IMPACT ASSESSMENT CASE STUDIES FROM SOUTHERN AFRICA

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VISUAL IMPACT ASSESSMENT OF A PEAKING POWER PLANT, KWAZULU NATAL

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Aims of the Project

Over the past decade, the surplus generating capacity in South Africa has steadily reduced due to increased demand for electricity. Government nominated the Department of Minerals and Energy (DME) to embark on a process to procure additional power generating capacity. DME was responsible for procuring approximately 1,000 MW of new peaking generation capacity as a contribution to meeting future capacity requirements. The initial focus of the process was in the Eastern Cape and KwaZulu Natal where the needs were most pressing. Full EIAs were commissioned to assess the potential impact of alternative peaking power plant projects. As part of the process specialist visual impact assessments (VIAs) were commissioned. This case study deals with the VIAs commissioned for the KwaZulu Natal component of the project.

Brief description of the development and alternatives considered

The proposed peaking power plants would comprise up to six gas turbine units, each capable of producing electrical power in the range of 114 to 191 MW depending on the manufacturer selected. Each unit would comprise a complete turbine, generator and auxiliary set operating in open cycle mode. Fuel is burned in the combustion chambers of the gas turbines to drive the electrical generators in order to generate electricity. The hot exhaust gases are then discharged via the stacks to the atmosphere.

The proposed plant would generate electricity, primarily during peak daily periods, to be injected into the Eskom transmission system. For the purpose of the EIA and the visual assessment an indicative layout (Figure 1) was modeled based on similar plants that had been recently constructed elsewhere in the world. Once the project was approved the construction was anticipated to take about 18 months. The expected lifetime of the power plant was 15 years, after which it could be extended.

Figure 1: An open cycle gas turbine power plant, similar to the type to be constructed for this project.

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Brief description of the development and alternatives considered

Alternatives

Through an extensive screening process undertaken by the DME, two alternative sites were identified, one at Avon and the other at Georgedale in KwaZulu-Natal. It was decided to carry out a comparative visual analysis to determine a preferred site, which would then be subjected to a full EIA. The visual assessment used scenic beauty, visual intrusion, visibility and visual exposure criteria. In the analysis both sites were rated high for magnitude of visual impact but for slightly different reasons. The scenic beauty of the Avon site was considered higher than that of Georgedale as it evoked a stronger sense of place – wide open rolling hills with expansive panoramic views of the surrounding areas. Although the general landscape character of both sites was similar (rural areas with rolling hills), more man-made interventions (railway line and station and urban development) were present near the Georgedale site. These distracted from the overall scenic beauty of the area. The Avon site had 'more to lose' from an aesthetic/sense of place point of view. Visibility on the other hand was rated high for Georgedale because more people would be affected by the power plant, and this was rated moderate to high for the Avon site.

The result was that there was no clear and compelling argument, from a visual impact point of view, that would select one site over the other. This result was fed into the scoping process and when combined with other specialist data a preferred site would be selected. However, when all specialist data was reviewed there still remained a 'deadlock' as to the choice of a preferred site. With this evidence the Client decided to carry out full impact assessments for both sites.

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Visual Impact Assessment process followed for the Avon Site

Visual resource

In determining visual impact it is understood that the receiving environment has worth. Therefore it is important to first establish the value of the landscape. To minimize the qualitative aspects involving human values and associations, the more quantifiable aspects of the landscape were emphasized in this study. Landscape character, landscape quality and 'sense of place' were used to evaluate the visual resource. These are intrinsic to the landscape and thus enable a value to be determined that is independent of the person doing the viewing.

The general area in the vicinity of the Avon site is characterized by rolling hills covered with sugar cane, which afford open panoramic views. The hills fall away to valleys which drain to the Umhlali River south of the site. Figure 2 demarcates the four land-types, and their relative scenic value, that occur in the area: utility (mostly power lines), urban/built up, rural/farmland and riverine. By far the dominant land type is rural farmland, which gives the area its sense of place.

