ENVIRONMENTAL IMPACT ASSESSMENT PROCESS
FINAL EIA REPORT

PROPOSED WIND ENERGY FACILITY AND ASSOCIATED INFRASTRUCTURE

WESTERN CAPE PROVINCE
(DEAT Ref No. 12/12/20/913)

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Prepared for

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PROJECT DETAILS

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Front Cover picture: A simulation of the proposed facility on the proposed site.

SUMMARY: ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Eskom Holdings Limited (Eskom) initiated an Environmental Impact Assessment (EIA) process to determine the environmental feasibility of a proposed Wind Energy Facility on a site on the West Coast in the Western Cape Province.

The scope of project includes construction, operation and decommissioning activities. Activities associated with all life-cycle phases of the proposed wind energy facility that could potentially impact on the environment have been assessed through this EIA study. The three primary components of the project include the following:

» A **Wind Energy Facility** including up to 100 wind turbine units, a substation, underground electrical cabling between turbines and the substation, internal access roads and an office building and visitors centre at the facility entrance.
» Overhead **power lines** (132 kV distribution lines) from the wind farm substation feeding into the electricity network/grid at the Juno transmission substation (near Vredendal).
» Improvement to the riding surface of the existing Divisional Road 2225 (known as Skaapvlei road) to provide access to the site (i.e. act as a **haul road** during the construction phase) from the R363 main tarred road at Koekenaap.

Eskom has appointed Savannah Environmental as an independent environmental assessment practitioner to undertake the EIA. The EIA process has been undertaken in accordance with the requirements of the National Environmental Management Act (NEMA; Act No. 107 of 1998).

This Environmental Impact Assessment Report represents the outcome of the EIA Phase of the EIA process and contains the following sections:

Chapter 1 provides background to the proposed Wind Energy Facility project and the environmental impact assessment.
Chapter 2 provides the strategic context for energy planning in South Africa.
Chapter 3 describes wind energy as a power option and provides insight to technologies for wind turbines.
Chapter 4 outlines the process which was followed during the EIA Phase, including the consultation program that was undertaken and input received from interested parties.
Chapter 5 describes the activities associated with the project (project scope).
Chapter 6 describes the existing biophysical and socio-economic environment.
Chapter 7 presents the assessment of environmental impacts associated with the Wind Energy Facility.

Chapter 8 presents the assessment of environmental impacts associated with the 132 kV power line alternatives.
Chapter 9 presents the conclusions of the facility and power line impact assessment as well as an impact statement.
Chapter 10 provides a list of references and information sources used in undertaking the studies for this EIA Report.

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. The EIA Phase addressed those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide sufficient information regarding the potential impacts and the acceptability of these impacts in order for the Competent Authority to make an informed decision regarding the proposed project.

The release of a draft EIA Report provided stakeholders with an opportunity to verify that the issues they have raised through the EIA process have been captured and adequately considered. The final EIA Report has incorporated all issues and responses raised during the public review of the draft EIA Report prior to submission to the National Department of Environmental Affairs and Tourism (DEAT).

The EIA Phase aimed to achieve the following:

- Provide an overall assessment of the social and biophysical environments affected by the proposed project.
- Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed wind energy facility and associated infrastructure.
- Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
- Undertake a fully inclusive public involvement process to ensure that I&APs are afforded the opportunity to participate, and that their issues and concerns are recorded.

The conclusions and recommendations of this EIA are the result of the assessment of identified impacts by specialists, and the parallel process of public participation. The public consultation process has been extensive and every effort has been made to include representatives of all stakeholders in the study area.

The most significant environmental impacts associated with the proposed project, as identified through the EIA, include:

» Visual impacts on the natural scenic resources of the region imposed by the components of the facility.
» Local site-specific impacts as a result of physical disturbance/modification to the site with the establishment of the facility.
» Impacts associated with the overhead power line between Juno Substation and the Wind Energy Facility substation.
» Impacts associated with the transportation of components to the site during the construction phase.
» Impacts on the social environment.

The findings of the specialist studies conclude that there are no environmental fatal flaws that should prevent the proposed project from proceeding, provided that the recommended mitigation and management measures are implemented. Based on the nature and extent of the proposed project, the local level of disturbance predicted as a result of the construction and operation of the facility, the findings of the EIA studies, and the understanding of the low significance level of potential environmental impacts, it is the opinion of the EIA project team that the significance levels of the majority of identified negative impacts can generally be reduced by implementing the recommended mitigation measures. The visual impact associated with the facility is the primary impact which cannot be significantly mitigated, however the impact of high significance is restricted to within a distance of 10 km of the site.

The following key recommendations are made:

» As far as possible, wind turbines and associated laydown areas and access roads which could potentially impact on sensitive areas should be shifted within the impact corridor in order to avoid these areas of high sensitivity (i.e. best practice is impact avoidance). Where this is not possible, alternative mitigation measures as detailed in this report must be implemented.
» Power line Alternative 1 with sub-alternative 1a must be adopted in order to minimise impacts of unacceptably high significance on vegetation. In addition, the deviation of Alternative 1, as recommended by the relevant officials when on-site, must be adopted to minimise concerns/impacts in the vicinity of the smallholdings north of Skaapvlei road.
» The extent of the improvements to Skaapvlei road (DR2225) be determined to ensure a durable haul route for the duration of the construction phase, and for the road to remain in a similar (or better) condition upon completion of the construction phase.
» In order to improve road traffic safety and mitigate the impact of construction traffic through the populated area/smallholdings on Skaapvlei road, it is

recommended that the R363/Skaapvlei road intersection as well as the first 1 800 m portion of the DR2225 from the R363 be improved to a bituminous surfaced road.

- All mitigation measures detailed within this report and the specialist report contained within Appendices G to Q must be implemented.
- The Environmental Management Plan (EMP) as contained within Appendix S of this report should form part of the contract with the Contractors appointed to construct and maintain the proposed wind energy facility, and will be used to ensure compliance with environmental specifications and management measures. The implementation of this EMP for all life cycle phases of the proposed project is considered to be key in achieving the appropriate environmental management standards as detailed for this project. It is also recommended that the process of communication and consultation with the community representatives is maintained after the closure of this EIA process, and, in particular, during the construction phase associated with the proposed project.
- Applications for all other relevant and required permits required to be obtained by Eskom be submitted. This includes permits for the transporting of all components (abnormal loads) to site, disturbance to archaeological sites, disturbance of protected vegetation, and disturbance to any wetlands.

PUBLIC REVIEW OF THE DRAFT EIA REPORT

The draft Environmental Impact Assessment Report was made available for review and comment by Interested and Affected Parties (I&APs) and stakeholders at the following public places in the project area from 07 January 2008 to 07 February 2008:

Town	Venue
Vredendal	Vredendal Library
	Matzikama Municipality
	Department of Agriculture & Land Care
Lutzville	Lutzville Municipal Office / Library
	Lutzville Farmers Association
Vanrhynsdorp	Cape Nature Offices
Ebenhaeser	Post office / Library
Strandfontein	Municipal Office
Doringbaai	Library
Moorreesburg	West Coast District Municipality offices

The report was also made available on:

- www.eskom.co.za/eia
- www.savannahSA.com

Comments were requested to be submitted to Shawn Johnston of Sustainable Futures ZA by 7 February 2008 as written submission via fax, post or e-mail.

In order to facilitate comments on the draft Environmental Impact Assessment Report, a public meeting and a stakeholder workshop were held during the review period (in Lutzville and Cape Town respectively). All interested and affected parties are invited to attend the public meeting held on Thursday, 24 January 2008 at the Lutzville Sports & Rugby Club (Open House 18h00 – 19h00, Public Meeting at 19h00) and/or the stakeholder meeting on Friday, 25 January 2008 at the Koeberg Visitor's Centre, Cape Town (at 09h30). The public meeting was advertised in the regional and local printed media (together with the notice of the draft EIA report release). Copies of the advertisements as well as minutes of these meeting are included as Appendix R.

The aim of these meetings was to provide feedback of the findings of the environmental impact assessment studies undertaken, and to invite comment on the proposed project.

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ABBREVIATIONS AND ACRONYMS

BID	Background Information Document
CAPE	Cape Action For People and the Environment
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CSIR	Council for Scientific and Industrial Research
CO_2	Carbon dioxide
D	Diameter of the rotor blades
DEA&DP	Western Cape Department of Environmental Affairs and Development Planning
DEAT	National Department of Environmental Affairs and Tourism
DME	Department of Minerals and Energy
DOT	Department of Transport
DWAF	Department of Water Affairs and Forestry
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
GIS	Geographical Information Systems
GG	Government Gazette
GN	Government Notice
GWh	Giga Watt Hour
HWC	Heritage Western Cape
I&AP	Interested and Affected Party
IDP	Integrated Development Plan
IEP	Integrated Energy Planning
km^2	Square kilometres
km/hr	Kilometres per hour
kV	Kilovolt
LUPO	Rezoning and Subdivision in terms of Land Use Planning Ordinance, Ordinance 15 of 1985
m^2	Square meters
m/s	Meters per second
MW	Mega Watt
NEMA	National Environmental Management Act (Act No 107 of 1998)
NERSA	National Energy Regulator of South Africa
NHRA	National Heritage Resources Act (Act No 25 of 1999)
NGOs	Non-Governmental Organisations
NIRP	National Integrated Resource Planning
NWA	National Water Act (Act No 36 of 1998)
PGWC	Provincial Government of the Western Cape
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SANRAL	South African National Roads Agency Limited
SDF	Spatial Development Framework

SIA	Social Impact Assessment
SSW	South south west
WCDM	West Coast District Municipality
WCMA01	Western Cape Municipal Area 1
ZVI	Zone of visual influence

DEFINITIONS AND TERMINOLOGY

Alternatives: Alternatives are different means of meeting the general purpose and need of a proposed activity. Alternatives may include location or site alternatives, activity alternatives, process or technology alternatives, temporal alternatives or the 'do nothing' alternative.

Ambient sound level: The reading on an integrating impulse sound level meter taken at a measuring point in the absence of any alleged disturbing noise at the end of a total period of at least 10 minutes after such meter was put into operation.

Archaeological material: Remains resulting from human activity which are in a state of disuse and are in or on land and which are older than 100 years, including artefacts, human and hominid remains and artificial features and structures.

Article 3.1 (*sensu* Ramsar Convention on Wetlands): "Contracting Parties "shall formulate and implement their planning so as to promote the conservation of the wetlands included in the List, and as far as possible the wise use of wetlands in their territory"".(Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

Betz Limit: It is the flow of air over the blades and through the rotor area that makes a wind turbine function. The wind turbine extracts energy by slowing the wind down. The theoretical maximum amount of energy in the wind that can be collected by a wind turbine's rotor is approximately 59%. This value is known as the Betz Limit.

Calcrete: A soft sandy calcium carbonate rock related to limestone which often forms in arid areas.

Clean Development Mechanism (CDM): An arrangement under the Kyoto Protocol allowing industrialised countries with a greenhouse gas reduction commitment (called Annex 1 countries) to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries. The most important factor of a CDM project is that it establishes that it would not have occurred without the additional incentive provided by emission reductions credits. The CDM allows net global greenhouse gas emissions to be reduced at a much lower global cost by financing emissions reduction projects in developing countries where costs are lower than in industrialised countries. The CDM is supervised by the CDM Executive Board

(CDM EB) and is under the guidance of the Conference of the Parties (COP/MOP) of the United Nations Framework Convention on Climate Change (UNFCCC) (refer http://unfccc.int/kyoto_protocol/mechanisms/items/2998.php).

Cumulative impacts: Impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of nutrients and heated water to a river that combine to cause algal bloom and subsequent loss of dissolved oxygen that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.

Cut-in speed: The minimum wind speed at which the wind turbine will generate usable power.

Cut-out speed: The wind speed at which shut down occurs.

Demand-side Management Programme (DSM): A joint initiative between the DME, the National Electricity Regulator (NER) and Eskom which aims to provide lower cost alternatives to generation system expansion by focusing on the usage of electricity. Consumers are incentivised to use electricity more efficiently and at times of the day outside of Eskom’s peak periods.

Direct impacts: Impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity (e.g. noise generated by blasting operations on the site of the activity). These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable

Disturbing noise: A noise level that exceeds the ambient sound level measured continuously at the same measuring point by 7 dB or more.

‘Do nothing’ alternative: The ‘do nothing’ alternative is the option of not undertaking the proposed activity or any of its alternatives. The ‘do nothing’ alternative also provides the baseline against which the impacts of other alternatives should be compared.

Doorbank horizon: A cemented crusty hard surface from an ancient landscape that underlies Aeolian sands in many areas on the west coast.

Early Stone Age: A very early period of human development dating between 300 000 and 2.6 million years ago.

Endangered species: Taxa in danger of extinction and whose survival is unlikely if the causal factors continue operating. Included here are taxa whose numbers of individuals have been reduced to a critical level or whose habitats have been so drastically reduced that they are deemed to be in immediate danger of extinction.

Endemic: An "endemic" is a species that grows in a particular area (is endemic to that region) and has a restricted distribution. It is only found in a particular place. Whether something is endemic or not depends on the geographical boundaries of the area in question and the area can be defined at different scales.

Energy utilisation factor (EUF): The percentage of actual generation compared to the total possible installed generation annually.

Environment: 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.

Environmental Impact: An action or series of actions that have an effect on the environment.

Environmental impact assessment: Environmental Impact Assessment (EIA), as defined in the NEMA EIA Regulations and in relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application.

Environmental management: Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the carrying capacity of the environment.

Environmental management plan: An operational plan that organises and co-ordinates mitigation, rehabilitation and monitoring measures in order to guide the implementation of a proposal and its ongoing maintenance after implementation.

Fossil: Mineralised bones of animals, shellfish, plants and marine animals. A trace fossil is the track or footprint of a fossil animal that is preserved in stone or consolidated sediment.

Generator: The generator is what converts the turning motion of a wind turbine's blades into electricity

Heritage: That which is inherited and forms part of the National Estate (Historical places, objects, fossils as defined by the National Heritage Resources Act of 2000).

HWC (Heritage Western Cape): The provincial compliance agency responsible for the conservation of heritage.

Indigenous: All biological organisms that occurred naturally within the study area prior to 1800

Indirect impacts: Indirect or induced changes that may occur as a result of the activity (e.g. the reduction of water in a stream that supply water to a reservoir that supply water to the activity). These types of impacts include all the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.

Integrated Energy Plan (IEP): A plan commissioned by the DME in response to the requirements of the National Energy Policy, in order 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.

Integrated Strategic Electricity Planning (ISEP): Eskom's planning process which provides strategic projections of supply-side and demand-side options to be implemented to deal with the energy management issues and meet long-term load forecasts.

