STRATEGIC CONTEXT FOR ENERGY PLANNING CHAPTER 2

2.1. Strategic Electricity Planning in South Africa

Eskom's core business is in the generation and transmission (transport) of electricity. Eskom is responsible for the provision of reliable and affordable power to its South African consumers, and currently generates approximately 95% of the electricity used in the country. Therefore the reliable provision of electricity by Eskom is critical for industrial development and related employment in the region and therefore a contributing factor to the overall challenge of poverty alleviation and sustainable development in South Africa. Electricity, by nature, cannot be stored and therefore must be used as it is generated. Therefore, electricity is generated in accordance with supply-demand requirements, and must be efficiently transmitted from the point of generation to the end-user. Eskom's capacity expansion programme supports Government's drive to boost economic growth to 6% by 2010, and investment decisions will be based on this growth target. It is estimated that this will translate in an average growth in demand for electricity of approximately 4% per annum.

If Eskom is to meet its mandate and commitment to supply the ever-increasing needs of end-users, it has to plan, establish and expand its infrastructure of generation capacity and transmission powerlines on an on-going basis. With current energy and electricity demands within the country projected to continue increasing, new investments in electricity generation and transmission capacity are required.

The decision to expand Eskom's electricity generation capacity is based on **national policy** and informed by on-going strategic planning undertaken by the national Department of Minerals and Energy (DME), the National Energy Regulator of South Africa (NERSA) and Eskom. The hierarchy of policy and planning documentation is illustrated in Figure 2.1.

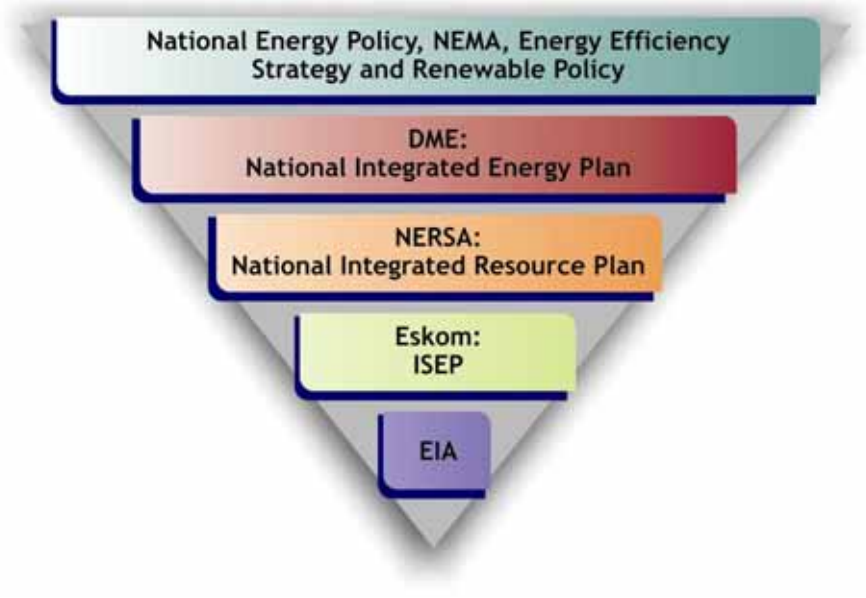


Figure 2.1: Hierarchy of electricity policy and planning documents

2.1.1. White Paper on the Energy Policy of the Republic of South Africa, 1998

Development within the energy sector in South Africa is governed by the White Paper on a National Energy Policy (the National Energy Policy), published by DME in 1998. This White Paper identifies five key objectives for energy supply within South Africa, i.e.:

» increasing access to affordable energy services;
» improving energy sector governance;
» stimulating economic development;
» managing energy-related environmental impacts; and
» securing supply through diversity.

Furthermore, the National Energy Policy identifies the need to undertake an Integrated Energy Planning (IEP) process and the adoption of a National Integrated Resource Planning (NIRP) approach. Through these processes, the most likely future electricity demand based on long-term southern African economic scenarios can be forecasted, and provide the framework for South Africa (and Eskom) to investigate a whole range of supply and demand side options.

2.1.2. Renewable Energy Policy in South Africa

Internationally there is increasing development of the use of renewable technologies for the generation of electricity due to concerns such as climate change and exploitation of resources. In response, the South African government

ratified the United Nations Framework Convention on Climate Change (UNFCCC) in August 1997 and acceded to the Kyoto Protocol, the enabling mechanism for the convention, in August 2002. In addition, national response strategies have been developed for both climate change and renewable energy.