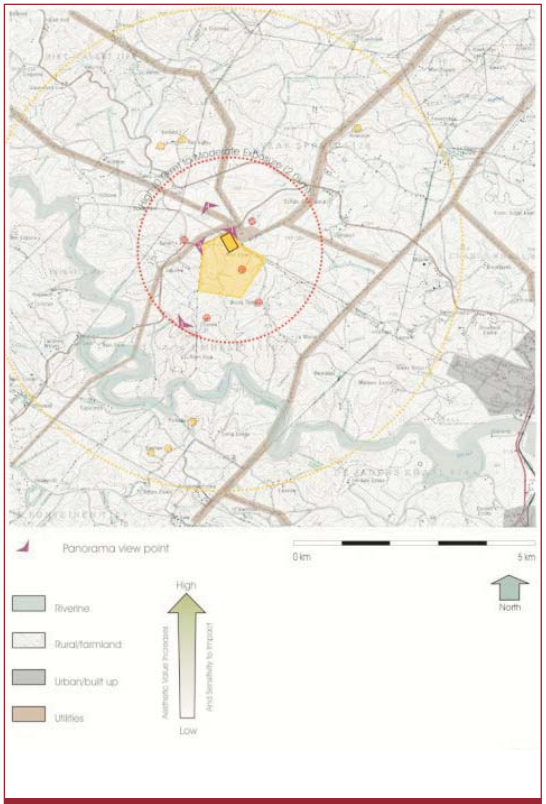

Figure 2: Land use types in the Avon area.

The scenic beauty of the study area was rated moderate to high i.e. an area that exhibits a positive character with valued features that combine to give the experience of unity, richness and harmony, which are potentially sensitive to change in general. But compromising the rural farm scene is the presence of numerous power lines and the existing Eskom-owned transmission substation.

Magnitude of visual impact

Using the worst case scenario, the visual impact of the peaking power plant at the Avon site was then measured as the change to the landscape (visual resource) caused by the physical presence of the plant and its infrastructure and the magnitude of that change i.e. the degree to which the change compromises, enhances or maintains the visual quality of a particular area.

This approach reflects the layman's concerns that normally are:

- Will I be able to see the new development?
- What will it look like?
- Will the development compromise views in the area?

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In the analysis it was therefore imperative to depict that change in as realistic a manner as possible by simulating the power plant's appearance using a technique that portrays an accurate characterisation of the project in its setting.

The visual impact assessment process is illustrated in Figure 3 on the right.

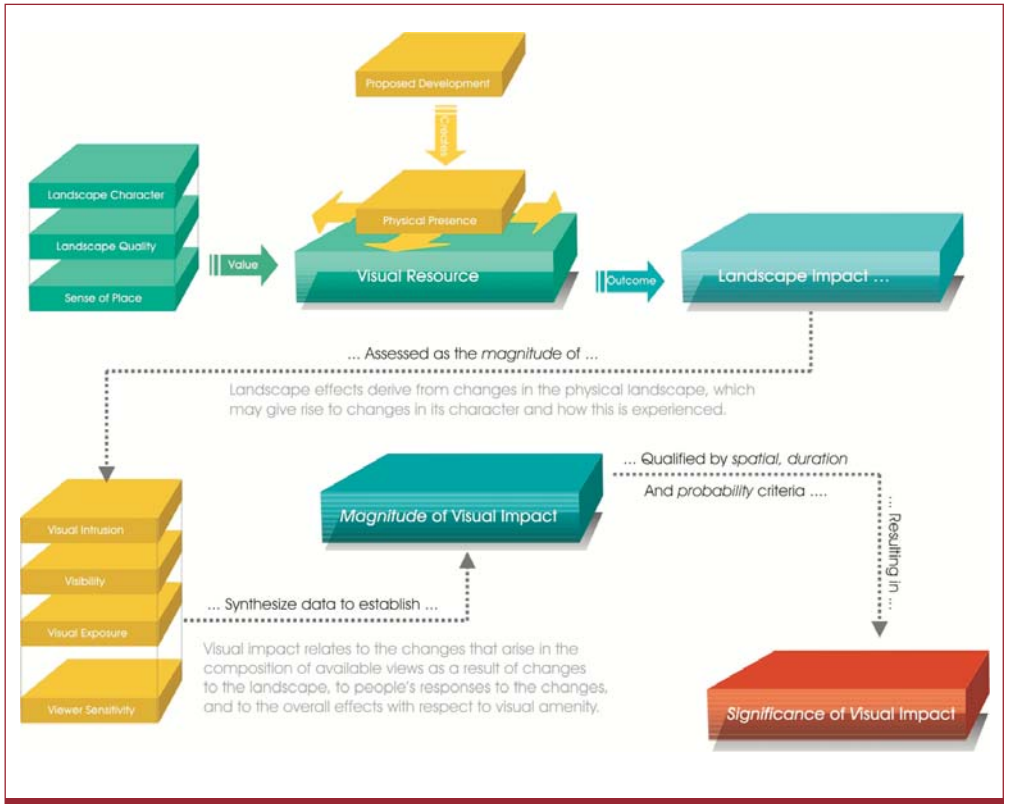

Figure 3: Visual Impact Assessment process

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Visual intrusion

Figure 1 illustrates the physical characteristics of a typical peaking power plant. The proposed plant will be similar in features but not identical.

