A risk matrix was catered for in the EIA (discussed further in each chapter of the EIA) however it did not compare to existing practices. The EIA did not discuss the gaps in the knowledge of uncertainties, therefore a B was considered.</p>                                                                                                                                                                                                                                                                                                                                                                                                    |

|                                              |                                                                                                                                                                                                                                                                           |   |                                                                                                                                                                                                                                                                                                                                                                                    |
|----------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| How does the power station operation affect: | to existing practices and to alternatives?                                                                                                                                                                                                                                |   |                                                                                                                                                                                                                                                                                                                                                                                    |
|                                              |                                                                                                                                                                                                                                                                           |   |                                                                                                                                                                                                                                                                                                                                                                                    |
|                                              | 7.2. capacity for monitoring changes (e.g. by providing good baseline information on initial conditions)?                                                                                                                                                                 | B | <p>Good baseline data monitoring on air and water. There was monitoring done on land (in terms of biodiversity but not in terms of landfill sites that impact on land quality) but the information was not as good as the information for air and water, therefore an A was considered.</p> <p><b>EIA for Medupi Power Station: Air Quality: Chapter 9: page 1 to page 144</b></p> |
|                                              |                                                                                                                                                                                                                                                                           |   |                                                                                                                                                                                                                                                                                                                                                                                    |
|                                              | 7.3. the adaptive and precautionary qualities of the industries waste and energy systems (including incorporation of qualities facilitating adaptation in the face of surprise: flexibility, reversibility, diversity, fall back options, and safe-fail characteristics)? | C | This was not considered in the EIA.                                                                                                                                                                                                                                                                                                                                                |

|                                                                                                                                 |                                                                                                                                                                                                            |   |                                                                                                                                                              |
|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                                                                                 |                                                                                                                                                                                                            |   |                                                                                                                                                              |
|                                                                                                                                 | 7.4. development of a context and culture of precaution and adaptation?                                                                                                                                    | C | This was not catered for in the EIA.                                                                                                                         |
| <b>8. Immediate and long term integration</b><br><b>How do the interrelations among the power station's operation's effects</b> | 8.1. the delivery or potential for positive feedbacks and mutual reinforcement of desirable effects from the project itself and from other current and reasonably anticipated activities and undertakings? | C | This was not catered for in the EIA.                                                                                                                         |
|                                                                                                                                 |                                                                                                                                                                                                            |   |                                                                                                                                                              |
|                                                                                                                                 | 8.2 the capacity to enhance these positive effects?                                                                                                                                                        | C | This was not catered for in the EIA.                                                                                                                         |
|                                                                                                                                 |                                                                                                                                                                                                            |   |                                                                                                                                                              |
|                                                                                                                                 | 8.3 Promotion of long term development on the workforce, employee                                                                                                                                          | A | <i>"The project will offer socio-economic benefits in the form of employment creation. It is therefore recommended that social investment initiatives be</i> |

|            |                                                                                                                                                                                                     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| influence: | households and the region                                                                                                                                                                           |   | <p><i>planned in close collaboration with local community structures (such as the Marapong Development Association) as well as with representatives of the local municipality that are involved with Local Economic Development (LED)".</i></p> <p>Social labour plans and mitigation were both discussed hence an A was allocated.</p> <p><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.5 page 433 (Social investment initiatives)</b></p> |
|            |                                                                                                                                                                                                     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|            | 8.4 Proper planning and rehabilitation of the power station infrastructure land and waste dumps in considering the future social and economic impact on communities and development for the region. | C | This was not catered for in the EIA.                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|            |                                                                                                                                                                                                     |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
|            | 8.5 Development and Implementation of social                                                                                                                                                        | A | <i>"It is therefore recommended that social investment initiatives be planned in close collaboration with local</i>                                                                                                                                                                                                                                                                                                                                                              |

|  |                                                                                                                                 |   |                                                                                                                                                                                                                                                                                                                                                                                                               |
|--|---------------------------------------------------------------------------------------------------------------------------------|---|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | labour plans to promote socio-economic development in the affected communities and to prevent or lessen negative social impacts |   | community structures (such as the Marapong Development Association) as well as with representatives of the local municipality that are involved with Local Economic Development (LED)". Social labour plans and mitigation were both discussed hence an A was allocated.<br><b>EIA for Medupi Power Station: Chapter 15 (Social Impact Assessment): Sect. 15.5.5 page 433 (Social investment initiatives)</b> |
|  |                                                                                                                                 |   |                                                                                                                                                                                                                                                                                                                                                                                                               |
|  | 8.6. the delivery or risk of negative feedbacks and mutually reinforcing adverse effects?                                       | C | This was not catered for in the EIA                                                                                                                                                                                                                                                                                                                                                                           |
|  |                                                                                                                                 |   |                                                                                                                                                                                                                                                                                                                                                                                                               |
|  | 8.7. the capacity to interrupt and reverse these negative effects?                                                              | C | This was not catered for in the EIA                                                                                                                                                                                                                                                                                                                                                                           |
|  |                                                                                                                                 |   |                                                                                                                                                                                                                                                                                                                                                                                                               |