Investment in renewable energy initiatives, such as the proposed wind energy facility, is supported by the National Energy Policy (DME, 1998). This policy recognises that renewable energy applications have specific characteristics which need to be considered. The Energy Policy is "*based on the understanding that renewables are energy sources in their own right, and are not limited to small-scale and remote applications, and have significant medium- and long-term commercial potential*." In addition, the National Energy Policy states that "*Renewable resources generally operate from an unlimited resource base and, as such, can increasingly contribute towards a long-term sustainable energy future*".

The White Paper on Renewable Energy (DME, 2003) supplements the Energy Policy, and sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. It also informs the public and the international community of the Government's vision, and how the Government intends to achieve these objectives; and informs Government agencies and organs of their roles in achieving the objectives.

The support for the Renewable Energy Policy is guided by a rationale that South Africa has a very attractive range of renewable resources, particularly solar and wind, and that renewable applications are, in fact, the least cost energy service in many cases from a fuel resource perspective (i.e. the cost of fuel in generating electricity from such technology); more so when social and environmental costs are taken into account. In spite of this range of resources, the National Energy Policy acknowledges that the development and implementation of renewable energy applications has been neglected in South Africa.

Government policy on renewable energy is therefore concerned with meeting the following challenges:

» Ensuring that economically feasible technologies and applications are implemented;
» Ensuring that an equitable level of national resources is invested in renewable technologies, given their potential and compared to investments in other energy supply options; and
» Addressing constraints on the development of the renewable industry.

In order to meet the long-term goal of a sustainable renewable energy industry, the South African Government has set the following 10-year target for renewable energy: "*10 000 GWh (0.8 Mtoe) renewable energy contribution to final energy*

consumption by 2013 to be produced mainly from biomass, wind, solar and small-scale hydro. The renewable energy is to be utilised for power generation and non-electric technologies such as solar water heating and bio-fuels. This is approximately 4% (1 667 MW) of the estimated electricity demand (41 539 MW) by 2013" (DME, 2003).

At present no sector or company specific targets have been put in place. However, government is currently finalising proposals which will in all likelihood impose renewable energy obligations or targets on energy generators such as Eskom. In order assist Government in meeting its target, Eskom is already investigating potential renewable energy projects, which include a Concentrated Solar Thermal project in the Northern Cape, as well as the proposed Wind Energy Facility.

2.1.3. Integrated Energy Plan (IEP) – 2003

In response to the requirements of the National Energy Policy, the DME commissioned the Integrated Energy Plan (IEP) to provide a framework in which specific energy policies, development decisions and energy supply trade-offs can be made on a project-by-project basis. The framework is intended to create a balance between the energy demand and resource availability to provide low cost electricity for social and economic development, while taking into account health, safety and environmental parameters.

The IEP projected that the additional demand in electricity would necessitate an increase in electricity generation capacity in South Africa by 2007. Furthermore, the IEP recognises that South Africa is likely to be reliant on coal for at least the next 20 years as the predominant source of energy.

2.1.4. National Integrated Resource Plan (NIRP), 2003/2004

In response to the National Energy Policy's objective relating to affordable energy services, NERSA commissioned a National Integrated Resource Plan (NIRP) in order to provide a long-term, cost-effective resource plan for meeting electricity demand, which is consistent with reliable electricity supply and environmental, social and economic policies. The planning horizon for the study was from 2003 to 2022. The objective of the NIRP is to determine the least-cost supply option for the country, provide information on the opportunities for investment into new power generating projects, and evaluate the security of supply.

The national electricity demand forecast took a number of factors into account. These include:

» A 2.8% average annual economic growth
» The development and expansion of a number of large energy-intensive industrial projects
» Electrification needs
» A reduction in electricity-intensive industries over the 20 year planning horizon
» A reduction in the number of electricity consumers – NIRP anticipates people switching to the direct use of natural gas
» The supply of electricity to large mining and industrial projects in Namibia and Mozambique; and
» Typical demand profiles.

Various demand side management and supply-side options are considered in the NIRP process, prior to identifying the least cost supply options for South Africa. The outcome of the process confirmed that coal-fired options are still required over the next 20 years and that additional base load plants will be required from 2010.