Interested and Affected Party: Individuals or groups concerned with or affected by an activity and its consequences. These include the authorities, local communities, investors, work force, consumers, environmental interest groups and the general public.

Late Stone Age (LSA): In South Africa this time period represents fully modern people who were the ancestors of southern African KhoeKhoen and San groups (40 000 – 300 years ago).

"Micro-siting": An international convention with regards to wind energy facilities. It refers to the process of specifically determining the position of each turbine based on the wind resource and topographical constraints in order to maximise production.

Middle Stone Age (MSA): An early period in human history characterised by the development of early human forms into modern humans capable of abstract though process and cognition 300 000 – 40 000 years ago.

Midden: A pile of debris or dump (shellfish, stone artefacts and bone fragments) left by people after they have occupied a place.

Miocene: A geological time period (of 23 million - 5 million years ago).

Nacelle: The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction.

National Integrated Resource Plan (NIRP): Commissioned by NERSA in response to the National Energy Policy's objective relating to affordable energy services, 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.

Natural properties of an ecosystem (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "...physical, biological or chemical components, such as soil, water, plants, animals and nutrients, and the interactions between them". (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

Palaeontological: Any fossilised remains or fossil trace of animals or plants which lived in the geological past, other than fossil fuels or fossiliferous rock intended for industrial use, and any site which contains such fossilised remains or trace.

Pleistocene: A geological time period (of 3 million – 20 000 years ago).

Pliocene: A geological time period (of 5 million – 3 million years ago).

Ramsar Convention on Wetlands: "The Convention on Wetlands (Ramsar, Iran, 1971) is an intergovernmental treaty whose mission is "the conservation and wise use of all wetlands through local, regional and national actions and international cooperation, as a contribution towards achieving sustainable development throughout the world". As of March 2004, 138 nations have joined the Convention as Contracting Parties, and more than 1300 wetlands around the world, covering almost 120 million hectares, have been designated for inclusion in the Ramsar List of Wetlands of International Importance." (Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer http://www.ramsar.org/). South Africa is a Contracting Party to the Convention.

Rare species: Taxa with small world populations that are not at present Endangered or Vulnerable, but are at risk as some unexpected threat could easily cause a critical decline. These taxa are usually localised within restricted geographical areas or habitats or are thinly scattered over a more extensive range. This category was termed Critically Rare by Hall and Veldhuis (1985) to distinguish it from the more generally used word "rare".

Red data species: Species listed in terms of the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species, and/or in terms of the South African Red Data list. In terms of the South African Red Data list, species are classified as being extinct, endangered, vulnerable, rare, indeterminate, insufficiently known or not threatened (see other definitions within this glossary).

Regional Methodology: The Western Cape Department of Environmental Affairs and Development Planning (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 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).

Rotor: The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm).

Significant impact: An impact that by its magnitude, duration, intensity or probability of occurrence may have a notable effect on one or more aspects of the environment.

Sustainable Utilisation (*sensu* Convention on Wetlands): Defined in Handbook 1 as the "human use of a wetland so that it may yield the greatest continuous benefit to present generations while maintaining its potential to meet the needs and aspirations of future generations". (Ramsar Convention Secretariat. 2004.

Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (refer http://www.ramsar.org/).

Structure (historic): Any building, works, device or other facility made by people and which is fixed to land, and includes any fixtures, fittings and equipment associated therewith. Protected structures are those which are over 60 years old.

Tower: The tower, which supports the rotor, is constructed from tubular steel. It is approximately 80 m tall. The nacelle and the rotor are attached to the top of the tower. The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 40 to 80 m tall. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

Wind power: A measure of the energy available in the wind.

Wind rose: The term given to the diagrammatic representation of joint wind speed and direction distribution at a particular location. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke.

Wind speed: The rate at which air flows past a point above the earth's surface.

Wise Use (*sensu* Convention on Wetlands): Defined in Handbook 1 (citing the third meeting of the Conference of Contracting Parties (Regina, Canada, 27 May to 5 June 1987) as "the wise use of wetlands is their sustainable utilisation for the benefit of humankind in a way compatible with the maintenance of the natural properties of the ecosystem".(Ramsar Convention Secretariat. 2004. Ramsar handbooks for the wise use of wetlands. 2nd Edition. Handbook 1. Ramsar Convention Secretariat, Gland, Switzerland.) (see http://www.ramsar.org/)

INTRODUCTION CHAPTER 1

Eskom Holdings Limited (Eskom) proposes to establish a commercial wind energy facility on a site in the Western Cape Province. This development is proposed to comprise a cluster of up to **100 wind turbines** (typically described as a wind energy facility) to be constructed on an area covering approximately 16 km^2 in extent, off-set at a distance of 2 km from the coastline. The study area has been investigated in detail through an Environmental Impact Assessment (EIA) process. The nature and extent of this facility, as well as potential environmental impacts associated with the construction of a facility of this nature is explored in more detail in this Environmental Impact Assessment (EIA) Report.

1.1. The Need for the Proposed Project

Internationally there is an increase in the deployment of renewable energy technologies for the generation of electricity due to concerns such as climate change and exploitation of non-renewable resources. The South African Government has set a 10-year target for renewable energy of 10 000 GWh renewable energy contribution to final energy consumption by 2013, to be produced mainly from biomass, wind, solar and small-scale hydro. This is amounts to ~4% (1 667 MW) of the total estimated electricity demand (41 539 MW) by 2013. In order to assist Government in meeting its target, Eskom is investigating potential renewable energy projects, which include a Concentrating Solar Thermal project in the Northern Cape, as well as the proposed Wind Energy Facility in the Western Cape.

In responding to the growing electricity demand within South Africa, the need for diversifying Eskom's energy mix, as well as meeting the country's targets for renewable energy, Eskom has undertaken initiatives to establish **renewable** forms of electricity generation capacity. Eskom embarked upon a research programme to investigate **South Africa's sources** of renewable energy, and identify appropriate alternative solutions to meet the electricity needs of the country. Through this research, the viability of a wind energy facility was investigated, and the potential to establish a wind energy facility at a site along the West Coast within the Western Cape was identified.

1.2. Background to the Project

As a precursor to initiating an Environmental Impact Assessment (EIA) process, Eskom embarked on a wind energy resource research programme, as well as a site identification and selection process to determine areas suitable for wind energy development in South Africa. Meteorological conditions are critically important when considering the siting of wind turbines and identifying ideal wind energy facility sites. Ultimately, the success of the facility is dependent on the available wind resource of a particular site – i.e. wind speed, spatial and temporal variations in the wind climate, turbulence and how the wind resource is affected by terrain.

According to the South African Wind Resource Database compiled by the National Department of Minerals and Energy (DME), the Council for Scientific and Industrial Research (CSIR) and Eskom, the West Coast north of the Olifants River has been identified to experience some of the highest wind speeds in South Africa. Eskom studied this area further and established a meteorological monitoring station to determine the potential for the wind resource north of the Olifants River to support the development of a Wind Energy Facility (i.e. the incidence of wind within the required velocity range). In addition, this area further supports other technical requirements for a wind energy facility in terms of land availability and accessibility, and accessibility of the electricity grid to meet transmission integration requirements.

In April 2007, Eskom embarked on a regional site identification and selection process (the site identification process is detailed in the Scoping Report) to determine and delineate areas north of the Olifants River as suitable sites for 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 and considered other local, provincial and national strategic environmental initiatives.

The regional site identification process aimed to determine and delineate areas suitable for wind energy development and included the consideration of sites/areas of special environmental importance and planning criteria, as well as issues relating to landscape character, value, sensitivity and capacity. These aspects were then balanced with technical constraining factors affecting the siting of a wind energy facility, including the wind resource (wind potential diminishing with distance from the coastline), factors affecting the wind resource (including relief), land availability, accessibility and existing grid infrastructure.

It was acknowledged that a proactive identification of a location/site appropriate for the introduction of wind energy technology would enhance the viability of the project and inform the scope of the required Environmental Impact Assessment.

1.3. Project Overview

Through the regional site identification process, an area ~37 km^2 in extent falling within the Matzikama Local Municipality and the District Management Area WCMA01 within the West Coast District Municipality (WCDM) (depicted on Figure 1.1) was identified by Eskom as being potentially suitable for wind energy development. This area was put forward for consideration within an EIA process, and comprised the following farms:

» Portion 5 of the farm Gravewaterkop 158 (known as Skaapvlei)
» A portion of Portion 620 of the farm Olifants River Settlement (known as Skilpadvlei)
» A portion of Portion 617 of the farm Olifants River Settlement (known as Nooitgedag)

The overarching objective for the wind energy facility planning process is to maximise electricity production through **exposure to the wind resource**, while minimising infrastructure, operational and maintenance costs, as well as **social and environmental impacts**. As **local-level environmental and planning issues** (except for the identification of obvious fatal flaws) were not assessed in sufficient detail through the regional-level site identification process, these issues were considered within **site-specific studies** and assessments through the EIA process in order to delineate areas of sensitivity within the broader site, and ultimately assess the potential impacts associated with the placement of the wind turbines and associated infrastructure on the site.

The performance of the wind turbines is also determined by disturbances to the wind resource, which requires that the turbines are appropriately spaced on the site. The wind energy facility is proposed to accommodate up to **100 turbines**. The turbines and associated infrastructure are proposed to be positioned over an area of less than **20 km^2**.

The construction and commissioning of the facility is proposed to be implemented in **two phases**, with the first commissioned phase of the project planned to comprise approximately 50 turbines (that is, approximately fifty 2 MW to 2,5 MW industry standard turbines which would generate in the order of 100 MW). The second phase would comprise the remaining fifty turbines (the total facility not exceeding 100 turbines). The generating capacity of the facility will be dictated by the choice of turbine (a current industry standard of 2 MW turbines has been assumed at this time). The infrastructure associated with the total wind energy facility would, therefore, include:

» Up to 100 **wind turbine units** (hub height of ~80 m - 78 m high steel tower plus 2 m high nacelle); 90m diameter rotor (consisting of 3x45 m blades)).

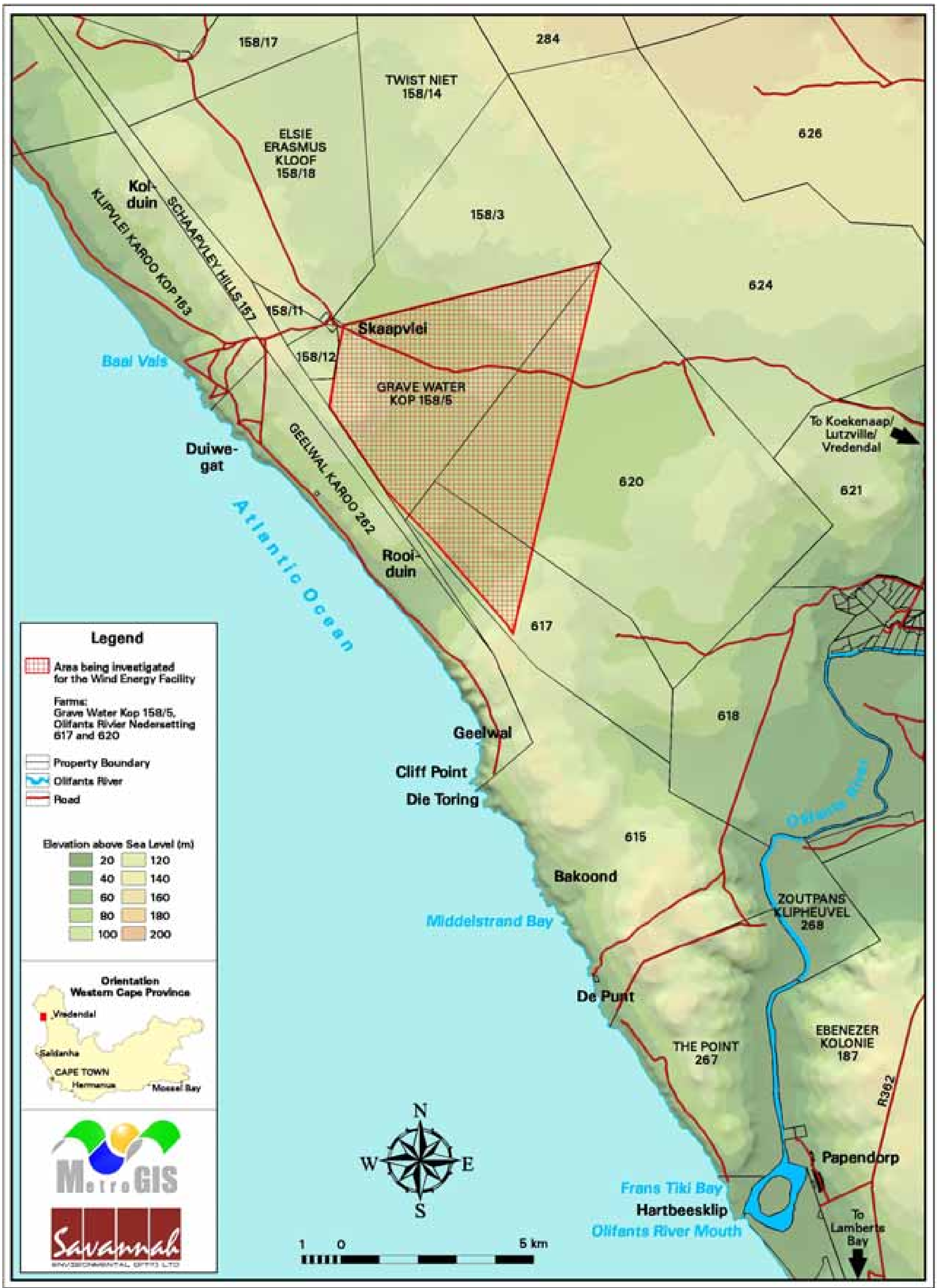


Figure 1.1: Locality map showing the 37 km^2 study area for the establishment of a wind energy facility on the West Coast north of the Olifants River

» A concrete **foundation** (of 15 m x 15 m) to support each turbine tower.
» Underground electrical **cabling** between each turbine and the substation.
» A **substation** (with a footprint of 80 m X 80 m) in an appropriate position to receive generated power via underground distribution cabling from each wind turbine.
» Overhead **power line** (132 kV distribution lines) from the wind farm substation feeding into the electricity network/grid at the Juno transmission substation (near Vredendal).
» An **access/haul road** to the site from the main R363 road at Koekenaap.
» **Internal access roads** providing access to each wind turbine site (with a permanent travel surface of approximately 6 m in width).
» A office/workshop building and **visitors centre** at the facility entrance (with a footprint of ~400 m^2 under roof).