### 4.3 Overall sub-criteria evaluation

This section will highlight the overall score for each criterion. Table 4-2 below is a simplified version of Table 4-1 in terms of the scoring. It indicates in the column on the extreme right-hand side columns the overall score for each of the eight criteria.

**TABLE 4-2: OVERALL SCORE FOR EACH OF THE SUSTAINABILITY CRITERIA EVALUATED AGAINST THE MEDUPI EIA**

| NUMBER | DESCRIPTION OF THE DEVELOPMENT                       | A | B | C |
|--------|------------------------------------------------------|---|---|---|
| 1      | SOCIO-ECOLOGICAL SYSTEM INTEGRITY AND RESILIENCE     |   | X |   |
| 2      | LIVELIHOOD SUFFICIENCY AND OPPORTUNITY               |   | X |   |
| 3      | INTRAGENERATIONAL EQUITY                             |   |   | X |
| 4      | INTERGENERATIONAL EQUITY                             |   | X |   |
| 5      | RESOURCE MAINTENANCE AND EFFICIENCY                  |   | X |   |
| 6      | SOCIAL-ECOLOGICAL CIVILITY AND DEMOCRATIC GOVERNANCE | X |   |   |
| 7      | PRECAUTION AND ADAPTATION FOR RESILIENCE             |   | X |   |
| 8      | IMMEDIATE AND LONG TERM INTEGRATION                  |   | X |   |

The set of case specific criteria that were developed in Chapter 3 (after considering Gibson's eight sustainability principles, Gaudreau and Gibson's sub-criteria, as well as literature relating to sustainability) were used to evaluate the Medupi EIA. The later part of the chapter focused on the overall score for each criterion. Chapter 5 will highlight the strengths and weaknesses of the Medupi power station EIA.

## CHAPTER 5: DISCUSSION

### 5.1 Introduction

In the previous chapter the Medupi EIA was evaluated against the developed set of case specific sustainability criteria (for power stations in South Africa). Each criterion will be expanded upon and discussed more extensively in this chapter. The overall assessment will be supplemented with a brief synopsis (one or two paragraphs) of the EIA's strengths and weaknesses. It will also focus on highlighting any key deficiencies which would require correction in order to consider sustainability in EIAs.

### 5.2 Socio-ecological system integrity and resilience

**TABLE 5-1: REVIEW AREA 1: SOCIO-ECOLOGICAL SYSTEM INTEGRITY AND RESILIENCE**

| NUMBER  | DESCRIPTION OF THE DEVELOPMENT                   | A | B | C |
|---------|--------------------------------------------------|---|---|---|
| 1       | SOCIO-ECOLOGICAL SYSTEM INTEGRITY AND RESILIENCE |   | X |   |
| AVERAGE |                                                  |   |   |   |

The deficiency in the EIA was regarding the potential impact on the longer term availability of resources of coal, water and land. This could lead to over exploitation of the socio-ecological resilience. Further implications of over exploitation of resources need to be noted in the EIA. Once these resources have deteriorated, industries could most likely cease to exist. Unrealistic demands on ecosystems have been made in recent decades to meet growing human demands. These demands have placed pressure on ecosystem balances and have depleted the ability of the natural environment to replace biocapacity consumed. Consequently, this has weakened the capacity of the natural environment to deliver ecosystem services such as purification of air, water and land. This creates a tension between the social, economic development and environmental sustainability. Over exploitation of coal, water and land causes a direct change and a reduction in ecosystem goods and services. These processes have a replica effect and thus threaten to diminish socio-ecological resilience and create sensitivity to both the environment and socio-economic change. The EIA requires further analysis of the nature of socio-ecological resilience and adaptation to vulnerability in order to identify long term robustness. Another key deficiency identified during the study is the effects on regional pollution levels on land. A sharpened focus on this issue is required. For example, an investigation of where to dispose of the domestic and hazardous waste streams. These waste streams will decrease the open space

of landfill sites. Will new sites be developed in the area to cater for this? This will increase the land pollution in the area. Will the waste streams be trucked away at enormous cost? The overall score for criterion 1 is a B, which is average. If the deficiencies are addressed, then the overall score will be strong on the socio-ecological system integrity and resilience.