2.1.5. Integrated Strategic Electricity Planning (ISEP) in Eskom

Eskom uses a modelling tool called Integrated Strategic Electricity Planning (ISEP) to plan its future capacity strategy. By analysing usage patterns and growth trends in the economy, and matching these with the performance features of various generation technologies and demand side management options, ISEP identifies the timing, quantity and type (base load or peaking) of new capacity options required in the long-term. These options include the Return-to-Service of the three mothballed coal-fired Simunye Power Stations (i.e. Camden, Komati and Grootvlei), conventional pulverised fuel power plants (i.e. coal-based power), pumped storage schemes, gas-fired power plants, nuclear plants, greenfield fluidised bed combustion technologies, renewable energy technologies (mainly wind and solar projects), and import options within the Southern African Power Pool. As the older Eskom power plants reach the end of their design life from approximately 2025, the use of all available technologies will need to be exploited in order to supply the country's growing electricity demand.

The most recently approved ISEP plan identifies the need for increased peaking supply by about 2006/7 and base load by about 2010. An increase in peaking supply has since been achieved through the commissioning of new plant, such as the OCGT facilities at Atlantis and Mossel Bay in the Western Cape. Figure 2.2 illustrates Eskom's "project funnel", which shows the range of supply options being considered by Eskom to meet the increasing demand for electricity in the country. There are many projects at various stages in the project funnel including research projects, transmission lines and generating options in South Africa and Southern Africa.

As can be seen from Figure 2.2, Eskom has concluded the required feasibility and business case studies for 100 MW of renewable energy (indicated by the pale blue circle entitled 'Renewable 1' evident on the boundary between 'Feasibility' and 'Build'). This business case is proposed to be implemented in the form of a commercial Wind Energy Facility on the West Coast (i.e. the subject of this EIA study).