The simulations on this page were used to illustrate the power plant superimposed over images of the existing landscape. These clearly indicate that the power plant would be highly visible from the northern perspective from the adjacent road (a & b). From the south it would be partially screened by existing trees located along the southern edge of the farmstead (c & d). However, the eastern section of the plant would be highly exposed to views from the south (e & f).

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The power plant's intrusive nature on the surrounding environment is clearly evident in the simulations. This is primarily due to the openness of views from the road, the plant's scale and bulk, and its contrast with existing landscape elements. The result is that key views and the scenic beauty of the landscape would be compromised from some directions. From those directions, the power plant would add to the cumulative negative effect on the visual environment of the existing substation and powerline facilities.

Visibility

The 'zone of potential influence', i.e. the distance beyond which views to the power plant would not be greatly influenced by its presence, was set at 5 km due to its bulk and scale. It was evident from Figure 5 that the viewshed for the power plant extended in two dominant 'strips' north and south of the site. The bulk of the viewshed occurred within a 3 km radius of the site. A series of high points (roughly 1,5 km from the site) created ridgelines that blocked views from east and west of the site.

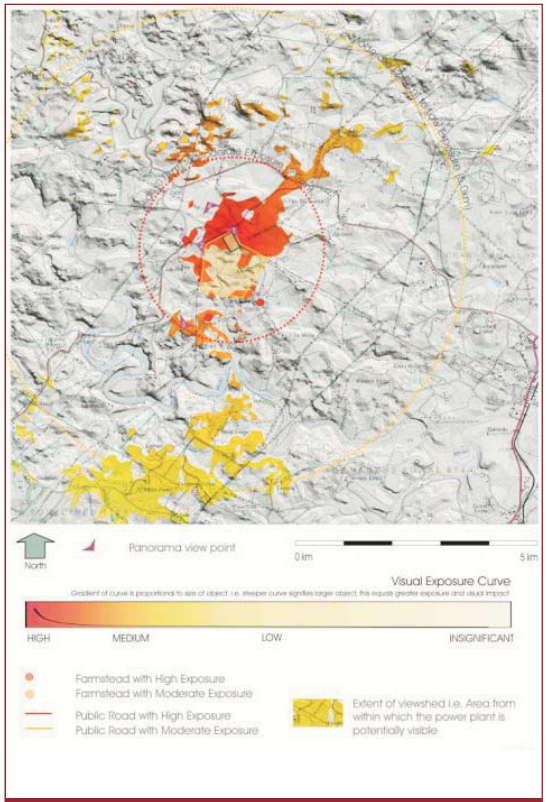

Figure 5: Viewshed for the proposed power plant

Labour accommodation, to the immediate north of the site, would have close views of the proposed site. The closest farm residence, approximately 1 km west of the site, was mostly screened from the proposed power plant by vegetation and topography. Further to the south were two farmsteads and to the north two more. Only one of these five would potentially have open views to the power plant site.

The analysis indicates that the power plant would be visible from less than a quarter of the zone of potential influence and would be visible from relatively few residential properties. The most prominent public views to the site would occur from the main road, which runs west and then north of the site. Where the road turns south, views to the site would be screened by a low ridge. This is not a heavily used road and caters mainly to the local farming community. The site would also be visible for a small section of the Shakaskraal road, immediately north-west of the site.

Within the context of the study region, the visibility of the proposed peaking plant at the Avon site was rated low primarily due to the

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'remoteness' of the site (i.e. in a rural area away from routes to and from nearby urban residential/tourist areas) and the fact that relatively few people would therefore be affected.

Visual exposure

Visual exposure is a contributing negative factor, specifically for close up views (views within a radius of 2 km of the site) from the adjacent road as well as the nearby labour housing and Gessla Farmstead south of the site.