### **5.3 Livelihood sufficiency and opportunity**

**TABLE 5-2: REVIEW AREA 2: LIVELIHOOD SUFFICIENCY AND OPPORTUNITY**

| NUMBER         | DESCRIPTION OF THE DEVELOPMENT         | A | B | C |
|----------------|----------------------------------------|---|---|---|
| 2              | LIVELIHOOD SUFFICIENCY AND OPPORTUNITY |   | X |   |
| <b>AVERAGE</b> |                                        |   |   |   |

In review area 2, the strength is exposure to toxic substances, for example those found in the air. The baseline information has been well established for the area, as Matimba Power Station has been operating in that area. In South Africa, power stations have been leaders in the field of setting up base line ambient stations. The associated technology assisted in sharing the information gained. Despite toxic substances being identified as strength in the Medupi EIA it is also a weakness in another sense. There is a need to add focus on exposure to toxic substances in water and on land as well. These exposures need to be documented. Another deficiency in the EIA is capacity building of the workforce. A skills transfer programme should be documented in the EIA. The overall score is a B. This is average and there is room for improvement. The EIA could even be evaluated as strong, once the deficiencies are addressed.

### **5.4 Intragenerational equity**

**TABLE 5-3: REVIEW AREA 3: INTRAGENERATIONAL EQUITY**

| NUMBER          | DESCRIPTION OF THE DEVELOPMENT | A | B | C |
|-----------------|--------------------------------|---|---|---|
| 3               | INTRAGENERATIONAL EQUITY       |   |   | X |
| <b>WEAKNESS</b> |                                |   |   |   |

The entire intragenerational equity section is recognised as a weakness in the EIA. Only one strength is highlighted in review area 3. The weakness stems from the fact that no

information was documented regarding the distribution of wealth, access to health care, gender equity, racism, access to resources, and the well-being of non-human species. A lot of focus needs to be added in this category. South Africa prior to 1994 followed the apartheid regime, which accommodated only certain race groups, as well as contributed to unequal gain for other race groups. This should be a major focus area for South Africa holistically. The concern is that there is no focus on equity between people of the same generation. The EIA needs to list how the equal distribution of resources will be considered. The overall score for this criterion is a C, which portrays weakness. In order for sustainability to be incorporated into EIAs for power stations, this area requires a lot of focus.

## 5.5 Intergenerational equity

**TABLE 5-4: REVIEW AREA 4: INTERGENERATIONAL EQUITY**

| NUMBER         | DESCRIPTION OF THE DEVELOPMENT | A | B | C |
|----------------|--------------------------------|---|---|---|
| 4              | INTERGENERATIONAL EQUITY       |   | X |   |
| <b>AVERAGE</b> |                                |   |   |   |

There is no strength in Review area 4. The weakness is particularly attributed to legacy costs. This is currently not addressed in the EIA. Thambiran and Diab (2011:6658) mention that *“access to energy, in particular fossil fuel based energy, has been a key driver of economic and social development throughout the world, yet is simultaneously the root cause of contemporary environmental problems such as climate change, acid rain and urban smog”*. Power stations have severe negative effects on climate change. Climate change is a legacy cost. The future generations will then have to bear the brunt of this legacy cost. Further investigations into cleaner technology are required. Another legacy cost not included was that of waste. It is recommended that further sub-criteria be developed for legacy costs due to the contributions of power stations to negative environmental impact. The overall score for this criterion is a B and once the deficiencies in the EIA are addressed, the score can improve to a strong sustainability contribution.