The scope of the proposed wind energy facility project on the West Coast, including details of all elements of the project (for the construction, operation and decommissioning phases) is discussed in detail in Chapter 5. Eskom have utilised specialist software to assist in selecting the optimum position for each turbine (for optimum power generation). This layout of the turbine field has informed the positioning of the other infrastructure such as access roads and the substation. The positioning/layout of all the components of this wind energy facility has been determined (with 90% confidence) and has been utilised in this assessment of potential impacts at a site-specific level (refer to Chapter 7).

1.4. Requirement for an Environmental Impact Assessment Process

The proposed wind energy facility project is subject to the requirements of the Environmental Impact Assessment Regulations (EIA Regulations) published in terms of Section 24(5) of the National Environmental Management Act (NEMA, No 107 of 1998). This section provides a brief overview of EIA Regulations and their application to this project.

NEMA is national legislation that provides for the authorisation of certain controlled activities known as “listed activities”. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. The National Department of Environmental Affairs and Tourism (DEAT) is the competent authority for this project as Eskom is a parastatal body. An application for authorisation has been accepted by DEAT (under Application Reference number 12/12/20/913). Through the decision-making process, DEAT will be supported by the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP).

The need to comply with the requirements of the EIA Regulations ensures that decision-makers are provided the opportunity to consider the potential environmental impacts of a project early in the project development process, and assess if environmental impacts can be avoided, minimised or mitigated to acceptable levels. Comprehensive, independent environmental studies are required to be undertaken in accordance with the EIA Regulations to provide the competent authority with sufficient information in order for an informed decision to be taken regarding the project. Eskom appointed Savannah Environmental (Pty) Ltd to conduct the independent Environmental Impact Assessment (EIA) process for the proposed project.

An EIA is also an effective planning and decision-making tool for the project proponent. It allows the environmental consequences resulting from a technical facility during its establishment and its operation to be identified and appropriately managed. It provides the opportunity for the developer to be forewarned of potential environmental issues, and allows for resolution of the issue(s) reported on in the Scoping and EIA reports as well as dialogue with affected parties.

In terms of sections 24 and 24D of NEMA, as read with Government Notices R385 (Regulations 27–36) and R387, a Scoping and EIA are required to be undertaken for this proposed project as it includes the following activities listed in terms of GN R386 and R387 (GG No 28753 of 21 April 2006):

No & date of relevant notice	Activity No (in terms of relevant Regulation / notice)	Description of listed activity
Government Notice R387 (21 April 2006)	1(a)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the generation of electricity where (i) the electricity output is 20 megawatts or more; or (ii) the elements of the facility cover a combined area in excess of 1 ha.
Government Notice R387 (21 April 2006)	1(l)	The construction of facilities or infrastructure, including associated structures or infrastructure, for the transmission and distribution of above ground electricity with a capacity of 120 kV or more.
Government Notice R387 (21 April 2006)	2	Any development, activity, including associated structures and infrastructure, where the total area of the developed area is, or is intended to be 20 ha or more.
Government Notice R386 (21 April 2006)	12	The transformation or removal of indigenous vegetation of 3 ha or more or of any size where the transformation or removal would occur within a critically endangered or an endangered ecosystem listed in terms of section 52 of the

No & date of relevant notice	Activity No (in terms of relevant Regulation / notice)	Description of listed activity
		National Environmental Management: Biodiversity Act, 2004 (Act No 10 of 2004).
Government Notice R386 (21 April 2006)	14	The construction of masts of any material of type and of any height, including those used for telecommunications broadcasting and radio transmission, but excluding (a) masts of 15 m and lower exclusively used by (i) radio amateurs; or (ii) for lightening purposes (b) flagpoles; and (c) lightening conductor poles.
Government Notice R386 (21 April 2006)	15	The construction of a road that is wider than 4m or that has a reserve wider than 6m, excluding roads that fall within the ambit of another listed activity or which are access roads of less than 30 m long.
Government Notice R386 (21 April 2006)	16(a)	The transformation of undeveloped, vacant or derelict land to residential, mixed, retail, commercial, industrial or institutional use where such development does not constitute infill and where the total area to be transformed is bigger than 1 ha.
Government Notice R386 (21 April 2006)	7	The above ground storage of a dangerous good, including petrol, diesel, liquid petroleum gas or paraffin, in containers with a combined capacity of more than 30 m^3 but less than 1 000 m^3 at any one location or site.

This report documents the assessment of the potential environmental impacts of the proposed construction and operation of up to 100 wind turbines within a wind energy facility, as well as the associated infrastructure on a site on the West Coast north of the Olifants River. This EIA Phase follows the Scoping Phase, and was conducted in accordance with the requirements of the EIA Regulations in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998).

1.5. Objectives of the Environmental Impact Assessment Process

The Scoping Phase of the EIA process identified potential issues associated with the proposed project, and defined the extent of the studies required within the EIA Phase. This was achieved through an evaluation of the proposed project, involving the project proponent, specialists with experience in EIAs for similar projects, and a public consultation process with key stakeholders that included both government authorities and interested and affected parties (I&APs).

The EIA addresses those identified potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction and operation, and recommends appropriate mitigation measures for potentially significant environmental impacts. The EIA report aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The release of a draft EIA Report provided stakeholders with an opportunity to verify that the issues they have raised through the EIA process had been captured and adequately considered. The final EIA Report incorporates all issues and responses raised during the public review of the draft EIA Report.

The EIA Report consists of nine chapters, which include:

Chapter 1 provides background to the proposed Wind Energy Facility project and the environmental impact assessment.
Chapter 2 provides the strategic context for energy planning in South Africa.
Chapter 3 describes wind energy as a power option and provides insight to technologies for wind turbines.
Chapter 4 outlines the process which was followed during the EIA Phase, including the consultation program that was undertaken and input received from interested parties.
Chapter 5 describes the activities associated with the project (project scope).
Chapter 6 describes the existing biophysical and socio-economic environment.
Chapter 7 presents the assessment of environmental impacts associated with the Wind Energy Facility.
Chapter 8 presents the assessment of environmental impacts associated with the 132 kV power line alternatives.
Chapter 9 presents the conclusions of the facility and power line impact assessment as well as an impact statement.

1.6. Details of Environmental Assessment Practitioner and Expertise to conduct the Scoping and EIA

Savannah Environmental was contracted by Eskom Holdings as an independent environmental assessment practitioner to undertake an Environmental Impact Assessment (EIA) for the proposed project, as required by the NEMA EIA Regulations. Neither Savannah Environmental, nor any its specialist sub-consultants on this project are subsidiaries of or affiliated to Eskom Holdings Limited. Furthermore, Savannah Environmental does not have any interests in secondary developments that may arise out of the authorisation of the proposed project.

Savannah Environmental is a specialist environmental consulting company providing a holistic environmental management service, including environmental assessment and planning to ensure compliance and evaluate the risk of development; and the development and implementation of environmental management tools.

The Savannah Environmental team has considerable experience in environmental assessment and environmental management, and has been actively involved in undertaking environmental studies for a wide variety of projects throughout South Africa. Strong competencies have been developed in project management of environmental EIA processes, as well as strategic environmental assessment and compliance advice, and the identification of environmental management solutions and mitigation/risk minimising measures.

Karen Jodas and Jo-Anne Thomas, the principle authors of this Environmental Impact Assessment Report, are both registered Professional Natural Scientists (in the practice of environmental science) with the South African Council for Natural Scientific Professions. They have gained extensive knowledge and experience on potential environmental impacts associated with electricity generation projects through their involvement in related EIA processes over the past ten (10) years. They have successfully managed and undertaken EIA processes for other power generation projects for Eskom Holdings Limited throughout South Africa. Curricula vitae for the Savannah Environmental project team consultants are included in Appendix A.

In order to adequately identify and assess potential environmental impacts, Savannah Environmental has appointed several specialist consultants to conduct specialist studies, as required. Details of these specialist studies are included in Chapter 4. The curricula vitae for the EIA specialist consultants are also included in Appendix A.

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 readily or inexpensively 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. 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, that is:

» Increasing access to affordable energy services
» Improving energy sector governance
» Stimulating economic development
» Managing energy-related environmental impacts
» 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.

2.2. 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
» 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 to assist Government in meeting its target, Eskom is already investigating potential renewable energy generation projects, which include a Concentrating Solar Thermal project in the Northern Cape, as well as the proposed Wind Energy Facility.

2.3. 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.
» That new electricity generation will remain predominantly coal-based, but with the potential for hydro, natural gas and nuclear capacity.
» The need to diversify energy supply through increased use of natural gas and new and renewable energies.
» Continuing investigations into nuclear options as a future new energy source.
» The promotion of the use of energy efficiency management and technologies.
» The need to ensure environmental considerations in energy supply, transformation and end use.
» The promotion of universal access to clean and affordable energy, with the emphasis on household energy supply being co-ordinated with provincial and local integrated development programmes.
» The need to introduce policy, legislation and regulation for the promotion of renewable energy and energy efficiency measures and mandatory provision of energy data.
» The need to undertake integrated energy planning on an on-going basis

2.4. 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
- 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.

2.5. 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 ISEP process identifies the timing, quantity and type (e.g. base load or peaking) of new electricity generating capacity required over the next 20 years. The planning scenarios are based on an average 4% growth in demand for electricity over the 20 year period. This translates into a 6% growth in GDP. The most recently approved ISEP plan identifies the need for increased *peaking* electricity generating by *2007* and additional *baseload* capacity by approximately *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.

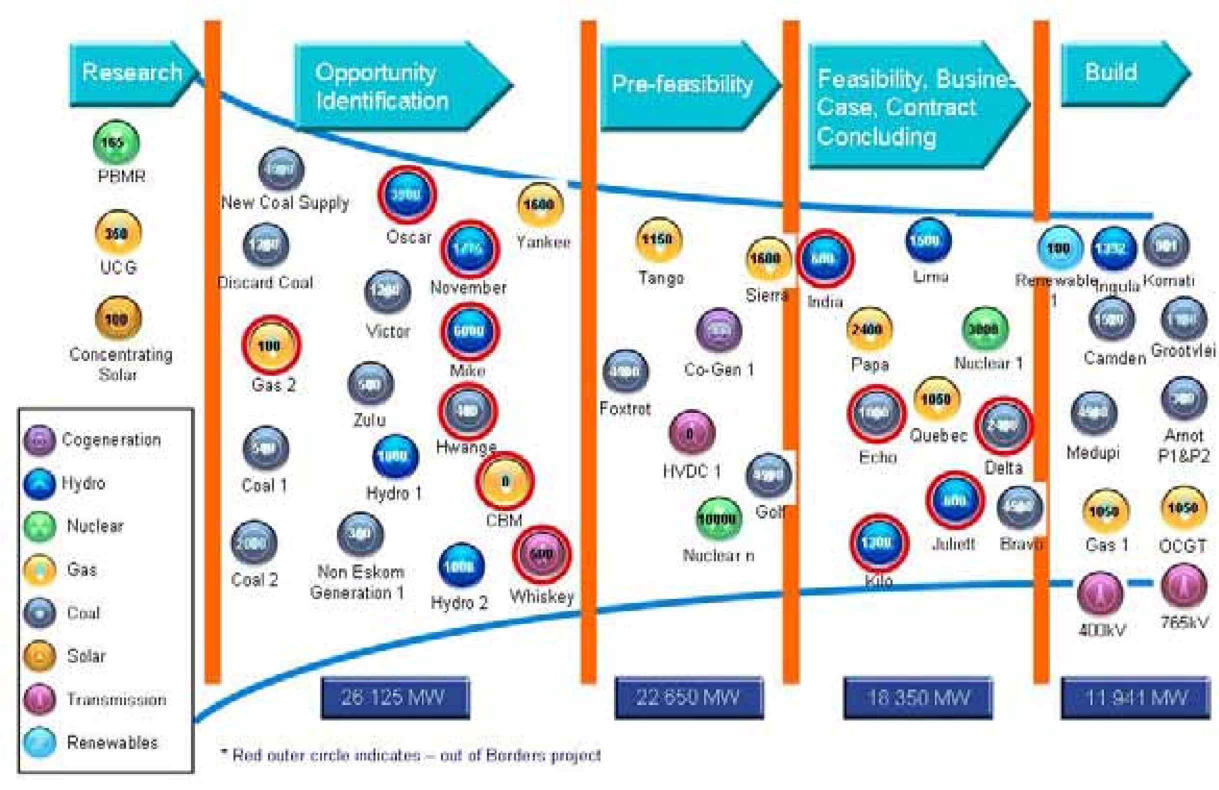


Figure 2.2: Eskom Project funnel showing the range of supply options being considered by Eskom to meet the increasing demand for electricity in the country

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).

2.6. 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 participation in clean development mechanism (CDM) project opportunities. The wind energy facility project is in a process of being registered for participation in the CDM projects for carbon credit trading.

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 ~278 400 tons of CO_2 per annum.

Renewable energy sources which are being 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:

a) the identification of promising options
b) an assessment of the financial and economic viability as well as resource potential in the country
c) the implementation of demonstration projects to conduct operational research
d) the provision of strategies for the uptake and sustainable deployment of the technologies where feasible.

Eskom have identified the Western Cape (with the Cape West Coast in particular) as a wind resource-rich region, with the DME/CSIR/Eskom South African Wind Resource Database identifying the West Coast north of the Olifants River as experiencing some of the highest wind speeds in South Africa. Eskom commissioned the Klipheuwel Wind Energy Demonstration Facility (north of Durbanville in the Western Cape) in February 2003 in order to conduct operational research. Research at this facility focused on how available wind energy technologies interact with the South African environment and results highlighted unique factors that can impact performance. A strategy is now in place in order for Eskom to commission a viable commercial wind energy facility project.

2.7. 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 strategy states that the wind energy potential in the Western Cape is considered to be high (potential in the order of 3 000 MW, but that wind resources do require confirmation). The potential advantages associated with wind are identified to include:

» Technology and capital costs are reducing with technology advancements.
» Maintenance is low.
» It is a clean energy option.
» Should the wind resource be favourable, the technology can be relatively 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.

2.8. 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. The consideration of environmental and spatial issues together with technical issues at a strategic regional level is supported, as this results in a well-informed siting process.

In this regard, DEA&DP 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).

In summary, this methodology includes guidelines 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. 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.

In April 2007, Eskom embarked on a regional site identification and selection 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. This area was earmarked as it met Eskom's wind resource requirements, as well as grid connection and accessibility requirements. 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.