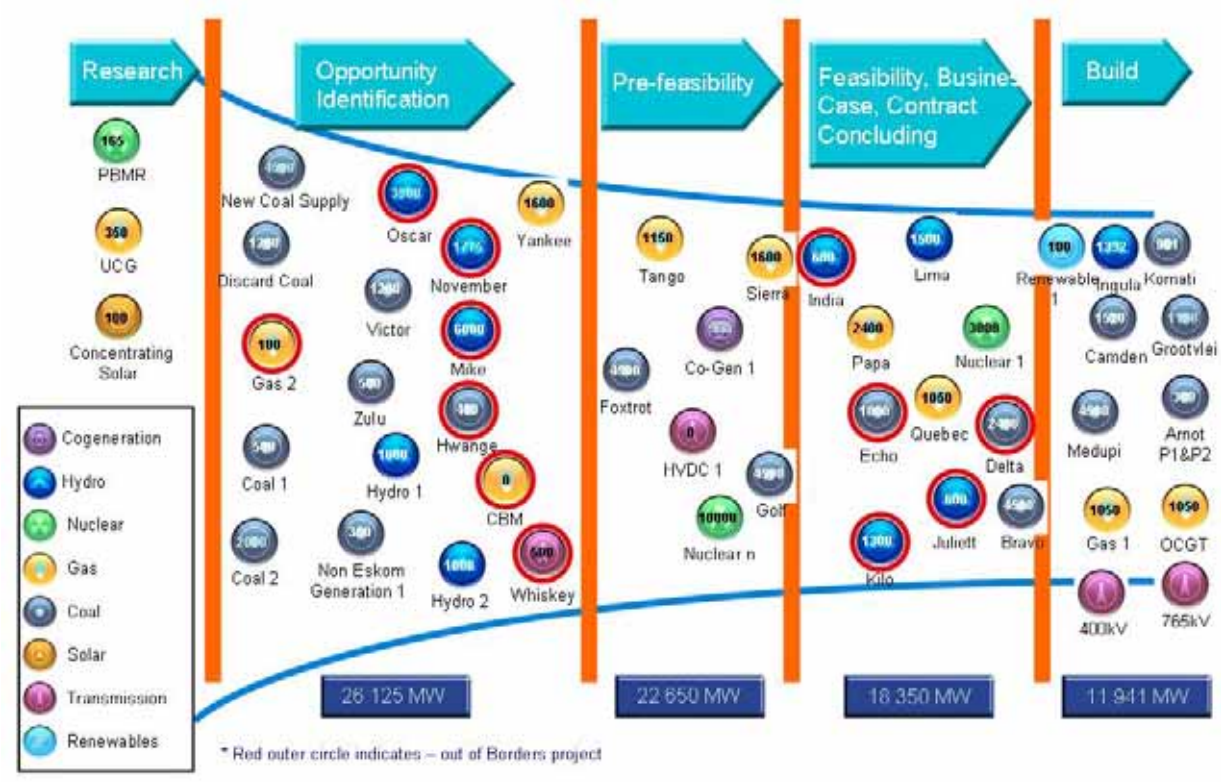


Figure 2.2: Eskom Project funnel showing the range of supply options being considered by Eskom to meet the increasing demand for electricity in the country

2.1.6. Eskom Renewable Energy Strategy

Renewable energy technologies are among the supply-side options being considered by Eskom. The organisation has developed a renewable energy strategy which outlines a number of focus areas, including research and development and clean development mechanism (CDM) opportunities.

The establishment of a wind energy facility qualifies as a CDM project as it meets all international requirements, as well as South African sustainable development criteria as defined by the designated national authority. The Wind Energy Facility will potentially reduce 225 800 tons of CO_2 per annum compared to what would have occurred without the project.

Renewable energy sources which have been evaluated are wind, solar, wave, tidal, ocean current, biomass and hydro. Through the South African Bulk Renewable Energy Generation (SABRE-Gen) programme, a vehicle was established to enable the evaluation of multi-MW, grid connected generation. The initiatives all follow the same functional structure: namely the identification of promising options, an assessment of the financial and economic viability as well as resource potential in the country, the implementation of demonstration projects to conduct operational research, and the provision of strategies for the uptake and sustainable deployment of the technologies where feasible.

Eskom commissioned the Klipheuwel Wind Energy Demonstration Facility (north of Durbanville) in February 2003. Research at this facility has focused on how available wind energy technologies interact with the South African environment and has highlighted unique factors that can impact performance.

2.2. Strategic Electricity Planning in the Western Cape

At present, a significant quantity of power supplied to the Western Cape is generated in the Eskom coal-fired power stations elsewhere in the country (predominantly located in Mpumalanga) and transferred to the Cape via the national transmission network. However, a portion of the Province's electricity is generated locally, including energy from the Koeberg Nuclear Power Plant, the Acacia Gas Turbines, the Palmiet Pumped Storage Facility, the Open Cycle Gas Turbine plants at Atlantis and Mossel Bay (peaking power) and a small contribution from the Klipheuwel Demonstration Wind Farm. The City of Cape Town also produces a small amount of electricity through the Steenbras Pumped Storage facility and local gas turbines. Although Eskom has transmission power line strengthening plans in place to assist in securing electricity supply for the Western Cape, there are a range of other options that may be preferable, including diversifying the supply mix and broadening the energy generation options.

The recent power failures and load shedding incidents in the Western Cape have highlighted the need for additional capacity in the Province.

2.2.1. Draft Western Cape Integrated Energy Strategy

The draft Western Cape Integrated Energy Strategy outlines the key energy concerns and opportunities facing the Western Cape and proposes a range of policies, strategies and actions that will allow the Province to develop a sustainable portfolio of energy solutions, while also reducing pollution and increasing access to energy for all citizens in the Province. The strategy document notes that due to the recent energy crisis in the Western Cape, the process of introducing a renewable energy policy, strategy and programme of

action has been fast-tracked. It is believed that this is necessary to ensure that measures to reduce energy consumption and increase the supply of clean, renewable energy can be taken as soon as possible.

The strategy lists the potential opportunities for increasing power supply to the Province, and includes the option of wind energy. In this regard, the document states that the wind energy potential in the Western Cape is high (~3 000 MW). The potential advantages associated with wind are identified to include:

» Technology and capital costs are reducing rapidly
» Low maintenance
» Clean energy option
» Can be quickly installed in areas needing supply.

In terms of recommendations of the Strategy, the Provincial Government of the Western Cape (PGWC) is committed to energy efficiency and renewable energy, and to reducing the Province's carbon footprint and eradicating energy poverty. In order to achieve this vision, the PGWC will:

» Support an approach to energy planning, which takes into account environmental, social and economic considerations.
» Support research and development around renewable energy and energy efficiency technologies.