## 5.6 Resource maintenance and efficiency

**TABLE 5-5: REVIEW AREA 5: RESOURCE MAINTENANCE AND EFFICIENCY**

| NUMBER         | DESCRIPTION OF THE DEVELOPMENT      | A | B | C |
|----------------|-------------------------------------|---|---|---|
| 5              | RESOURCE MAINTENANCE AND EFFICIENCY |   | X |   |
| <b>AVERAGE</b> |                                     |   |   |   |

In review area 5, no strengths are highlighted. Several weaknesses are indicated and require more focus. These include the severity of damage from resource extraction. This means that the potential over extraction of natural resources used for input into the power generating sector was not researched and hence the severity of impact could not be determined. The outputs of the process can also cause a resource issue, such as depletion of open space, as well as contributing to climate change. A lifecycle assessment should be incorporated into the EIA. Another recommendation is the incorporation of a cost benefit analysis, which would highlight energy savings verses energy costs, water use etc. Another focus area *is the transition from non-renewable high impact energy and material sources to renewable and low impact sources*. Alternative energy generation from renewable resources should be further researched. These alternative forms of energy generation would have a low impact on sources, due to the fact that renewable resources are being used instead of non-renewable sources. The latter are high impact energy sources. The overall score for this criterion is a B, which is average. By implementing the recommendations the overall score could be adjusted to an A, which is a strong score.

## 5.7 Social–ecological civility and democratic governance

**TABLE 5-6: REVIEW AREA 6: SOCIAL-ECOLOGICAL CIVILITY AND DEMOCRATIC GOVERNANCE**

| NUMBER          | DESCRIPTION OF THE DEVELOPMENT                       | A | B | C |
|-----------------|------------------------------------------------------|---|---|---|
| 6               | SOCIAL-ECOLOGICAL CIVILITY AND DEMOCRATIC GOVERNANCE | X |   |   |
| <b>STRENGTH</b> |                                                      |   |   |   |

Review area 6 indicated a number of strengths that were noted in the EIA. South Africa is renowned for addressing social issues and these have been well addressed in the Medupi EIA. The overall score for this criterion is A, which is a strength.

## 5.8 Precaution and adaptation for resilience

**TABLE 5-7: REVIEW AREA 7: PRECAUTION AND ADAPTATION FOR RESILIENCE**

| NUMBER  | DESCRIPTION OF THE DEVELOPMENT           | A | B | C |
|---------|------------------------------------------|---|---|---|
| 7       | PRECAUTION AND ADAPTATION FOR RESILIENCE |   | X |   |
| AVERAGE |                                          |   |   |   |

The vulnerability and adaptive capacity of the ecosystem has not been captured in the EIA. This weakness creates issues, as the resilience of the ecosystem cannot be assessed. A resilience strategy needs to be developed. It should consider a long term approach and be based on alleviating the underlying causes that can factor in stress. It could also look at enhancing capacities to better manage future uncertainty and change. In order for precautionary adaptation to occur, constant monitoring with mitigation is a must. The weaknesses highlight the fact that industrial waste and energy systems were not researched from an adaptive and precautionary point of view. The overall score indicates a B which is average.

## 5.9 Immediate and long term integration

**TABLE 5-8: REVIEW AREA 8: IMMEDIATE AND LONG TERM INTEGRATION**

| NUMBER  | DESCRIPTION OF THE DEVELOPMENT      | A | B | C |
|---------|-------------------------------------|---|---|---|
| 8       | IMMEDIATE AND LONG TERM INTEGRATION |   | X |   |
| AVERAGE |                                     |   |   |   |

Review area 8 indicates strength in noting the social labour plans in the EIA. A number of weaknesses need to be researched in the immediate and long term integration. Further engagement should be allowed for in order to elicit positive feedback and mutual reinforcement of desirable effects of the power generating sector. The discussion should allow for enhancement of these positive effects. This engagement should also capture the risk of negative feedback and how to mutually reinforce adverse effects of the power generating sector. An area to be further researched is to interrupt and investigate ways to reverse these negative effects. The overall score for this criterion is a B, which is average.

## **5.10 Conclusion**

The case specific sustainability criteria for power stations were used to evaluate the EIA developed for Medupi Power Station in South Africa in order to assess, the extent to which sustainability was incorporated into the EIA process. The overall score of the evaluation of the extent to which sustainability was covered in the Medupi Power Station was a B. This is indicated as average. The evaluation indicated the strength of the EIA lies in the categories for social-ecological civility and democratic governance and the weakness lies in the intragenerational equity category. In order for the EIA scoring to have a stronger sustainability extent, focus needs to be on improving the intragenerational equity aspect, according to the recommendations mentioned earlier. The next chapter will conclude the research and will indicate recommendations for future studies.

