AGRICULTURAL IMPACT STUDY:

PROPOSED ESKOM POWER STATION IN THE WITBANK GEOGRAPHICAL AREA

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1 Introduction

Trade-offs between industry, agriculture and the environment is an inherent element of development. The increased need for electricity in southern Africa, compelled the largest electricity supplier in Africa, Eskom to increase its own capacity to provide affordable electricity to the developing economies of southern Africa. The availability of fuel such as coal obviously plays an important role in the decision for the location of a new power plant. The Mpumalanga/Gauteng area near Witbank and Bronkhorstspruit was therefore identified as a possible area for the construction of a new power plant. Legislation compels all new developments to execute a detailed environment impact assessment (EIA). The new development will replace agricultural land and therefore the need to include an agricultural impact assessment as part of the EIA.

Agriculture is one of the largest economic sectors in Mpumalanga[1], producing 15% of total output in South Africa (South Africa Yearbook, 2003). The growing demand for agricultural products is an important driver of the agricultural sector therefore emphasizing the importance of acceptable land use patterns that reflects the importance of agriculture in the Province.

Mpumalanga as a province is dominated by vast open areas of natural vegetation which comprises of 71% of the total land area in the Province. The extend of transformed land and / or degraded land is relatively small. Most of the converted land is under some form of cultivation (26%), including commercial plantations, which comprise 8% of the total area of Mpumalanga. Urban areas only comprise about 1.25% of the Province which is relatively small (Department of Agriculture, 2006 (1)).

Agricultural production in Mpumalanga ranges widely from summer cereals and legumes in the highveld region to subtropical and citrus fruit and sugar in the

[1] Although Site Y is located in Gauteng, agriculture on this site is more representative of agricultural patterns in the highveld of Mpumalanga than agriculture in Gauteng

lowveld. The main agricultural crops produced in the highveld[2] area include sunflower seed, sorghum, dry beans, soy beans, potatoes, cotton and maize. Mpumalanga is also well known for intensive and extensive beef production and the production of other animal produce such as chickens, eggs and pork. For the most part of the highveld, dry land farming is utilized in agricultural production, with intensive irrigation activities in the Loskop area near Groblersdal and in the lowveld area adjacent to the Crocodile and Komati Rivers (MII, 2003; Department of Agriculture, 2006 (1)).

The domestic demand for food crops is stimulated by the continuous population growth rate in the province. Considerable potential for increased agro-processing exists in the Province (MII, 2003), but increased agricultural production is constrained by the limited water resources in some of the water-stressed catchments (Department of Agriculture, 2006(1)).

Water is a constraint for the expansion of current agricultural production as is the impact of agricultural activities such as irrigation on available water resources. Agricultural activities have also an impact on biodiversity due to the clearing and loss of vegetation, with the introduction of new cultivated land and irrigation schemes. The clearing of land to be replaced by intensive agricultural activities also results in the loss of habitats and ecosystems, and the associated environmental services provided by such ecosystems (i.e. erosion control, groundwater recharge, etc.). The clearing of natural vegetation and transformation of ecosystems also results in the creation of pathways for alien species invasion. Apart from the obvious disturbance caused by the clearing of land for agricultural production, other environmental impacts also include (Department of Agriculture, 2006(1)):

- Deterioration of soil quality from increased leaching of nutrients;
- Water quality can be adversely affected by siltation and by human and agricultural wastes; and

[2] Kendall is located in the highveld region of Mpumalanga

- Contamination of surface and groundwater from fertilizer and pesticide run-off.

Many demands are placed on land resources in the province, ranging from the use of land for:

- agricultural production,
- mining,
- industries,
- forestation,
- ecotourism,
- private game farming, and
- protected areas for nature conservation.

Since land is a limited resource, the demand for land will coincide with economic development and population growth. Economic and population growth have as one of its consequences the demand for, and an increased competition for land from different sectors. The computation of a cost benefit analysis to determine the benefit of new developments to society is therefore one of the basic elements of an EIA. In most cases agriculture has to give way to other developments; especially when developments are regarded as of national interest.

2 Rationale for agricultural impact assessment.

Both sites X and Y as indicated in Figure 1 (Locality Plan) of the Draft Scoping Report for this project (Ninham Shand, 2006) comprise mainly of agricultural land with only a small percentage of the land consisting of roads and other public infrastructure and rivers. The purpose of this report is to compute and compare the agricultural value of the two sites with each other in order to assist with the final decision on the selection of a specific site for the new power station. The second objective is to compute the impact or loss in agricultural production if all

the land is withdrawn from agricultural production for the duration of the power plant's operation.