2.2.2. Regional Methodology for Wind Energy Site Selection: a Guideline Document prepared by DEA&DP

Detailed planning, including the use of criteria and thresholds to designate areas of suitability for development is supported by the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) for the Western Cape, specifically with regards to the siting of wind energy facilities in the Province. By introducing environmental and spatial issues together with technical issues at the strategic regional level, the siting process is better informed.

In this regard, DEA&DP have developed a guideline document entitled *Strategic Initiative to Introduce Commercial Land Based Wind Energy Development to the Western Cape - Towards a Regional Methodology for Wind Energy Site Selection* (Western Cape Provincial Government, May 2006). The vision of the strategic initiative was to develop and establish a policy on the implementation of a *methodology* to be used for the identification of areas suitable for the establishment and implementation of wind energy developments (i.e. appropriate site selection) in the Western Cape. This overall objective was supported by a number of sub-objectives, including:

» To facilitate the practical implementation of wind energy generation technology in a manner that meets the principles of the White Paper on Energy Policy for the Republic of South Africa
» To introduce wind energy developments to the Western Cape in a co-ordinated manner, that meets all requirements of sustainability as reflected in the National Environmental Management Act (Act No 107 of 1998), and which is based on international best practice
» To encourage responsible and rational wind energy developments, which are beneficial not only to developers, but to communities at large
» To discourage the investment of time and money in potentially unsuitable sites
» To introduce the wind energy industry to the public and thereby increase support for and interest in alternative renewable energy sources
» To provide policy guidance in terms of the environmental impact assessment process.

The methodology proposed within this guideline document is intended to be a regional level planning tool to guide planners and decision-makers with regards to appropriate areas for wind energy development (on the basis of planning, environmental, infrastructural and landscape parameters). Since the development of this guideline, the methodology has not had the opportunity to be tested (but future use of the methodology by wind energy developers would provide further input and direction to this guideline).

In summary, this methodology includes methods for the assessment and delineation of areas appropriate for wind energy development, including the use of appropriate 'negative' and 'positive' buffer zones (suitable to the South African context) to build in cumulative impact concerns, and the incorporation of landscape issues relating to landscape character, value, sensitivity and capacity. It was not the intention of the Regional Assessment Methodology developed by DEA&DP to consider local level issues in significant detail at the regional level. It is stated that these issues are to be considered within site-specific studies and assessments (i.e. through an EIA) for the suitable area/site identified through the Regional Assessment approach.

The guideline document outlines a number of assessment techniques that were reviewed as part of the guideline development process (which considered a study area extending from the Diep River in the South to a line north of the Berg River). Some of the key findings and recommendations are summarised below.

National, Regional and Local Perspectives

It is important that at the national level that positive policy is enacted to encourage wind energy (and indeed all renewable) development (refer to Section 2.1). A national perspective should ensure that wind resource rich provinces and

regions are identified in order to ensure a co-ordinated and holistic national strategy. In this regard, it is accepted that the Cape West Coast will inevitably be attractive to wind energy developers due to the prevalence of coastal wind regimes. However, the importance of employing an effective cumulative impact model is emphasised.

International Best Practice and Applicability to the Western Cape

From a review of international best practice and experiences, the following was concluded:

» Internationally, the importance of landscapes, particularly their social and strategic value are increasingly being acknowledged, leading to the realisation that the intangible value of landscapes (and living environments) must be addressed in spatial planning.
» Designating areas of suitability for wind energy developments promotes more effective implementation of projects and enhances integration with other land-uses. Environmental and spatial issues can be addressed early in the siting process by introducing them at the strategic regional level.
» In spite of commonality of environmental concerns internationally, the thresholds developed to address wind energy developments vary significantly between countries, due to differences in legal frameworks and policies, different approaches to forward planning, different geographical sizes, biophysical and cultural characteristics, and degree of landscape modification.
» A large volume of scientific and professional information regarding wind energy facilities already exists in most of the developed countries. Sensitive areas and scenically valuable landscapes have already been identified in leading countries, prior to the development of wind energy regional siting criteria.
» The process of identifying 'sensitive' areas usually entails analysis by specialists of a defined geographical area on a broad scale, based on regional-level biological, environmental and landscape factors, to define areas of sensitive landscapes ("negative mapping") to exclude wind energy developments. A key foundation in most of the international precedent was the existence of strategic regional landscape assessments. These, often resource intensive, assessments do not generally exist in South Africa and DEA&DP have expressed concern that a developing country such as South Africa cannot afford expensive studies on landscape sensitivity and capacity and have therefore initiated the investigation of a robust "regional guiding criteria" method. A key challenge to the guideline development process was therefore to assess whether a regional level landscape assessment method (that is not unduly resource or time intensive) could be added to a criteria based method.