## **CHAPTER 6: CONCLUSION AND RECOMMENDATIONS**

### **Introduction**

It can be concluded that sustainability is incorporated into South African legislation however there is a gap in the environmental legislation i.e. the current NEMA EIA process does not require a comprehensive sustainability framework assessment, as contained in this mini thesis. Despite the existence of legislation, the challenge lies in the fact that it is not always effectively implemented. The EIA process is seen as a tool that can effectively deliver sustainability outcomes. However this process is not effectively utilised. The high level sustainability principles developed by Gibson together with the sub-criteria developed by Gaudreau and Gibson, as well as relevant literature were used as tools to develop a set of case specific sustainability criteria for power stations in South Africa, in order to incorporate sustainability into EIAs. It was demonstrated through this research that the case specific sustainability criteria can be used to incorporate sustainability thinking in an EIA.

### **Research Questions**

The research questions that were posed earlier will be reflected upon.

#### **The first question was:**

- Which sustainability criteria will be relevant to the coal fired power generation sector in South Africa?

The sustainability criteria were developed in Chapter 3, Table 3-4, titled “Case specific sustainability criteria”.

#### **The second question was:**

- To what extent was sustainability considered in the Medupi EIA?

An assessment was conducted by evaluating a set of case specific sustainability criteria against the Medupi EIA. This evaluation reflected that sustainability is incorporated into the EIA, however it is average and further recommendations would allow the EIA to be a more effective tool for the incorporation of a stronger sustainability impact. This can be viewed in Chapter 4, Table 4-1, titled “Sustainability criteria evaluation against the Medupi EIA”.

#### **The last question was:**

- What recommendations can enhance sustainability in the coal fired power generation sector?

The recommendations from this research are highlighted below in point form below:

- Consideration for the equal distribution of resources.
- Further sub-criteria to be developed for legacy costs. These should focus on climate change and waste, due to the contribution of power stations to negative environmental impacts.
- Lifecycle assessment and cost benefit analysis should be incorporated into the EIA.
- Strategy to be developed and incorporated into the EIA on long term robustness of socio-ecological resilience and adaptation.
- South Africa should consider introducing guidelines on how to incorporate sustainability thinking in EIAs.

### **Future research**

Sustainability creates a number of opportunities and therefore cannot be ignored. Future research should be considered in the following areas:

- How various other environmental management tools can be used to incorporate sustainability into EIAs.
- Amend the NEMA EIA process to include a requirement a comprehensive sustainability framework assessment
- Research can be conducted on the extent to which sustainability was achieved in other large industries.
- Development of guidelines for the incorporation of sustainability into the different environmental management tools which can lead to improving and building effective stakeholder relationships.
- Review of power station EMS and the extent to which management commitments address the requirements of the EIA and EMP
- Review the findings of the World Bank review on the management commitments for Medupi Power Station and reflect on the gaps identified in the reports.
- Review the requirements for good governance which is aligned to the NEMA principles (focusing on how has the issue been addresses and achieved as part of the EIA documentation and management commitments).

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## **LIST OF ABBREVIATIONS**

|                |                                                                       |
|----------------|-----------------------------------------------------------------------|
| <b>AIDS</b>    | - Acquired Immune Deficiency Syndrome                                 |
| <b>BBSEEC</b>  | - Broad-based socio-economic empowerment charter                      |
| <b>BER</b>     | - Bureau for Economic Research                                        |
| <b>DEA</b>     | - Department of Environmental Affairs                                 |
| <b>DEAT</b>    | - Department of Environmental Affairs and Tourism                     |
| <b>DME</b>     | - Department of Minerals and Energy                                   |
| <b>DPW</b>     | - Department of Public Works                                          |
| <b>EEA</b>     | - Employment Equity Act                                               |
| <b>EIA</b>     | - Environmental Impact Assessment                                     |
| <b>HIV</b>     | - Human Immunodeficiency Virus                                        |
| <b>L DEDET</b> | - Limpopo Department of Economic Development, Environment and Tourism |
| <b>MPRDA</b>   | - Mineral and Petroleum Resources Development Act                     |
| <b>NEMA</b>    | - National Environmental Management Act                               |
| <b>NFSD</b>    | - National Framework for Sustainable Development                      |
| <b>SADC</b>    | - Southern African Development Community                              |
| <b>SLP</b>     | - Social and Labour Plan                                              |
| <b>STDs</b>    | - Sexually transmitted diseases                                       |
| <b>WCED</b>    | - World Commission on Environment and Development                     |
| <b>WHO</b>     | - World Health Organization                                           |

Limpopo Department of Economic Development, Environment and Tourism (L DEDET)

**Key:** KZN – KwaZulu-Natal, MP – Mpumalanga, FS – Free State, NW – North West, GP – Gauteng, EC – Eastern Cape, LP – Limpopo, NC – Northern Cape, WC – Western Cape

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