3 Methodology

The value of agricultural production is determined by the combination of several factors that are interrelated to each other. The Kendall area is regarded as one of the areas in South Africa with the highest agricultural potential because of the combination of high potential soil, climate and close proximity to the markets. Agricultural production *inter alia* depends on the following factors:

- Soil potential
- Climate
- Topography
- Vegetation
- Water supply, ie. irrigation potential
- Availability and distance from infrastructure such as roads, silos, input suppliers etc.
- Availability of markets for products produced on the land
- Security of the area
- Sustainability of current production methods

Methodology used to obtain and analyze the agricultural data was as follows:

- On-site inspection to obtain a general picture of the region
- Information regarding land ownership provided by Ninham Shand
- Literature study to compare agriculture in the region with agricultural production on specific sites
- Obtain information regarding agriculture in the region from Department of Agriculture's extension offices and agricultural businesses
- Use of satellite imagery to determine land use patterns
- Obtain gross margin data for crops in the region

- Obtain farm level data from individual farmers through questionnaires
- Compute annual agricultural value per ha
- Compute loss in agricultural production by using net present value (NPV) over period of 40 years.
- Compare two sites with each other

4 Results and analysis of results

The data needed to compute and verify agricultural potential are grouped into:

- soil potential, land use and farming system;
- infrastructure;
- potential yields;
- distance from markets;
- gross margins; and
- contribution towards food production in the area.

It is important to note that this section does not deal with the socio-economic impact such as labour etc.

4.1 Soil potential and land use

Based on on-site inspection, satellite imagery as well as data received from individual farmers, it is shown in Table 1 that 27% of land at site X is cultivated for dry land purposes compared to 39% dry lands at site Y. Although farmers at site X indicated a larger percentage of their land as high potential (45 % compared to 32 % for site Y), land cultivated for cash crops does not correspond with their own perception of land potential. The reason for this might be in the fact that crop farmers are in general better informed on their soil potential than livestock farmers; or farmers at site X over value their soil potential; or farmers at site Y are able to cultivate medium potential land because of the presence of reliable water for irrigation purposes at site Y.

Also shown in Table 1 is the small percentage of land under irrigation compared to site Y where 8% of the land is under irrigation from the Wilge river. Farmers indicated that the Wilge river is regarded as a reliable source of irrigation water. Most of the irrigation systems (except for two farms) are pivot systems with good supporting infrastructure (pumps and pipe lines).

Site X has 6 % more natural grazing than site Y with 54% compared to 48%. Site X also has 18% pastures compared to 13% of the land planted with pastures at site Y.

Table 1: Comparison of data between site X and site Y

	Site X	**Site Y**
High potential soil	45 %	32 %
Land cultivated (Dry land)	27 %	39 %
Irrigation land	1 %	8 %
Natural grazing	54 %	48 %
Pastures	18 %	13 %

The land use patterns shown in Table 1 are an indication that more livestock farm activities are taking place at site X whereas farmers at site Y focus more on crop farming. The exception is one farmer at site Y who has an intensive piggery of 4500 pigs and a beef feedlot in combination with intensive pastures under irrigation

4.2 Infrastructure

Most of the farms within the designated areas are equipped with good infrastructure. However, the data clearly show that farms at site Y are much more built up and equipped with modern infrastructure than site X. This is expected taken into consideration the farming systems of livestock farming at site X and crop farming at site Y. Site X has a few good quality farm dwellings and sheds, with livestock handling facilities on nearly all farms and one irrigation system compared to much more infrastructure at site Y. Site Y boasts with 9 farm houses

and other well maintained infrastructure such as irrigation pumps and systems, a 200 ton capacity silo, 14 sheds, handling facilities for animals, a fully equipped piggery with heating systems and a feedlot.

4.3 Potential yields

The difference between site X and Y in terms of yields is very similar under dry land conditions. Farmers at site X indicated their average yields for the past three years as between 3.5 and 5 tons per ha whereas farmers at site Y indicated 4.4 to 4.8 ton as the average for the past three years. However, farmers who irrigated their maize at site Y reported average yields of about 10 tons for the past three years with one farmer with a normal sprinkler irrigation system reporting 8 ton per ha.

Farmers also reported different carrying capacities for natural grazing with farmers at site X indicated that they need three ha per livestock unit (LSU) compared to two ha per LSU at site Y. Just based on the data obtained regarding crop and animal yields, it seems that site Y has better agricultural potential than site X. The recommended carrying capacity for this region however, is 5 ha per LSU and all calculations were based on the recommended carrying capacity (Department of Agiculture, 2006, Standard Bank, 2006).

4.4 Distance from markets

Almost all agricultural products, in relation with industrial products, have a lower price/volume relation which means that the price received on the farm becomes lower the further the farmer is away from the market. This is illustrated in Figure 1:

Transport costs are mainly determined by three factors, namely:

- The bulkiness of the product
- The perishability of the product

- The degree of special treatment of the product.