Cumulative Impact Issues

The experience in Europe is that the very high cumulative impact of wind farms has resulted due to a policy of permitting small wind energy schemes in relatively close proximity to each other (only 2.5 km apart in Denmark). The 'dispersed' European model has clearly created significant cumulative visual impact. Scottish National Heritage are now promoting a minimum distance between wind farms of 30 km, especially due to the increasing size of turbines themselves, as well as the tendency to develop large wind farms with many turbines (often over 100 turbines per farm).

As a result the DEA&DP guideline document recommends that:

» Large installations should be located extremely far apart (30 – 50 km)
» Smaller installations should be encouraged, even individual turbines, in urban/brownfield areas.

The document also notes that issue of decision-making also needs to be further debated in terms of powers and functions in the Constitution of the Republic of South Africa. The political tendency will be for appropriate 'concentration' zones to be designated at national and provincial level, and for district and local authorities to be expected to ensure effective implementation of projects. This should be reconciled however with local interests, although local interest (potentially 'not in my backyard' attitudes) should not be allowed to "trump" broader national and provincial imperatives.

Recommended Urban Focus

The guideline document notes that South African rural and wilderness landscapes have a high aesthetic value. The generally unspoilt nature of these areas in the Western Cape are the foundation of the tourism industry, as well as a key reason why the "second home" market is so healthy in rural tourism and wilderness areas.

After several decades of driving a 'rural' model, the Danish wind energy policy has shifted (based on experience of creating visual 'clutter' in rural landscapes) to emphasising urban and industrial locations as 'first preference' for wind developments. South Africa can learn and benefit from this experience and avoid the mistake of pursuing a "rural" model without also emphasising the importance of urban locations for wind energy development.

Recommended Disturbed Landscape Focus

In addition to the urban focus discussed above, the proposed methodology outlined in the guideline document also departs from some of the international precedent by purposefully focussing on existing disturbed landscapes, and in particular, those rural landscapes that have already been 'vertically compromised'

by the location, for example, of transmission powerlines, railway lines, and all telecommunication towers.

Landscape Assessment: Subjective / Qualitative

The role and value of public participation in perceptual based studies to determine landscape character and sensitivity to wind turbines has been highly questionable in overseas experiences. It is accordingly recommended that a very high value should be placed on professional judgement from practitioners at the local level when assessing landscape values. This method is likely to be quicker and more effective than attempting a qualitative (GIS) based assessment technique.

Bird Migration Routes and Other Information

In Europe, a large body of knowledge exists in relation to avifauna, particularly nesting sites of many species and migration routes. This information accordingly featured prominently in spatial mapping overlays. Although South Africa and the Western Cape do not have this quality of information, experience has shown that, at the strategic level, this is not a major issue. At the local level, however, it is recommended that an avifaunal study be conducted to establish whether any resident bird populations would be threatened by a wind energy development.

Protecting Rural Landscape Values (put after "Urban Emphasis")

In the assessment of suitable sites for wind turbines in Europe, a great degree of emphasis is given to quantifying views from residential locations. This policy emphasis has had the impact of effectively pushing these projects into more 'remote' rural locations where a qualitative analysis can show that, in relative terms, only a small minority of people resident in a particular area will see the turbines. A specific finding of the study was that, in the South African context, this policy was flawed in that it had the effect of 'penalising' rural areas, where it is normal to expect that residents have chosen such areas for, *inter alia*, the relative non-disturbance by urban facilities.

Site Specific Aesthetic Considerations

Site-specific recommendations which should be considered in the establishment of a wind energy facility development are listed, and included *inter alia*:

» Layout: use of linear, non-organic layouts; and consistent hub height
» Turbines: Limit variety in turbine type/style; adhere to use of off-white to light grey turbines which are non-reflective; avoid colouration of blades; and limit use of warning lights (except where required by authorities).