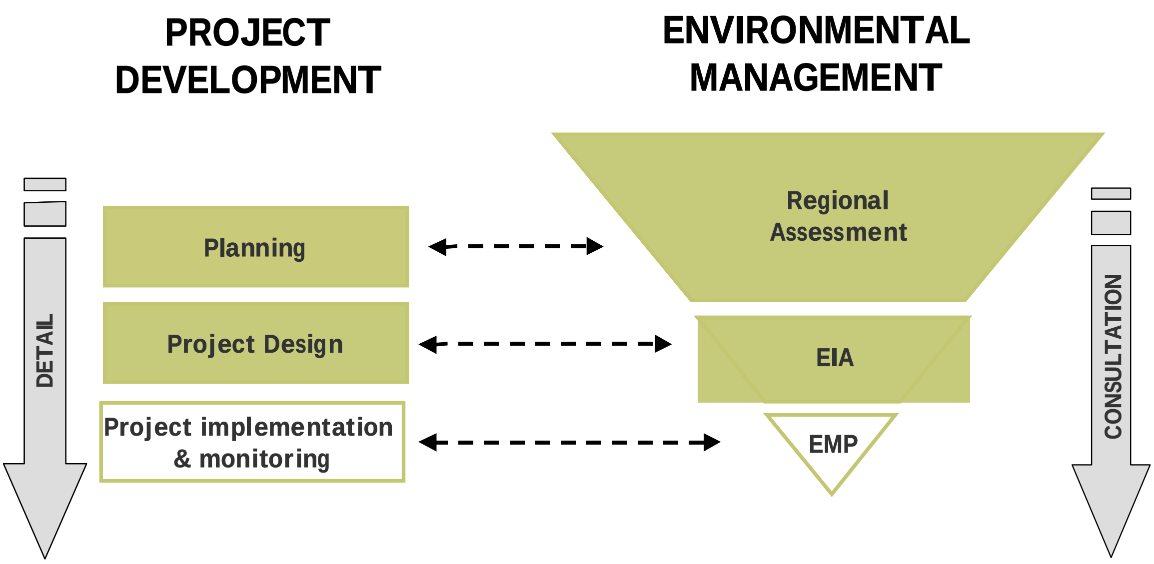
Based on the outcomes of the regional assessment and site identification process, Eskom has taken the site identified through this process forward into the EIA process for assessment through site specific studies.

2.9. 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 below.



WIND ENERGY AS A POWER GENERATION OPTION CHAPTER 3

Wind energy is firmly established as a mature technology for electricity generation, with a reported 65 000 MW installed base worldwide. It is one of the fastest growing electricity generating technologies with installed capacity increasing by ~10 000 MW annually, and features in energy plans worldwide. Use of wind for electricity generation is essentially a non-consumptive use of a natural resource, and produces an insignificant quantity of greenhouse gases in its life cycle. A wind energy facility also qualifies as a Clean Development Mechanism (CDM) project (i.e. a financial mechanism developed to encourage the development of renewable technologies) as it meets the international requirements in this regard.

Knowing and understanding the challenges faced by fossil fuels requires that there be a shift in the way that energy is generated and consumed, and this renewable energy project is part of Eskom's contribution in increasing its role in implementing such technologies that complement South Africa's energy mix. Worldwide, many solutions and approaches are being developed to reduce environmental pollution and CO_2 emissions. It is acknowledged that the more cost effective solution in the short-term is not necessarily the least expensive long-term solution. This holds true not only for direct project cost, but also indirect project cost such as impacts on the environment. Renewable energy options follow such a model in that such ventures typically have high capital costs, however, the fuel costs for such a facility are free. This has a net result of a low long-term cost for such a facility, with added benefits of reduced (or zero) environmental pollution. Renewable energy is considered one of the 'clean sources of energy' with the potential to contribute greatly to a more ecologically, socially and economically sustainable future.

3.1. Investigations into Wind Energy for South Africa

Eskom commissioned the Klipheuwel Wind Energy Demonstration/Research Facility (north of Durbanville in the Western Cape) in February 2003. Research at this facility has focused on how the technology interacts with the South African environment and has highlighted unique factors that can impact performance. The research information collected ranges from production statistics, daily operational requirements, detailed condition monitoring and national resource understanding and analysis. This 3.2 MW installation generates about 4 GWh annually with an availability of the turbine of 90%, and an energy utilisation factor[1] of 16% over a year period.

The demonstration facility has been a major success and results of the research have provided Eskom with valuable technical and strategic information pertaining to utilising wind as a source of energy, and has provided guidance with regards to the establishment of a large scale commercial facility.

Figure 3.1: Photograph of the existing three turbines at the Klipheuwel Demonstration Facility, Durbanville

As a part of Eskom's wind research programme a national wind atlas for South Africa was compiled (in conjunction with the DME and the CSIR for the South African Renewable Resource Database). Results indicate that wind energy in South Africa is limited to particular areas (typically on the coastline). Areas of high potential for future commercial wind farm development were earmarked, and high-accuracy meteorological measurement stations erected at these sites for on-going monitoring.

Based on the lessons learnt from the Klipheuwel pilot demonstration facility as well as the analyses on Eskom's measured wind data, Eskom determined that a full-scale commercial wind energy facility could successfully be established in South Africa. The West Coast north of the Olifants River was identified to experience some of South Africa's best wind resources for the development of a wind energy facility (i.e. the incidence of wind within the required velocity range). The construction of such a commercial facility is now being proposed on a site to the north of the Olifants River.

[1] Energy utilisation factor is an indication of the operation of the turbine to the total time within the same period (i.e. average operation over a year expressed as a percentage). The wind turbine utilisation factor is a function of the availability of the wind resource.

3.2. The Importance of the Wind Resource for Energy Generation

Wind energy has the attractive attribute that the fuel is free. The economics of a wind energy project crucially depend on the wind resource at the site. Detailed and reliable information about the speed, strength, direction, and frequency of the wind resource is vital when considering the installation of a wind energy facility, as the wind resource is a critical factor to the success of the installation.

Wind speed is the rate at which air flows past a point above the earth's surface. Average annual wind speed is a critical siting criterion, since this determines the cost of generating electricity. With a doubling of average wind speed, the power in the wind increases by a factor of 8, so even small changes in wind speed can produce large changes in the economic performance of a wind farm (for example, an increase of average wind speed from 22 km/hr to 36 km/hr (6 m/s to 10 m/s) increases the amount of energy produced by over 130%). Wind turbines can start generating at wind speeds of between 10 km/hr to 15 km/hr (~3 m/s to 4 m/s), with nominal wind speeds required for full power operation varying between ~45 km/hr and 60 km/hr (~12.5 m/s to 17 m/s). Wind speed can be highly variable and is also affected by a number of factors, including surface roughness of the terrain.

Wind power is a measure of the energy available in the wind.

Wind direction at a site is important to understand, but it is not critical in site selection as wind turbine blades automatically turn to face into the predominant wind direction at any point in time.

South Africa can be considered as having a moderate wind resource as compared to Northern Europe (Scandinavia), Great Britain and Ireland and New Zealand where wind energy facilities are already implemented. Typical annual wind speeds range from 15 km/hr to 25 km/hr (4 m/s to 7 m/s) around South Africa's southern, eastern and western coastlines (with more wind typically along the coastline). This translates to an expected annual energy utilisation factor of between 15% and 30%, the value depending on the specific site selected.

Actual wind measurements (over a period of 3 years) in the vicinity of the proposed site to the north of the Olifants River applied to typical wind turbine performance has indicated that a wind energy facility on the West Coast would perform as well as international facilities, with an energy utilisation factor of ~26%. Climatic variation may impact this production figure by as much as 30% on a year-on-year basis (both negative and positive). Therefore, by comparing recorded annual energy utilisation factors for wind energy facilities internationally, it is evident that the performance of a South African facility would be in line with international trends (refer Table 3.1).

Table 3.1: Record of Annual Energy Utilisation Factors

Location	Average Capacity Factor
UK	29%
Rural Germany	16%
Denmark	24%
Klipheuwel Demonstration facility – South Africa	16%*
Proposed Facility on the West Coast	26%

*Actual performance over a period of 3 years

Figure 3.2 provides a wind rose[2] of actual measured data from the Eskom meteorological station on the farm De Punt, north of the Olifants River. The length of time that the wind comes from a particular sector is shown by the length of the spoke, and the speed is shown by the thickness of the spoke. The wind direction is conventionally indicated from the periphery towards the centre of the graph, and not from the centre outwards.

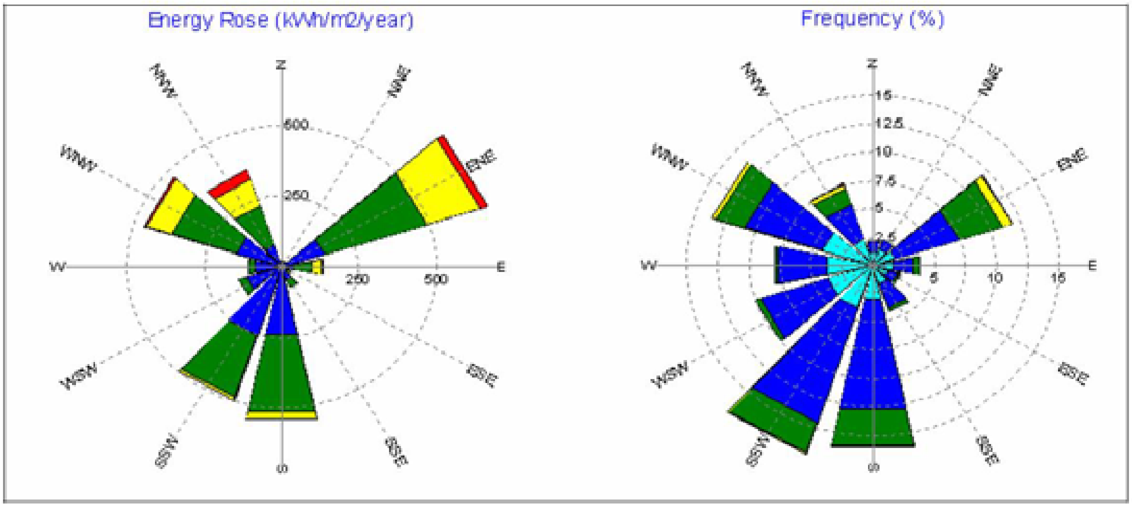


Figure 3.2: Wind Rose from measured data at the Eskom meteorological station at De Punt, indicating both wind energy as well as frequency of wind direction (% of time in a direction)

Figure 3.2 illustrates that the predominant wind direction experienced on the West Coast is from the SSW (i.e. percent of time in a direction). This is, however, not the strongest wind (or wind with most energy) experienced in this area, but the SSW wind is experienced most frequently. The design (and micro-siting[3]) of a wind farm is sensitive to the shape of the wind rose for the site. Although modern wind turbines are able to yaw to the direction of the wind, the micro-siting must consider the wind direction and strength of the wind in the optimal positioning of the turbines.

[2] 'Wind rose' is the term given to the diagrammatic representation of joint wind speed and direction distribution at a particular location.

[3] 'Micro-siting' is a term used within the wind energy facility industry and refers to the detailed final positioning in a wind farm layout to maximise energy production.

The wind speed measured at a meteorological station is also affected by the local topography (extending to a few tens of kilometres from the station) or surface roughness. The effect of height variation/relief in the terrain is seen as a speeding-up/slowing-down of the wind due to the topography. Elevation in the topography exerts a profound influence on the flow of air, and results in turbulence within the air stream, and this also has to be taken into account in the placement of turbines.

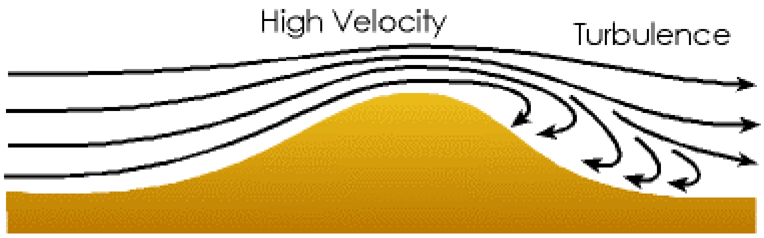


Figure 3.3: Illustration of the effect of relief on air flow

A wind resource measurement and analysis programme must be conducted for the site proposed for development, as only measured data will provide a robust prediction of the facility's expected energy production over its lifetime.

The placement of a wind energy facility, and in fact the actual individual turbines must, therefore, consider the following technical factors:

» Predominant wind direction and frequency
» Distance from coast, where wind moving over the land mass results in a loss of wind energy (and ultimately a loss in production)
» Topographical features or relief affecting the flow of the wind (e.g. causing shading effects and turbulence of air flow)
» Effect of adjacent turbines on wind flow and speed – specific spacing is required between turbines in order to reduce the effects of wake turbulence.

Wind turbines typically need to be spaced approximately 2 to 3xD apart, and 5 to 7xD where a turbine is behind another (D = the diameter of the rotor blades). This is required to minimise the induced wake effect the turbines might have on each other. The micro-siting of the turbines on the site has been determined using industry standard software systems, which automatically consider the spacing requirements. Considering a typical 2 MW capacity turbine whose rotors are approximately 90 m in diameter (each blade is 45 m in length), each turbine within a turbine row is separated by approximately 300 m. The erection of turbines in subsequent parallel rows requires a separation distance of 600 m to 700 m.

3.3. What is a Wind Turbine and How Does It Work

The kinetic energy of wind is used to turn a wind turbine to generate electricity. A wind turbine consists of **three rotor blades** and a **nacelle** mounted at the tip of a tapered **steel tower**. The mechanical power generated by the rotation of the blades is transmitted to the generator within the nacelle via a gearbox and drive train.