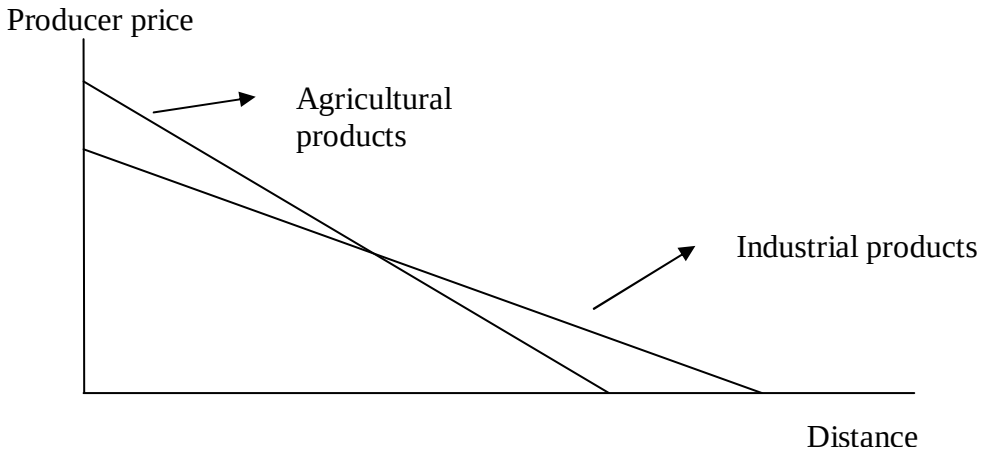

Figure 1: Producer Price of Agricultural Products versus Industrial Products

It is clear that all three of the above-mentioned factors are more frequently present in agricultural products than in industrial products. It is also clear that the farm price or the price that the producer receives declines much more quickly in agricultural products the further away they are from the market. It can therefore be concluded that bulky and perishable products need special care and should be produced as close as possible to the market. Flowers and perishable vegetables such as tomatoes are good examples. Maintaining the cold chain from the farm to the market is costly and necessary to ensure quality of perishable products. Products that are less bulky and perishable need less special care and can be produced further away from the market because of lower transport costs. It is for these reasons that distance from markets play an important role. Both sites X and Y are approximately the same distance from the main markets therefore not allowing distance from markets to influence the decision between sites X and Y. Of importance however is the fact that both sites are located near main markets with good marketing potential for future production. Availability of a reliable source of water for irrigation at site Y and the distance from major markets offer the possibility of the future production of high value crops such vegetables at site Y

4.5 Gross margins for different crops and farming systems

One of the most objective and accurate measures to calculate the value of agricultural production is by means of gross margin calculations. Gross margins provide the gross value of agricultural production after deduction of direct input costs. It is therefore a valuable indication of the profit potential of specific crops. Other costs also influencing profits in agriculture are the financial ability of the owner of the land or the amount of capital available and the overhead costs that have to be covered by the products that are produced

The following gross margin data were obtained for different crops and farming systems in the region (Department of Agriculture, 2006; Standard Bank, 2006):

- Maize (dry land) R1000/ha (Price R900 per ton)
- Maize (irrigation) R1950/ha (Price R900 per ton)
- Soy beans R1350/ha (Price R1400 per ton)
- Dry beans R2200/ha (Price R3000 per ton)
- Beef production R2000 per LSU (carrying capacity 5ha/LSU)

A comparison of financial yields is shown in Table 2. It is clear from the data that the potential revenue per ha at site Y is much larger than revenue per ha at site X. The average gross margin revenue for site X is R749 per ha compared to R961 per ha on site Y. Total revenue per site however differs in that potential revenue is higher at site X because of the size difference of the sites. Estimated size for site X is 5000 ha compared to approximately 2500 ha for site Y.

Total loss in gross agricultural production adds up to R289 m at site X and R259 m at site Y if all the land is withdrawn from agricultural production for a period of 40 years. The net present value (NPV) at a discount rate of 10% adds up to R70.7m and R63.4m respectively for sites X and Y. The loss in total net income adds up to R150 m at site X and R96 m at site Y. The NPV of net income calculated at a discount rate of 10% per annumn is R 36.6m and R 23.5m respectively.