In April 2007, Eskom embarked on a regional site identification and selection process (refer to Chapter 4 for details of the site identification process) to determine and delineate areas north of the Olifants River on the West Coast as suitable for siting of a commercial wind energy development. In order to assist in

addressing the challenge of ensuring that wind energy projects meet economic (including technical), social and environmental sustainability criteria, the study was based on the Western Cape Provincial guidelines for locating wind energy projects (specifically Report 5: Proposed Regional Methodology) and also considered other local, provincial and national strategic environmental initiatives.

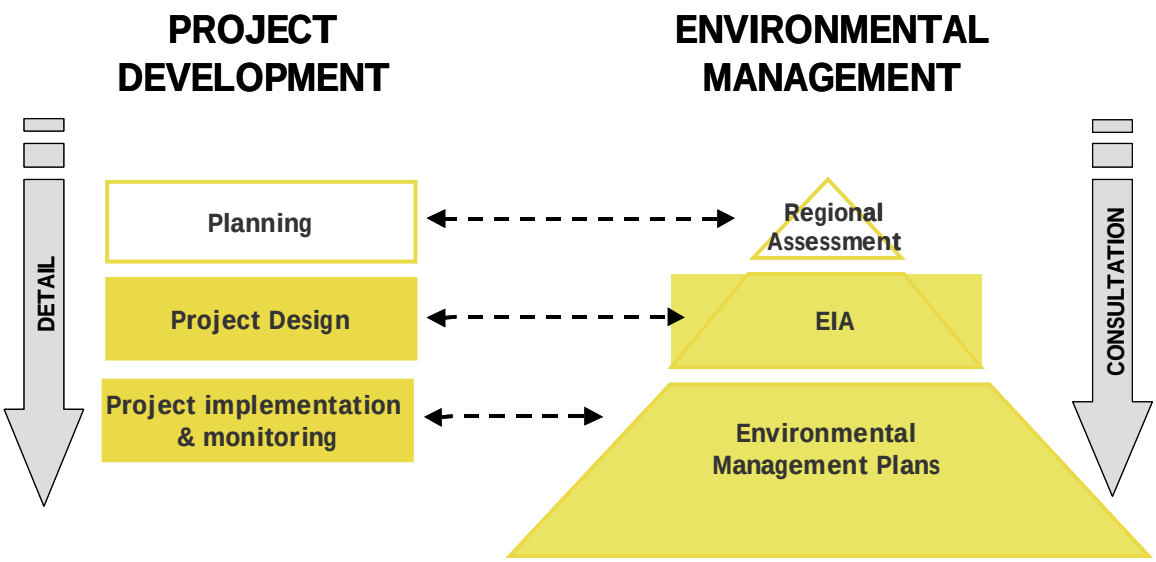
Based on the outcomes of the regional assessment and site identification process, Eskom has taken this site forward into an EIA process, where site specific studies and assessments can be undertaken. The guideline document also sets out a methodology for the undertaking of landscape assessments as part of the EIA process at project level (Report 6: proposed project level methodology), which will be considered through this EIA process.

2.3. Project Planning and the site-specific Environmental Impact Assessment

Eskom Generation's planning process is based on anticipated electricity demand, rather than immediate load requirements in order to timeously supply the anticipated increased demand in the country. This is due to the long lead-time process of acquiring the necessary permissions to construct such infrastructure from DEAT and the National Energy Regulator of South Africa (NERSA), and negotiations with landowners, and power generation infrastructure purchase, delivery and ultimately construction.

In terms of the EIA Regulations under NEMA, a Scoping and EIA report (including an environmental management plan (EMP)) are required to be compiled for this proposed project. The EIA is considered as an effective planning and decision-making tool in the planning process of a new power generation facility. It allows the environmental consequences resulting from a technical facility during its establishment and its operation to be identified and appropriately managed through project design and implementation. The level of detail at a site-specific level is refined through the process, and allows for resolution of potential issue(s) through dialogue with affected parties.

The relationship between project development and the environmental assessment and management process is depicted in the figure overleaf.


PROJECT DEVELOPMENT
ENVIRONMENTAL MANAGEMENT
DETAIL
Planning
Project Design
Project implementation & monitoring
Regional Assessment
EIA
Environmental Management Plans
CONSULTATION