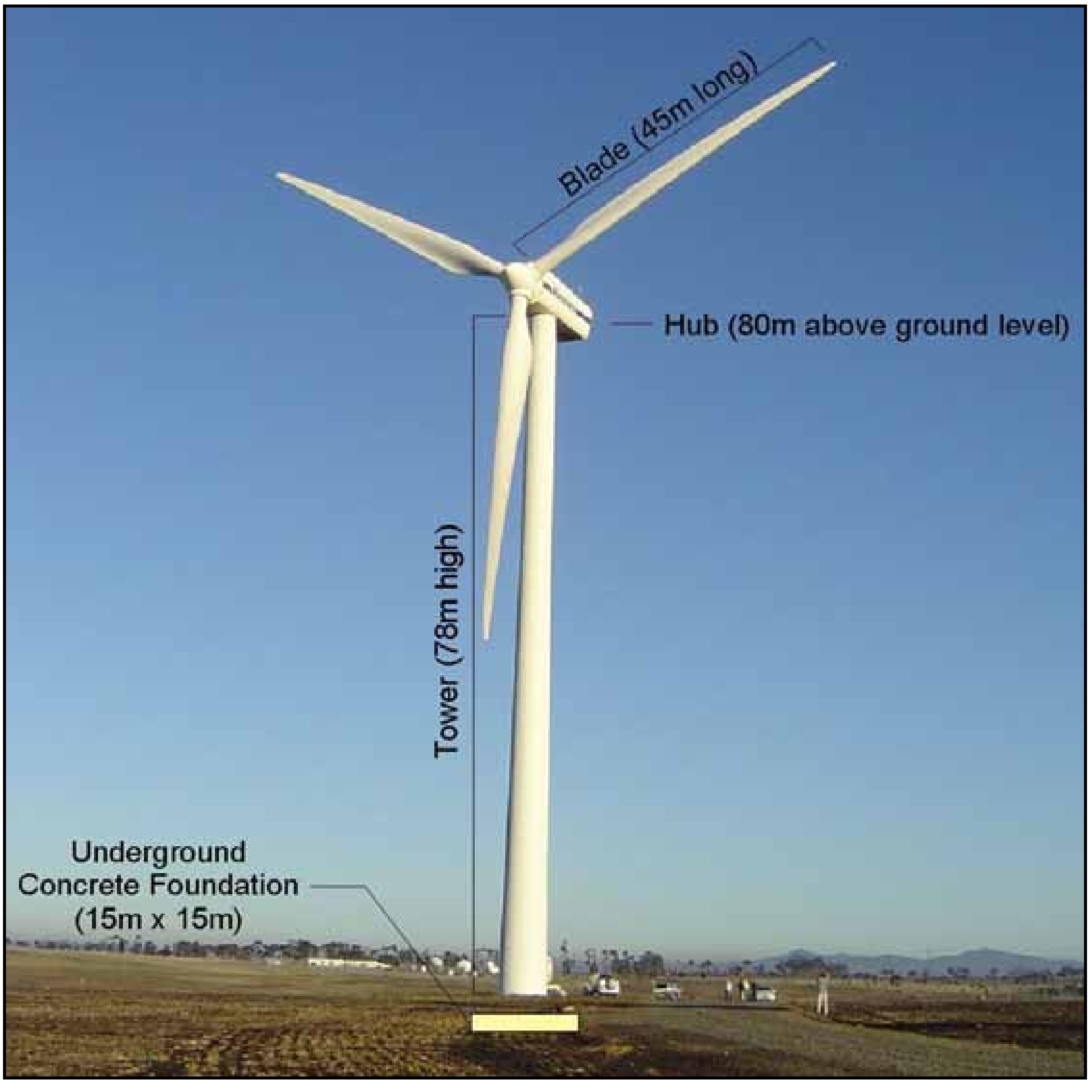
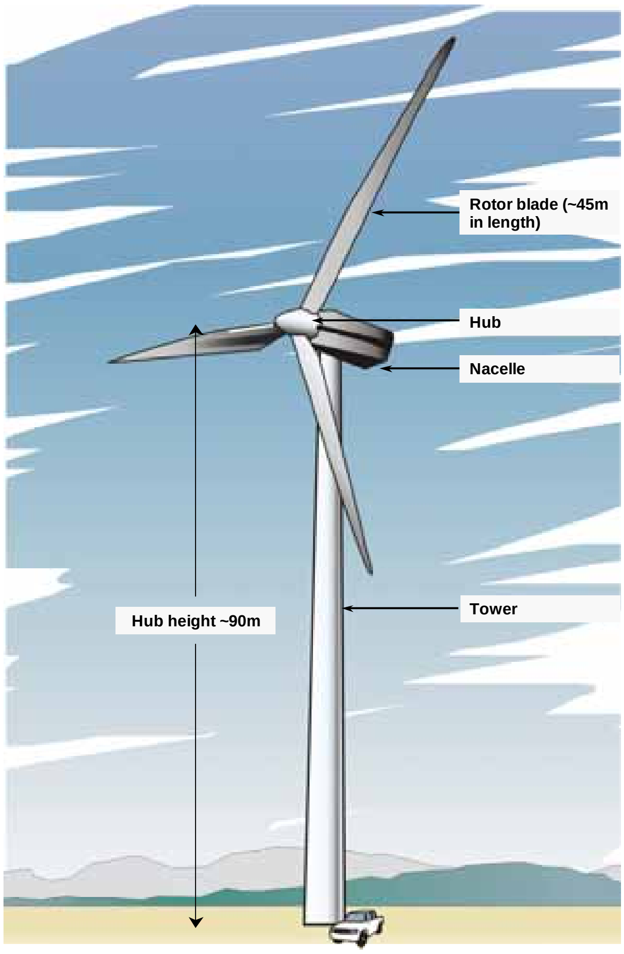


Figure 3.4: Illustration of the main components of a wind turbine (turbine at Eskom's Klipheuwel wind demonstration facility)

Turbines are able to operate at varying speeds. The amount of energy a turbine can harness depends on both the wind velocity and the length of the rotor blades. It is anticipated that the turbines utilised for the proposed wind energy facility on the West Coast will have a hub height of ~80 m, and a rotor diameter of ~90 m (i.e. each blade ~45 m in length). These turbines would be capable of generating in the order of 2 MW each (in optimal wind conditions). Wind turbines can start generating at wind speeds of between 10 km/hr to 15 km/hr (~3 m/s to 4 m/s), with nominal wind speeds required for full power operation varying between ~45 km/hr and 60 km/hr (12.5 m/s and 17 m/s).

3.3.1. Main Components of a Wind Turbine



A wind turbine consists of the following major components:

» Tower
» Rotor
» Nacelle

The Tower

The tower, which supports the rotor, is constructed from tubular steel. It is approximately 80 m tall. The nacelle and the rotor are attached to the top of the tower.

The tower on which a wind turbine is mounted is not just a support structure. It also raises the wind turbine so that its blades safely clear the ground and so it can reach the stronger winds at higher elevations. Larger wind turbines are usually mounted on towers ranging from 40 m to 80 m tall. The tower must be strong enough to support the wind turbine and to sustain vibration, wind loading and the overall weather elements for the lifetime of the wind turbine.

The Rotor

The portion of the wind turbine that collects energy from the wind is called the rotor. The rotor converts the energy in the wind into rotational energy to turn the generator. The rotor has three blades that rotate at a constant speed of about 15 to 28 revolutions per minute (rpm). The speed of rotation of the blades is controlled by the nacelle, which can turn the blades to face into the wind ('yaw control'), and change the angle of the blades ('pitch control') to make the most use of the available wind.

The rotor blades function in a similar way to the wing of an aircraft, utilising the principles of **lift** (Bernoulli). When air flows past the blade, a wind speed and pressure differential is created between the upper and lower blade surfaces. The pressure at the lower surface is greater and thus acts to "lift" the blade. When blades are attached to a central axis, like a wind turbine rotor, the lift is translated into rotational motion. Lift-powered wind turbines are well suited for electricity generation.

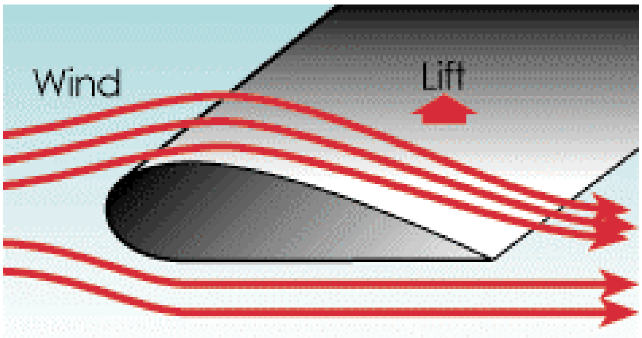


Figure 3.5: Illustration of the principle of lift

The rotation of the rotor blades produces a characteristic 'swishing' sound as the blades pass in front of the tower roughly once a second. The other moving parts, the gearbox and generator, cannot be heard unless the observer is physically inside the turbine tower.

The tip-speed is the ratio of the rotational speed of the blade to the wind speed. The larger this ratio, the faster the rotation of the wind turbine rotor at a given wind speed. Electricity generation requires high rotational speeds. Lift-type wind turbines have optimum tip-speed ratios of around 4 to 5.

The Nacelle

The nacelle contains the generator, control equipment, gearbox and anemometer for monitoring the wind speed and direction (as shown in Figure 3.6).

The **generator** is what converts the turning motion of a wind turbine's blades into electricity. Inside this component, coils of wire are rotated in a magnetic field to produce electricity. The generator's rating, or size, is dependent on the length of the wind turbine's blades because more energy is captured by longer blades.

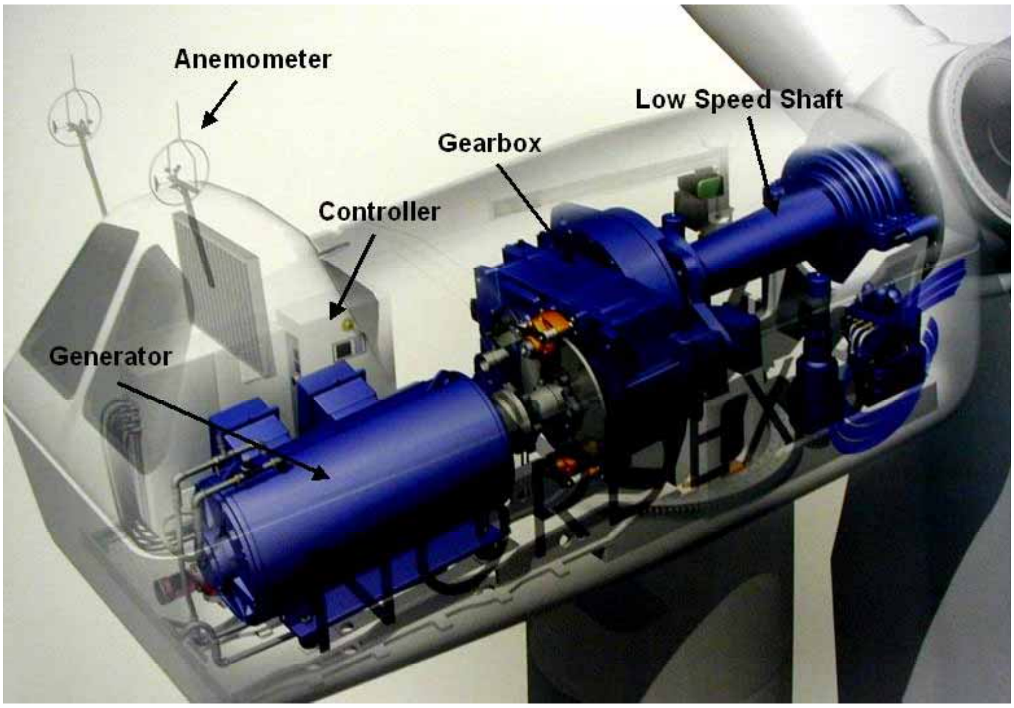


Figure 3.6: Detailed structure of a nacelle of a horizontal axis turbine

3.3.2. Operating Characteristics of a Wind Turbine

A turbine is designed to operate continuously, unattended and with low maintenance for more than 20 years or >120 000 hours of operation. Once operating, a wind farm can be monitored and controlled remotely, with a mobile team for maintenance, when required.

The **cut-in speed** is the minimum wind speed at which the wind turbine will generate usable power. This wind speed is typically between 10 and 15 km/hr (~3 m/s and 4 m/s).

At very high wind speeds, typically over 90 km/hr (25 m/s), the wind turbine will cease power generation and shut down. The wind speed at which shut down occurs is called the **cut-out speed**. Having a cut-out speed is a safety feature which protects the wind turbine from damage. Normal wind turbine operation usually resumes when the wind drops back to a safe level.

3.3.3. Understanding the Betz Limit

It is the flow of air over the blades and through the rotor area that makes a wind turbine function. The wind turbine extracts energy by slowing the wind down. The more kinetic energy a wind turbine extracts from the wind, the more the wind will be slowed down as it passes the turbine. In reality, a wind turbine will deflect the wind, even before the wind reaches the rotor plane. This means that it will never be possible to capture all of the energy in the wind using a wind turbine.

The theoretical maximum amount of energy in the wind that can be collected by a wind turbine's rotor is approximately 59%[4]. This value is known as the Betz Limit. If the blades were 100% efficient, a wind turbine would not work because the air would give up all its energy, and the air would not be able to move away from the rotor (i.e. the air could not leave the turbine). In practice, the collection efficiency of a rotor is not as high as 59%. A more typical efficiency is 35% to 45%. A wind energy system (including rotor, generator etc) does not exhibit perfect efficiencies, and will therefore deliver between 15% and 30% of the original energy available in the wind (between 20% to 25% being typical for modern systems).

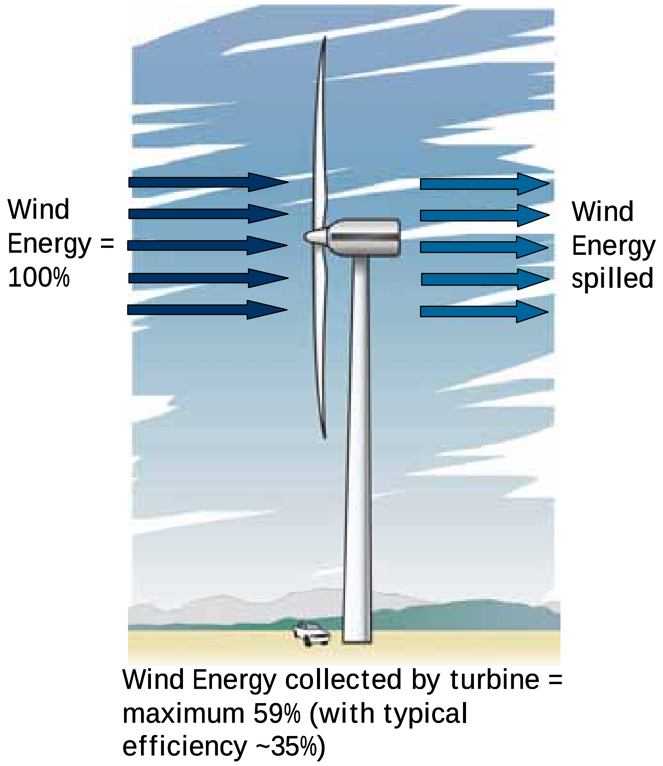


Figure 3.7: Illustration of the principle of the Betz Limit

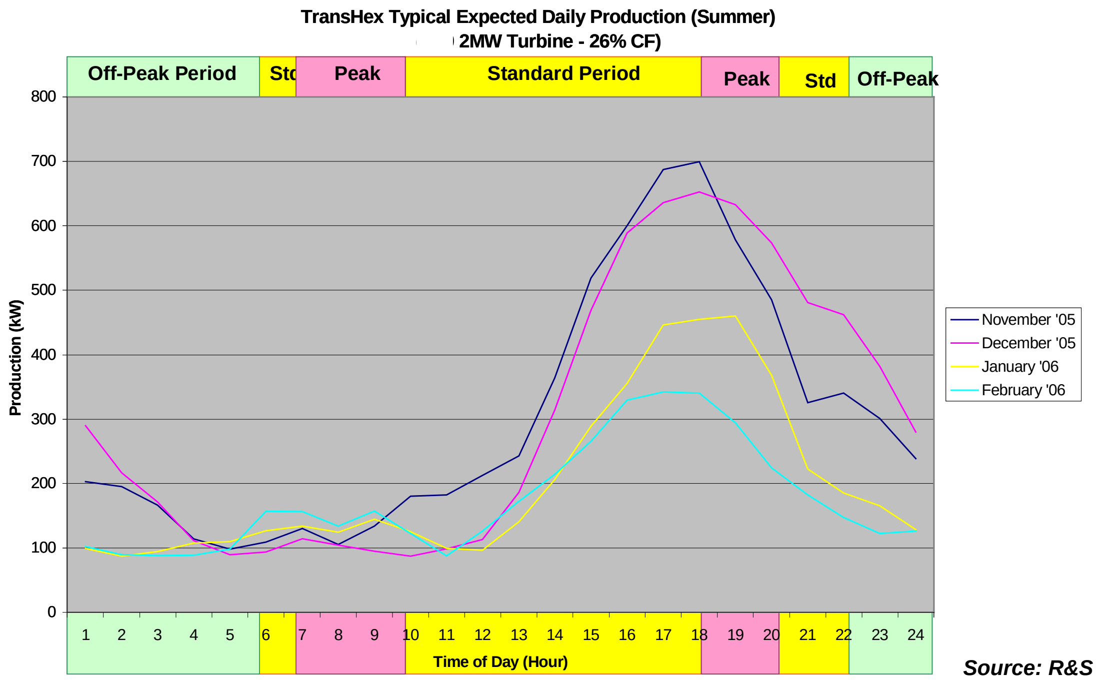
3.4. Wind Energy on the West Coast as a Power Option