Sensitivity

Views from residences and tourist facilities are typically more sensitive since they are more frequent and of longer duration. Residences, farmsteads and the two tarred roads in the vicinity of the site were regarded as sensitive viewpoints. The nearest affected residence is the property across the road and 750 m to the west of the Avon site. A number of other farmsteads lie to the north and south-east of the proposed site as indicated in Figure 5. Local public roads pass to the immediate north and west of the proposed site.

Magnitude of visual impact

In synthesising the criteria to achieve a magnitude rating, a numerical or weighting system was avoided. Attempting to attach a precise numerical value to qualitative resources is rarely successful, and should not be used as a substitute for reasoned professional judgement. It was predicted that the proposed power plant at the Avon site would have a moderate to high negative impact on key public views within the study area i.e. where the affected environment is altered but natural, cultural and social functions and processes continue in a modified way. It would also negatively impact on the visual quality of what is currently a landscape of moderate scenic beauty.

Significance of visual impact

The significance of the visual impact was predicted using the worst-case scenario. The ratings with mitigation assume that the measures illustrated in the simulations on the following page are effectively applied i.e. primarily the creation of tree screens along the periphery of the site and painting the plant's structure with colours that reflect and compliment the surrounding environment. The magnitude of impact was then qualified with spatial, duration and probability criteria to determine the significance of the impact during the various phases of the project.

Impacts

- The power plant was to be located in a landscape of moderate to high value, not tolerant of change;
- It would be visible from less than a quarter of the zone of potential influence;
- It would cause an intensive change over a localized area resulting in major changes in key views;
- Construction activities would add to the cumulative negative effect on the visual quality of the landscape.

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Simulations of views of the power plant after application of mitigatory measures

Mitigatory measures

- The minimum amount of vegetation and topsoil should be removed from site. Ensure that existing natural vegetation is retained wherever practicable and incorporated into the site design, especially on the periphery of the site;
- Dust suppression and wheel-washing techniques should be in place at all times;
- Only the footprint of the structures and infrastructure should be exposed and hard-covered.
- Paint buildings and structures with colours that reflect and complement the natural browns, dark greens and greys of the surrounding landscape. Avoid shiny or bare metal.
- Plant trees and shrubs along the western and southern sections of the site where compatible with overhead lines.
- Install light fixtures that provide precisely directed illumination to reduce light 'spillage' beyond the immediate surrounds of the power plant.
- Avoid high pole-top security lighting along the periphery of the site, use only security lights that are activated on illegal entry to the site.
- At decommissioning, return the site to its pre-development condition.

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Decision making process

Using the approach described above, a full visual assessment was carried out for each site. Both sites were rated as having a medium impact, although the significance rating before and after mitigation was slightly higher at the Georgedale site. Also, when the results for all parameters of the full EIA were compared, the Georgedale site had a number of significant flaws (ecology, social and development restrictions). Ultimately the Authority returned a positive Record of Decision for the Avon site.

There was however a vociferous appeal made against the Avon site, specifically from a visual impact point of view as well as the potential impact the development could have on property values. The VIA was therefore again scrutinized during the Appeals process.

The approach and method followed in the VIA gave the Authorities and the public a clear understanding of what the visual impact could be and that it could be mitigated, assuming effective implementation of the mitigation measures. The result was that the appeal was overturned.

Conclusions & lessons learnt

A visual impact analysis addresses the importance of the inherent aesthetics of the landscape, the public value of viewing the natural landscape, and the contrast or change in the landscape from the proposed project.

For some topics, such as water or air quality, it is possible to use measurable, technical international or national guidelines or legislative standards, against which potential effects can be assessed. The assessment of likely effects on a landscape resource and on visual amenity is more complex, since it is determined through a combination of quantitative and qualitative evaluations.

In following the approach used in this case study, the VIA included a combination of objective and subjective judgements, and it was important that a structured and consistent approach be used. It was necessary to differentiate between arguments that involve a degree of subjective opinion (as in the assessment of landscape value) from those that are normally more objective and quantifiable (as in the determination of magnitude of change). Ultimately, judgement was based on the training and experience of the author (a qualified and experienced professional Landscape Architect), supported by clear evidence and reasoned argument. It is this approach that provided the Authorities with a clear 'picture' of what the potential visual impact could be and that mitigation measures could successfully reduce the impact if effectively implemented. This enabled the Authorities to take a rational judgement in their proclamation and at the Appeals hearing. The end result being that the project was given the go ahead.

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