Table 2: Comparison of gross margins and revenue between sites X and Y

	Site X (5000 ha)	Site Y (2500 ha)
Gross income per annum	R 7,239,160	R 6,485,102
Net income per annum	R 3,747,164	R 2,401,404
Gross production 40yrs	R 289,500,000	R 259,000,000
NPV Gross production 40 yrs	R 70,792,000	R 63,418,000
Total net income 40 yrs	R 149,886,500	R 96,056,000
NPV net income 40 yrs	R 36,643,706	R 23,483,500
Gross income per ha	R 1,447	R 2,594
Net income per ha	R 749	R 961
Total net income per ha 40 yr	R 29,977.30	R 38,422.40
Gross production per ha 40 yrs	R 57,900	R 103,600
NPV gross production per ha 40yrs	R 14,158.40	R 25,367.20
NPV net income per ha 40 yrs	R 7,328.74	R 9,393.40

Important in the calculation of NPV though, is to highlight that inflation also has an influence on the value of agricultural production. The producer price index (PPI) for agriculture for the years 1965 to 2002 is shown in Figure 2 (Statistics SA, 2005).

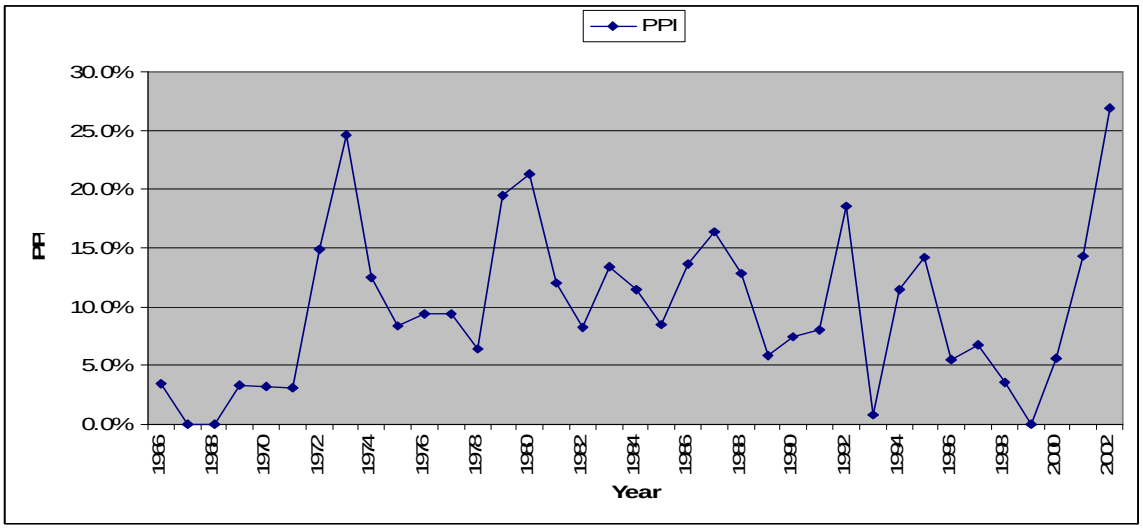

Figure 2. Producer Price Index (PPI) for Agriculture, 1965 to 2003 (Statistics SA, 2005)

The average PPI for agriculture for the 37 years as shown in Table 2 is 9.9%. If the PPI for agriculture follows the same trend for the next 40 years, the total NPV in real terms (2006 base year) of the loss in gross agricultural production could then add up to R289 million and R259 million respectively.

The farm with the intensive piggery and feedlot on site Y is not included in the calculations since its data is not representative of the rest of the farms. Should other factors indicate a preference for site Y, which is doubtful, this farm should be excluded from the site. It is possible to exclude this farm from the site since it is very small and is located at the border of the proposed site Y.

5 Conclusion and recommendation

Based on agricultural information alone, the recommended site for the power plant is site X because of the following reasons:

- Lower agricultural potential per ha
- Site Y is much better developed in terms of infrastructure such as irrigation systems and other fixed infrastructure such as buildings than site X
- Farming systems are much more intensive on site Y than on site X
- The presence of the Wilge river through site Y open up much more opportunities for agricultural and other developments as is the case at site X.

The size of site X is approximately 5000 ha compared to about 2500 ha at site Y and the argument that a larger portion of land will be withdrawn from agricultural land at site X than at site Y might be brought forward. The fact of the matter however, is that the land space to be occupied by the new power station will be more or less the same at both sites, with the rest of the land available for agricultural production after construction of the power plant by means of lease contracts to farmers. The important factor therefore is the impact on agriculture per ha rather than the total impact of the two sites.

Based on the impact of agriculture alone, this study therefore concludes and recommends the utilization of site X for the proposed power station.

To reduce the impact on agriculture, it is recommended that surplus land not occupied by infrastructure or otherwise (especially after completion of construction) be leased back to farmers for utilization of agricultural production. ESCOM could contribute towards land reform in South Africa by making the surplus land available to emerging black farmers who aspire to become commercial farmers.

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