Actual wind measurements at the proposed site applied to typical wind turbine performance has indicated an energy utilisation factor of 26%. However climatic variation may impact this production figure by as much as 30% on a year-on-year basis (both negative and positive). This is based on European experience

[4] Betz' Law says that you can only convert less than 16/27 (or 59%) of the kinetic energy in the wind to mechanical energy using a wind turbine. Betz' Law was first formulated by the German Physicist Albert Betz in 1919.

over the last 100 years. Experiences in wind at the site also indicate large variations in wind resource. This variation could potentially change the possibilities of the proposed project to 16% utilisation (18 km/hr (5 m/s) average annually) and a 36% utilisation (25 km/hr (7 m/s) average annually).

Figure 3.8 indicates the typical expected daily production (for summer) on the West Coast site (assuming the use of a 2 MW industry standard wind turbine).



Source: R&S

Figure 3.8: Graph indicating the typical expected daily production (for summer) on a site on the West Coast north of the Olifants River

APPROACH TO UNDERTAKING THE ENVIRONMENTAL IMPACT ASSESSMENT PHASE CHAPTER 4

An Environmental Impact Assessment (EIA) process refers to that process (dictated by the EIA Regulations) which involves the identification of and assessment of direct, indirect and cumulative environmental impacts associated with a proposed project. The EIA process comprises two phases: **Scoping Phase** and **EIA Phase**. The EIA process culminates in the submission of an EIA Report (including an environmental management plan (EMP)) to the competent authority for decision-making. The EIA process is illustrated below:

The EIA Phase for the proposed Wind Energy Facility on the West Coast has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of Section 24(5) of the National Environmental Management Act (NEMA; Act No 107 of 1998). The environmental studies for this proposed project were undertaken in two phases, in accordance with the EIA Regulations.

4.1. Phase 1: Scoping Study

The Scoping Study, which commenced in July 2007, provided I&APs with the opportunity to receive information regarding the proposed project, participate in the process and raise issues of concern.

The Scoping Report aimed at detailing the nature and extent of the proposed wind energy facility, identifying potential issues associated with the proposed project, and defining the extent of studies required within the EIA. This was achieved through an evaluation of the proposed project, involving the project proponent, specialist consultants, and a consultation process with key stakeholders that included both relevant government authorities and interested and affected parties (I&APs). In accordance with the requirements of the EIA Regulations, feasible project-specific alternatives (including the “do nothing” option) were identified for consideration within the EIA process.

The draft Scoping Report compiled was made available at public places for I&AP review and comment. All the comments, concerns and suggestions received during the Scoping Phase and the draft report review period were included in the final Scoping Report and plan of study for EIA. The Scoping Report was submitted to the National Department of Environmental Affairs and Tourism (DEAT) and the Western Cape Department of Environmental Affairs and Development Planning (DEA&DP) in September 2007. The Final Scoping Report was accepted by DEAT, as the Competent Authority (refer correspondence included in Appendix B). In terms of this acceptance, an Environmental Impact Assessment was required to be undertaken for the proposed project.

4.2. Phase 2: Environmental Impact Assessment

Through the Scoping Study, no environmental fatal flaws were identified to be associated with the development of the proposed wind energy facility, and no absolute 'no-go' areas were identified within the broader area evaluated. However, a number of issues requiring further study for both the wind energy development site as well as the associated infrastructure (including the 132 kV power line) were highlighted. These issues have been assessed in detail within the EIA phase of the process.

The EIA Phase aimed to achieve the following:

» Provide an overall assessment of the social and biophysical environments affected by the proposed project.
» Assess potentially significant impacts (direct, indirect and cumulative, where required) associated with the proposed wind energy facility and associated infrastructure.
» Identify and recommend appropriate mitigation measures for potentially significant environmental impacts.
» Undertake a fully inclusive public involvement process to ensure that I&AP are afforded the opportunity to participate, and that their issues and concerns are recorded.

The EIA addresses potential environmental impacts and benefits (direct, indirect and cumulative impacts) associated with all phases of the project including design, construction and operation, and aims to provide the environmental authorities with sufficient information to make an informed decision regarding the proposed project.

The EIA process followed for this project is described below.

4.3. Overview of the EIA Phase

The EIA Phase has been undertaken in accordance with the EIA Regulations published in Government Notice 28753 of 21 April 2006, in terms of NEMA. Key tasks undertaken within the EIA phase included:

» Consultation with relevant decision-making and regulating authorities (at National, Provincial and Local levels).
» Undertaking a public involvement process throughout the EIA process in accordance with Regulation 56 of Government Notice No R385 of 2006 in order to identify any additional issues and concerns associated with the proposed project.
» Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with Regulation 59 of Government Notice No R385 of 2006).
» Undertaking of independent specialist studies in accordance with Regulation 33 of Government Notice No R385 of 2006.
» Preparation of a EIA Report in accordance with the requirements of the Regulation 32 Government Notice No R385 of 2006.
» Preparation of a Environmental Management Plan (EMP) in accordance with the requirements of the Regulation 34 Government Notice No R385 of 2006.

These tasks are discussed in detail below. As part of a quality system, control sheets detailing the requirements for the key tasks as listed above have been completed by the EIA team, and are included in Appendix C.

4.3.1. Regulating Authority Consultation

The National DEAT is the competent authority for this application. A record of all authority consultation undertaken prior to the commencement of the EIA Phase is included within the Scoping Report. Consultation with the regulating authorities (i.e. DEAT and DEA&DP) has continued throughout the EIA process. On-going consultation included the following:

» Invitation to attend a stakeholder workshop during the review period of the Draft Scoping Report (i.e. 23 August 2007).
» Submission of a Final Scoping Report (September 2007) following a 30-day public review period (and consideration of stakeholder comments received).
» Ad hoc discussions with DEAT and DEA&DP in order to clarify the findings of the Scoping Report and the issues identified for consideration in the EIA process.
» Provision of an opportunity for DEAT and DEA&DP representatives to visit and inspect the proposed site, power line alternatives and the study area (undertaken on 23 January 2008). Other relevant authorities, organs of state

and representatives from the local Municipalities were invited to attend in order to provide the opportunity for open and construction discussion.
» Submission of a Final Environmental Impact Assessment (EIA) Report and Environmental Management Plan following the 30-day public review period.

A consultation meeting with DEAT and DEA&DP in order to discuss the findings and conclusions of the EIA Report will also be undertaken as part of this EIA process, if required.

4.3.2. Consideration of Alternatives

The following project alternatives were investigated in the EIA:

» The **'do nothing' alternative**: Eskom does not establish a wind energy facility in the Western Cape (maintain status quo).
» **Site-specific alternatives**: in terms of actual turbine positions and positions of the associated infrastructure on the site (i.e. access roads, substation/s, visitors centre over an area of less than 20 km^2.
» **Alternative servitudes for power line routing**: A 132 kV power line is proposed to connect the substation at the wind energy facility to the electricity distribution network/grid at the Juno Transmission Substation (outside Vredendal). Alternative routes/corridors for the 132 kV power line have been assessed in the EIA phase.
» **Transportation route alternatives:** for transportation of all components associated with the project to the site. The various transportation options (harbour, rail, air, road), as well as the possible routes associated with these options were assessed through the transportation study (refer Appendix Q) and summarised in Chapter 8.

4.3.3. Public Involvement and Consultation: EIA Phase

The public involvement process was initiated at the start of the site selection process, and has continued through the EIA process for this project. The aim of the public participation process was primarily to ensure that:

» Information containing all relevant facts in respect of the proposed project was made available to potential stakeholders and I&APs.
» Participation by potential I&APs was facilitated in such a manner that all potential stakeholders and I&APs were provided with a reasonable opportunity to comment on the proposed project.
» Comment received from stakeholders and I&APs was recorded, considered and incorporated into the EIA process.

In summary, the public participation process for this project has included the following key steps/activities:

Regional assessment/site selection process	Focus group meetings	April 2007
Scoping Phase	Advertisement of EIA Process	July 2007
	Distribution of Background Information Document (BID)	July 2007
	Focus group meetings	July 2007
	Public review period for DSR	August 2007
	Public meeting & stakeholder meeting	August 2007
EIA Phase	Focus group meetings	November 2007
	Advertisement of public review period for DEIA Report	January 2008
	Public review period for Draft EIA Report	January 2008
	Public meeting & stakeholder meeting	January 2008

Through on-going consultation with key stakeholders and I&APs, issues raised through the Scoping Phase for inclusion within the EIA study were confirmed. All relevant stakeholder and I&AP information has been recorded within a database of affected parties (refer to Appendix D for a listing of recorded parties). While I&APs were encouraged to register their interest in the project from the onset of the process, the identification and registration of I&APs has been ongoing for the duration of the EIA process and the project database has been updated on an on-going basis. 216 parties have registered their interest in the project to date.

The following variables were considered in the decision regarding the level of public participation required for the EIA Phase as well as the process to be followed:

» *The scale of anticipated impacts of the proposed project:* the project is a greenfields development.
» *The public sensitivity and the degree of controversy of the project:* the project concept is new to South Africa, and has had both positive and negative exposure. The project affects privately-owned properties.
» *The characteristics of the potentially affected parties:* there are existing organisational structures that represent I&APs and their interests, and good exposure/information sharing of the project to the local communities took place during the scoping phase (i.e. I&APs are well informed on the project).

In order to accommodate the varying needs of stakeholders and I&APs, as well as ensure the relevant interactions between stakeholders and the EIA specialist team, the following opportunities were provided for I&APs issues to be recorded and verified through the EIA phase, including:

» **Focus group meetings** (pre-arranged and stakeholders invited to attend)
» One-on-one **consultation meetings** and telephonic consultation sessions (consultation with various parties, for example with directly affected landowners, by the project participation consultant as well as specialist consultants)
» Written, faxed or e-mail **correspondence**.
» **Public meeting** and **stakeholder meeting** (during the review period of the Draft EIA Report – refer to section 4.3.6)

Table 4.1 provides details of the formal focus group meetings held during the EIA phase of the public consultation process.

Table 4.1: Details of the focus group meetings held during the EIA phase of the public consultation process

Organisation	Parties Present	Date
West Coast District Municipality	Municipal Manager, Officials and Councillors	19 November 2007
Lutzville Farmers Union Executive	Members and individuals	19 November 2007
Matzikama Municipality, Provincial Departments & Key Stakeholders of Vredendal area	Officials and Councillors, Cape Nature, Western Cape Department of Transport and Public Works, Department of Agriculture & Land Care, Transhex Mining, SAWAWA	20 November 2007

Notes from focus group meetings held with stakeholders are included within Appendix E.

4.3.4. Identification and Recording of Issues and Comments

Issues and comments raised by I&APs over the duration of the EIA process have been synthesised into Comments and Response Reports (refer to Appendix F for the Comments and Response Reports compiled from both the Scoping and EIA Phases). A summary of the key issues raised to date includes:

» Visual impacts
» Social impacts and benefits
» Impacts on landowners
» Tourism
» Agriculture concerns
» Noise impacts
» Transportation and road access

» Construction phase concerns
» Safety and security
» Site waste management
» Site footprint
» Land use and planning
» Biodiversity impacts
» Impacts on birdlife
» Integration with the electricity grid
» Project cost
» Technology and equipment specifications
» Aviation airspace

The Comments and Response Reports include responses from members of the EIA project team and/or the project proponent. Where issues are raised that the EIA team considers beyond the scope and purpose of this EIA process, clear reasoning for this view is provided.

4.3.5. Assessment of Issues Identified through the Scoping Process

Based on the findings of the Scoping Study, the following issues were identified as not requiring further investigation within the EIA:

» Potential impacts on agricultural potential for the proposed wind energy facility site.
» Potential impacts on groundwater resources.
» Potential impacts associated with geology and soil conditions (subject to a detailed geotechnical study being undertaken by the project proponent).

Issues which required further investigation within the EIA phase, as well as the specialists involved in the assessment of these impacts are indicated in Table 4.2.

Table 4.2: Specialist studies undertaken within the EIA phase

Specialist	Specialist study	Refer Appendix
Nick Helme of Nick Helme Botanical Surveys	Flora	Appendix G
Prof. Le Fras Mouton of the Department of Botany & Zoology, Stellenbosch University	Terrestrial fauna	Appendix H
Andrew Jenkins & Jon Smallie of the Endangered Wildlife Trust (EWT)	Avifauna	Appendix I
Pete Illgner (Environmental Consultant and Researcher)	Geomorphology, surface processes and wetlands	Appendix J
Garry Paterson of the Agricultural Research Council (ARC): Institute for	Agricultural potential (for power line alternatives)	Appendix K

Soil, Climate and Water		
Tim Hart of the Archaeology Contracts Office, Department of Archaeology: University of Cape Town	Heritage	Appendix L
Lourens du Plessis of MetroGIS	Visual	Appendix M
Mike Fabricius of The Journey	Tourism	Appendix N
Tony Barbour (Environmental Consultant and Researcher)	Social Impact	Appendix O
Adrian Jongens of Jongens Keet Associates	Noise	Appendix P
Mark Pinder of Arup SA (Pty) Ltd	Transportation & access	Appendix Q

A peer review of the EIA process was undertaken by Jonathan Crowther of CCA Environmental.

Specialist studies considered direct and indirect environmental impacts associated with the development of the wind energy facility and all associated infrastructure (including alternatives with regards to site design and layout), as well as the alternative alignments/corridors of the proposed 132 kV power line. Issues were assessed in terms of the following criteria:

» The **nature**, a description of what causes the effect, what will be affected and how it will be affected.
» The **extent**, wherein it is indicated whether the impact will be local (limited to the immediate area or site of development), regional, national or international. A score of between 1 and 5 is assigned as appropriate (with a score of 1 being low and a score of 5 being high).
» The **duration**, wherein it is indicated whether:
  * the lifetime of the impact will be of a very short duration (0–1 years) – assigned a score of 1;
  * the lifetime of the impact will be of a short duration (2-5 years) - assigned a score of 2;
  * medium-term (5–15 years) – assigned a score of 3;
  * long term (> 15 years) - assigned a score of 4; or
  * permanent - assigned a score of 5.
» The **magnitude**, quantified on a scale from 0-10, where a score is assigned:
  * 0 is small and will have no effect on the environment;
  * 2 is minor and will not result in an impact on processes;
  * 4 is low and will cause a slight impact on processes;
  * 6 is moderate and will result in processes continuing but in a modified way;
  * 8 is high (processes are altered to the extent that they temporarily cease); and

    * 10 is very high and results in complete destruction of patterns and permanent cessation of processes.
» The **probability** *of occurrence*, which describes the likelihood of the impact actually occurring. Probability is estimated on a scale, and a score assigned:
    * Assigned a score of 1–5, where 1 is very improbable (probably will not happen);
    * Assigned a score of 2 is improbable (some possibility, but low likelihood);
    * Assigned a score of 3 is probable (distinct possibility);
    * Assigned a score of 4 is highly probable (most likely); and
    * Assigned a score of 5 is definite (impact will occur regardless of any prevention measures).
» the **significance**, which is determined through a synthesis of the characteristics described above (refer formula below) and can be assessed as low, medium or high.
» the **status**, which is described as either positive, negative or neutral.
» the degree to which the impact can be reversed.
» the degree to which the impact may cause irreplaceable loss of resources.
» the *degree* to which the impact can be *mitigated.*

The **significance** is determined by combining the criteria in the following formula:

$S=(E+D+M)P$; where

S = Significance weighting
E = Extent
D = Duration
M = Magnitude
P = Probability
The **significance weightings** for each potential impact are as follows:

» **< 30 points:** Low (i.e. where this impact would not have a direct influence on the decision to develop in the area),
» **30-60 points:** Medium (i.e. where the impact could influence the decision to develop in the area unless it is effectively mitigated),
» **> 60 points:** High (i.e. where the impact must have an influence on the decision process to develop in the area).

As Eskom has the responsibility to avoid or minimise impacts and plan for their management (in terms of the EIA Regulations), the mitigation of significant impacts is discussed. Assessment of impacts with mitigation is made in order to demonstrate the effectiveness of the proposed mitigation measures. An Environmental Management Plan is included as Appendix S.

The specialist EIA studies are contained within Appendices G - Q.

4.3.6. Public Review of Draft EIA Report and Feedback Meetings

The draft EIA Report was made available for public review from 7 January 2008 to 7 February 2008 at the following locations:

Town	Venue
Vredendal	Vredendal Library
	Matzikama Municipality
	Department of Agriculture & Land Care
Lutzville	Lutzville Municipal Office / Library
	Lutzville Farmers Association
Vanrhynsdorp	Cape Nature Offices
Ebenhaeser	Post office / Library
Strandfontein	Municipal Office
Doringbaai	Library
Moorreesburg	West Coast District Municipality offices

The report was also made available on websites, including:
» www.eskom.co.za/eia
» www.savannahSA.com

In addition, soft copies (CDs) of the report were also made available to stakeholders requesting such copies (for example, the Matzikama Business Chamber).

In order to facilitate comments on the Draft EIA Report, a public meeting and a stakeholder workshop were held during the review period for the Draft EIA Report as follows:

» Public feedback meeting in study area: 24 January 2008 at the at the Lutzville Sport and Rugby Club, Open House at 18h00 to 19h00 and Public Meeting at 19h00
» Stakeholder meeting in Cape Town: 25 January 2008 at the Koeberg Visitors Centre at 09h30

The aim of these meetings was to provide feedback of the findings of the environmental impact assessment studies undertaken, and to invite comment on the proposed project. Copies of the minutes of these meeting are included in Appendix R.

The public review process and details of the public meeting were advertised in the following regional and local newspapers:

» Regional newspaper - *Die Burger*: Monday & January 2008
» Regional/Local newspaper - *Olifantsrivier Herald*: Thursday 17 January 2008
» Regional/Local newspaper - *Ons Kontrei*: Friday 18 January 2008

Copies of the advertisements are included in Appendix R.

In addition, posters were erected in public places (including shops, post office, municipal office etc) to inform I&APs of the report availability and public meeting. In addition to printed media, over ten radio announcements were also made on Radio Namakwaland (the local radio station). All registered I&APs were notified of the availability of the report and public meeting by letter (refer Appendix R). Identified key stakeholders were personally invited to attend the key stakeholder workshop by letter (refer to Appendix R).

4.4. Regulatory and Legal Context

The South African energy industry is evolving rapidly, with regular changes to legislation and industry role-players. The regulatory hierarchy for an energy generation project of this nature consists of three tiers of authority who exercise control through both statutory and non-statutory instruments – that is National, Provincial and Local levels.

As wind energy development is a multi-sectoral issue (encompassing economic, spatial biophysical, and cultural dimensions) various statutory bodies are likely to be involved in the approval process for wind energy facility project and the related statutory environmental assessment process.

4.4.1. Regulatory Hierarchy

At National Level, the main regulatory agencies are:

» *Department of Minerals and Energy (DME):* This department is responsible for policy relating to all energy forms, including renewable energy. Wind energy is considered under the White Paper for Renewable Energy and the Department undertakes research in this regard. It is the controlling authority in terms of the Electricity Act (Act No 41 of 1987).
» *National Energy Regulator (NER):* This body is responsible for regulating all aspects of the electricity sector, and will ultimately issue licenses for wind energy developments to generate electricity.
» *Department of Environment and Tourism (DEAT):* This Department is responsible for environmental policy and is the controlling authority in terms of NEMA and the EIA Regulations. As Eskom is a statutory body, DEAT is the

competent authority for this project, and charged with granting the relevant environmental authorisation.

» *Department of Transport and Public Works:* This department is responsible for roads and the granting of exemption permits for the conveyance of abnormal loads on public roads.
» *Department of Transport - Civil Aviation Authority:* This department is responsible for aircraft movements and radar, which are aspects that influence wind energy development location and planning.
» *The South African Heritage Resources Agency (SAHRA):* The National Heritage Resources Act (Act No 25 of 1999) and the associated provincial regulations provides legislative protection for listed or proclaimed sites, such as urban conservation areas, nature reserves and proclaimed scenic routes.

At Provincial Level, the main regulatory agencies are:

» *Provincial Government of the Western Cape (PGWC) – Department of Environmental Affairs and Development Planning (DEA&DP):* This is the principal authority involved in the EIA process and determines many aspects of Provincial environmental policy. The Department is a commenting authority for the EIA Application, and the regulating authority for any sub-division or rezoning which may be required in terms of the relevant town planning legislation.
» *Heritage Western Cape:* Considers the application and provides comment (and a decision regarding the project) in terms of Section 38(8) of the National Heritage Resources Act (Act No 25 of 1999) and Regulation 3(3)(a) of PN 298 (29 August 2003).
» *CapeNature:* This Department's involvement relates specifically to the biodiversity and ecological aspects of the proposed development activities on the receiving environment to ensure that developments do not compromise the biodiversity value of an area. The Department considers the significance of impacts specifically in threatened ecosystems as identified by the National Spatial Biodiversity Assessment or systematic biodiversity plans.
» *Western Cape Department of Transport and Public Works - Roads infrastructure branch:* This Department's involvement relates specifically to the consideration of the impact to transport infrastructure, and specifically the road network, as well as application for new access points on the proclaimed road network and/or servitudes within proclaimed road reserves.
» *Department of Agriculture and Land Care:* This Department's involvement relates specifically to sustainable resource management and land care.

At Local Level, the local and municipal authorities are the principal regulatory authorities responsible for planning, land use and the environment. In the Western Cape, both Local Municipalities and District Municipalities play a role. The relevant Municipalities include:

» *Matzikama Municipality:* Offices in Vredendal
» *West Coast District Municipality (WCDM):* Offices in Moorreesburg

The following is relevant regarding regulation at a district and/or local level:

» In terms of the Municipal Systems Act (Act No 32 of 2000) it is compulsory for all municipalities to go through an Integrated Development Planning (IDP) process to prepare a five-year strategic development plan for the area under their control. The IDP process, specifically the spatial component (Spatial Development Framework), in the Western Cape Province is based on a bioregional planning approach to achieve continuity in the landscape and to maintain important natural areas and ecological processes.
» Bioregional planning involves the identification of priority areas for conservation and their placement within a planning framework of core, buffer and transition areas. These could include reference to visual and scenic resources and the identification of areas of special significance, together with visual guidelines for the area covered by these plans.
» By-laws and policies have been formulated by local authorities to protect visual and aesthetic resources relating to urban edge lines, scenic drives, special areas, signage, communication masts, etc.
» Municipal legislation and by-laws regulate zoning within the local/district municipal areas, and application would be required for the required rezoning of any property.

4.4.2. Legislation and Guidelines that have informed the undertaking of this EIA Process

The following legislation and guidelines have informed the scope and content of this EIA Report:

» National Environmental Management Act (NEMA; Act No 107 of 1998)
» EIA Regulations, published under Chapter 5 of the NEMA (GN R385, GN R386 and GN R387 in Government Gazette 28753 of 21 April 2006)
» Guidelines published in terms of the NEMA EIA Regulations, in particular:
  * Guideline 3: General Guide to Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)
  * Guideline 4: Public Participation in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, May 2006)
  * Guideline 5: Assessment of alternatives and impacts in support of the Environmental Impact Assessment Regulations, 2006 (DEAT, June 2006)
  * Guideline on Public Participation, 2006 (DEA&DP, July 2006)
  * Guideline on Alternatives, 2006 (DEA&DP, July 2006)

» Guideline document developed by DEA&DP 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)
» Specialist study guidelines published by DEA&DP, in particular:
  * Strategic initiative to introduce commercial land-based wind energy development to the Western Cape (specifically Reports 5 and 6)
  * Guideline for determining the scope of specialist involvement in EIA processes (June 2005)
  * Guideline for involving visual and aesthetic specialists in EIA processes (June 2005)
  * Guideline for involving biodiversity specialists in EIA processes (June 2005)
  * Fynbos Forum Ecosystem Guidelines for environmental assessment in the Western Cape (2005)
  * Guideline for involving heritage specialists in EIA processes (June 2005)
  * Guideline for involving hydrogeologists in EIA processes (June 2005)
  * Guideline for Environmental Management Plans (June 2005)
  * Guideline for involving social assessment specialists in EIA processes (February 2007)
  * Guideline on public participation: NEMA Environmental Impact Assessment Regulations (September 2007)

Several other Acts, standards or guidelines have also informed the project process and the scope of issues assessed in the EIA process, and the various permitting requirements associated with the proposed Wind Energy Facility. A listing of relevant legislation and permitting requirements is provided in Table 4.3 overleaf.

Table 4.3: Relevant legislative permitting requirements applicable to the Wind Energy Facility Project EIA

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
National Environmental Management Act (Act No 107 of 1998)	EIA Regulations have been promulgated in terms of Chapter 5. Activities which may not commence without an environmental authorisation are identified within these Regulations. In terms of Section 24(1) of NEMA, the potential impact on the environment associated with these listed activities must be considered, investigated, assessed and reported on to the competent authority (the decision-maker) charged by NEMA with granting of the relevant environmental authorisation. In terms of GNR 387 of 21 April 2006, a scoping and EIA process is required to be undertaken for the proposed Wind Energy Facility and associated infrastructure	National Department of Environmental Affairs and Tourism – lead authority. Western Cape Department of Environmental Affairs and Development Planning – commenting authority.	This EIA report is to be submitted to DEAT and DEA&DP in support of the application for authorisation submitted in March 2007.
National Environmental Management Act (Act No 107 of 1998)	In terms of the Duty of Care provision in S28(1) Eskom as the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to ensure that any pollution or degradation of the environment associated with this project is avoided, stopped or minimised.	Department of Environmental Affairs and Tourism (as regulator of NEMA).	While no permitting or licensing requirements arise directly by virtue of the proposed Wind Energy Facility, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
Environment Conservation Act (Act No 73 of 1989)	Section 20(1) provides that where an operation accumulates, treats, stores or disposes of waste on site for a continuous period, it must apply for a permit to be classified as a suitable waste disposal facility.	National Department of Environmental Affairs and Tourism and Department of Water Affairs and Forestry.	As no waste disposal site is to be associated with the Wind Energy Facility or associated infrastructure, no permit is required in this regard.
Environment Conservation Act (Act No 73 of 1989)	National Noise Control Regulations (GN R154 dated 10 January 1992). Provincial noise control regulations have been	National Department of Environmental Affairs and Tourism	There is no requirement for a noise permit in terms of the legislation. A Noise Impact Assessment is required to

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
	promulgated for the Western Cape in Provincial Notice (PN 627/P5309/2299) dated 20 November 1998. In terms of these Regulations, industrial noise limits are 61 dBA and noise limits from any source other than an industrial source are 65 dBA. Draft regulations relating to noise control published in Provincial Gazette No 6412, PN 14 dated the 25th of January 2007. Noise limits are based on the acceptable rating levels of ambient noise contained in SANS 10103.	Western Cape Department of Environmental Affairs and Development Planning Local authorities, i.e. Matzikama Local Municipality and the West Coast District Municipality (administers the WCMA01)	be undertaken in accordance with SANS 10328. This has been undertaken as part of the EIA process (refer to Appendix P). There are noise level limits which must be adhered to. If these are exceeded, then mitigation (like noise zones) are required to be implemented From the findings of the noise assessment, no exceedance of noise limits is anticipated.
National Water Act (Act No 36 of 1998)	Section 21 sets out the water uses for which a water use license is required.	Department of Water Affairs and Forestry	As no water use (as defined in terms of S21 of the NWA) will be associated with the Wind Energy Facility, no water use permits or licenses are required to be applied for or obtained.
National Water Act (Act No 36 of 1998)	In terms of Section 19, Eskom as the project proponent must ensure that reasonable measures are taken throughout the life cycle of this project to prevent and remedy the effects of pollution to water resources from occurring, continuing or recurring.	Department of Water Affairs and Forestry (as regulator of NWA)	While no permitting or licensing requirements arise directly by virtue of the proposed Wind Energy Facility, this section will find application during the EIA phase and will continue to apply throughout the life cycle of the project.
Atmospheric Pollution Prevention Act (Act No 45 of 1965)	In terms of section 27, the Minister may declare certain areas as dust control areas. The area in which the project site where the proposed WEF is to be situated has not been declared as a dust control area. Section 28 sets out prescribed steps or, where no steps have been prescribed, adopt the best practicable means for preventing such dust from becoming so dispersed or causing such nuisance.	National Department of Environmental Affairs and Tourism - Chief Air Pollution Control Officer (CAPCO)	Although there is no legal obligation relating to the activities to be undertaken within the proposed development area (as the area is not a declared dust control area), it is suggested that as best practice and in accordance with Section 28, best practicable means should be used to prevent dust generation from the roads and excavations during

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
			construction in order to prevent dust from becoming a nuisance.
National Heritage Resources Act (Act No 25 of 1999)	Section 38 states that Heritage Impact Assessments (HIAs) are required for certain developments, including: * Construction of a road, power line, pipeline or other similar linear development or barrier exceeding 300 m in length. * Any development or other activity which will change the character of a site exceeding 5 000m^2. The relevant Heritage Resources Authority must be notified of developments such as linear developments (such as roads and power lines), bridges exceeding 50 m, or any development or other activity which will change the character of a site exceeding 5 000 m^2; or the re-zoning of a site exceeding 10 000 m^2 in extent. This notification must be provided in the early stages of initiating that development, and details regarding the location, nature and extent of the proposed development must be provided.	South African Heritage Resources Agency (SAHRA) – National heritage sites (grade 1 sites) as well as all historic graves and human remains Heritage Western Cape – all Provincial heritage sites (grade 2 sites), generally protected heritage and structures (grade 3a – 3c sites) and prehistoric human remains	Subsection 4 of the NHRA provides that within 14 days of receipt of notification, the relevant Heritage Resources Authority must notify the proponent to submit an impact assessment report if they believe that a heritage resource may be affected or notify the Proponent that this section does not apply. Heritage Western Cape have reviewed the Final Scoping Report (including a Heritage Assessment) and have indicated that HWC has no objection to the development on the proposed site, and that no further heritage related studies are required (refer to record of decision included within Appendix F). A permit may be required should identified cultural/heritage sites identified on the site be required to be disturbed or destroyed as a result of the proposed development.
National Environmental Management: Biodiversity Act (Act No 10 of 2004)	In terms of Section 57, the Minister of Environmental Affairs and Tourism has published a list of critically endangered, endangered, vulnerable and protected species in GNR 151 in Government Gazette 29657 of 23 February 2007 and the regulations associated therewith in GNR 152 in GG29657 of 23 February 2007, which came	National Department of Environmental Affairs and Tourism	As Eskom will not carry on any restricted activity, as is defined in Section 1 of the Act, no permit is required to be obtained in this regard. Specialist flora and fauna studies are required to be undertaken as part of the EIA process. These studies have been

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
	into effect on 1 June 2007. In terms of GNR 152 of 23 February 2007: Regulations relating to listed threatened and protected species, the relevant specialists must be employed during the EIA phase of the project to incorporate the legal provisions as well as the regulations associated with listed threatened and protected species (GNR 152) into specialist reports in order to identify permitting requirements at an early stage of the EIA phase.		undertaken for the proposed Wind Energy Facility and associated infrastructure (refer to Appendix G and H) A permit may be required should the protected plant species which are present on the proposed development site are to be disturbed or destroyed as a result of the proposed development.
Nature Conservation Ordinance (Act 19 of 1974)	Article 63 prohibits the picking (defined in terms of article 2 to include, cut, chop off, take, gather, pluck, uproot, break, damage or destroying of certain flora. Schedule 3 lists endangered flora and Schedule 4 lists protected flora. Articles 26 to 47 regulates the use of wild animals	CapeNature	A permit may be required should any endangered or protected plant species present on the proposed development site are to be disturbed or destroyed as a result of the proposed development.
Conservation of Agricultural Resources Act (Act No 43 of 1983)	Regulation 15 of GNR1048 provides for the declaration of weeds and invader plants, and these are set out in Table 3 of GNR1048. Weeds are described as Category 1 plants, while invader plants are described as Category 2 and Category 3 plants. These regulations provide that Category 1, 2 and 3 plants must not occur on land and that such plants must be controlled by the methods set out in Regulation 15E.	Department of Agriculture	While no permitting or licensing requirements arise from this legislation, this Act will find application during the EIA phase and will continue to apply throughout the life cycle of the project. In this regard, soil erosion prevention and soil conservation strategies must be developed and implemented. In addition, a weed control and management plan must be developed and implemented.
Minerals and Petroleum Resources Development Act (Act No 28 of 2002)	A mining permit or mining right may be required where a mineral in question is to be mined (e.g. materials from a borrow pit) in accordance with the	Department of Minerals and Energy.	As no borrow pits are expected to be required for the construction of the Wind Energy Facility and associated

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
	provisions of the Act.		infrastructure, no mining permit or mining right is required to be obtained. All borrow material will be commercially sourced for use during the life cycle of this project.
National Veld and Forest Fire Act (Act No 101 of 1998)	In terms of Section 12 Eskom would be obliged to burn firebreaks to ensure that should a veldfire occur on the property, that same does not spread to adjoining land. In terms of Section 13 Eskom must ensure that the firebreak is wide enough and long enough to have a reasonable chance of preventing a veldfire from spreading; not causing erosion; and is reasonably free of inflammable material. In terms of Section 17, Eskom must have such equipment, protective clothing and trained personnel for extinguishing fires as are prescribed or in the absence of prescribed requirements, reasonably required in the circumstances.	Department of Water Affairs and Forestry.	While no permitting or licensing requirements arise from this legislation, this Act will find application during the operational phase of the project.
Hazardous Substances Act (Act No 15 of 1973)	This Act regulates the control of substances that may cause injury, or ill health, or death by reason of their toxic, corrosive, irritant, strongly sensitising or inflammable nature or the generation of pressure thereby in certain instances and for the control of certain electronic products. To provide for the rating of such substances or products in relation to the degree of danger; to provide for the prohibition and control of the importation, manufacture, sale, use, operation, modification, disposal or dumping of such substances and	Department of Health	It is necessary to identify and list all the Group I, II, III and IV hazardous substances that may be on the site by the activity and in what operational context they are used, stored or handled. If applicable, a license is required to be obtained from the Department of Health.

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
	products. Group I and II: Any substance or mixture of a substance that might by reason of its toxic, corrosive etc, nature or because it generates pressure through decomposition, heat or other means, cause extreme risk of injury etc., can be declared to be Group I or Group II hazardous substance; Group IV: any electronic product; Group V: any radioactive material. The use, conveyance or storage of any hazardous substance (such as distillate fuel) is prohibited without an appropriate license being in force.		
Aviation Act (Act No 74 of 1962) 13th amendment of the Civil Aviation Regulations (CARs) 1997	Any structure exceeding 45m above ground level, or structures where the top of the structure exceeds 150m above the mean ground level (like on top of a hill), the mean ground level considered to be the lowest point in a 3 km radius around such structure. Structures lower than 45m, which are considered as a danger or a potential danger to aviation, shall be marked as such when specified. Overhead wires, cables, etc., crossing a river, valley or major roads shall be marked and in addition, their supporting towers marked and lighted if an aeronautical study indicates that it could constitute a hazard to aircraft. Section 14 of Obstacle limitations and marking outside aerodrome or heliport - CAR Part 139.01.33 relates specifically to appropriate	Civil Aviation Authority (CAA)	While no permitting or licensing requirements arise from this legislation, this Act will find application during the operational phase of the project. Appropriate marking is required to meet the specifications as detailed in CAR Part 139.01.33 (refer to the relevant excerpt included in Appendix T)

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
	marking of wind energy facilities.		
National Road Traffic Act (Act No 93 of 1996)	The Technical Recommendations for Highways (TRH 11): "Draft Guidelines for Granting of Exemption Permits for the Conveyance of Abnormal Loads and for other Events on Public Roads" outline the rules and conditions which apply to the transport of abnormal loads and vehicles on public roads and the detailed procedures to be followed in applying for exemption permits are described and discussed. Legal axle load limits and the restrictions imposed on abnormally heavy loads are discussed in relation to the damaging effect on road pavements, bridges and culverts. The general conditions, limitations and escort requirements for abnormally dimensioned loads and vehicles are also discussed and reference is made to speed restrictions, power/mass ratio, mass distribution and general operating conditions for abnormal loads and vehicles. Provision is also made for the granting of permits for all other exemptions from the requirements of the National Road Traffic Act and the relevant Regulations.	Western Cape Department of Transport and Public Works (provincial roads) South African National Roads Agency (national roads)	An abnormal load/vehicle permit will be required to transport the various components to site. These include: * Route clearances and permits will be required for transporting the nacelles by road-based transport. * Transport vehicles exceeding the dimensional limitations (length) of 22m and will require a permit. * Depending on the trailer configuration and height when loaded, some of the turbine components may not meet specified dimensional limitations (height and width) but will be permitted under certain permit conditions.
Development Facilitation Act (Act No 67 of 1995)	Provides for the overall framework and administrative structures for planning throughout the Republic.	Western Cape Department of Environmental Affairs and Development Planning Local authorities, i.e. Matzikama Local Municipality and the West Coast District Municipality (for WCMA01)	Eskom must submit a land development application in the prescribed manner and form as provided for in the Act. A land development applicant who wishes to establish a land development area, must comply with the extensive procedures set out in the DFA.

Legislation	Applicable Requirements	Relevant Authority	Timing of Permitting Process & Integration with NEMA EIA process
Land Use Planning Ordinance 15 of 1985	Details land subdivision and rezoning requirements and procedures	Western Cape Department of Environmental Affairs and Development Planning Local authorities, i.e. Matzikama Local Municipality and the West Coast District Municipality (for WCMA01)	Given that the wind energy development is proposed on land that is zoned for agricultural use, a rezoning application in terms of Section 17 of LUPO to an alternative appropriate zone will be required. It is anticipated that the wind energy development would require a rezoning to either Industrial Zone 1[5] or Special Zone[6] as defined in the Scheme Regulations in terms of Section 8 of LUPO (Government Gazette, December 1988). Rezoning is required to be undertaken following the issuing of an environmental Authorisation for the proposed project.
Subdivision of Agricultural Land Act (Act No 70 of 1970)	Details land subdivision requirements & procedures. Applies for subdivision of all agricultural land in the Province.	Western Cape Department of Environmental Affairs and Development Planning Local authorities, i.e. Matzikama Local Municipality and the West Coast District Municipality (for WCMA01)	Subdivision will have to be in place prior to any subdivision approval in terms of Section 24 and 17 of LUPO. Subdivision is required to be undertaken following the issuing of an environmental Authorisation for the proposed project.

[5] "Industry: means an enterprise defined in the regulations made in terms of Section 35 of the Machinery and Occupational Safety Act (Act 6 of 1983)" (note, these Regulations include any 'electrical installation')."

[6] "Special Usage: means a use which is such, or in respect of which the land use restrictions are such, that it is not catered for in these regulations, and which is set out in detail … by means of conditions of approval, or by means of conditions applicable to the special zone."

SCOPE OF THE WIND ENERGY FACILITY PROJECT CHAPTER 5

This chapter provides details regarding the scope of the proposed wind energy facility on the West Coast, including all required elements of the project and necessary steps for the project to proceed. The scope of project includes construction, operation and decommissioning activities. Activities associated with all life-cycle phases of the proposed wind energy facility that could potentially impact on the environment have been assessed through this EIA Study. The three primary components of the project (i.e. areas of activity) include the following:

» A **Wind Energy Facility** including up to 100 wind turbine units, a substation, underground electrical cabling between turbines and the substation, internal access roads and an office building and visitors centre at the facility entrance.
» Overhead **power lines** (132 kV distribution lines) from the wind farm substation feeding into the electricity network/grid at the Juno transmission substation (near Vredendal).
» Upgrading activities to the existing Divisional Road 2225 (known as Skaapvlei road) to provide access to the site (i.e. act as a **haul road** during the construction phase) from the R363 main tarred road at Koekenaap.

The details of these activities are provided in the sections which follow.

5.1. Project Construction Phase

In order to construct the proposed wind energy facility and associated infrastructure, a series of activities will need to be undertaken. The erection and commissioning of the turbines will be completed in a 2-phased approach, as this facility lends itself to phased-construction. It is proposed that Phase 1 comprise a facility with a capacity of approximately 100 MW (i.e. in the order of 50 industry-standard 2 MW capacity turbines). The construction phase for erection of approximately 50 wind turbines plus all of the required associated infrastructure is expected to take in the order of 12 months. Phase 2 of the proposed wind energy facility (i.e. the remaining 100 MW) is proposed to commence on commissioning of Phase 1. As this second phase will also involve the erection of approximately 50 turbines, it is estimated that the construction phase for erection of approximately 50 wind turbines plus all of the required associated infrastructure is expected to take a further 12 months. Therefore, a total construction period of 24 months is anticipated for the entire development.

It is expected that there will be between 6 and 15 people in a construction crew, depending on the construction phase of project and the nature of activities being undertaken. There will be more than one crew operating on the site at any one time. It is anticipated that on average 4 teams of 15 people (i.e. on average 60 people) will be working on the site during the course of the construction phase for the project, including the construction of the substation and power lines. A peak maximum of 300 people working on the wind energy facility site, access road and power lines can be expected during the accelerated programme (i.e. when there is a need to accelerate some of the activities to meet key dates).

Construction crews will constitute mainly skilled and semi-skilled workers. No employees will reside on the construction site at any time during the construction phase, and the intention is for appropriate accommodation to be sought and provided within the neighbouring towns.

The following construction activities have been considered to form part of the project scope of the Wind Energy Facility on the West Coast.

5.1.1. Conduct Surveys and Confirm Site Layout

Prior to initiating construction, a number of surveys will be required including, but not limited to:

» Geotechnical survey to provide information regarding subsurface characteristics for founding conditions and road building. This process will be required to be undertaken by a qualified geotechnical engineer.
» Wind energy facility site survey and confirmation (and pegging) of the turbine micro-siting footprints, laydown areas and access road routes. This micro-siting exercise will be required to be undertaken in conjunction with qualified heritage and vegetation specialists.
» Survey of substation site. This will be required to be undertaken in conjunction with qualified vegetation specialist.
» Survey and profiling of power line servitude to determine specific tower locations. This profiling exercise will be required to be undertaken in conjunction with qualified heritage, vegetation and avifauna specialists.

Eskom has utilised specialist software to assist in selecting the optimum position for each turbine (for optimum power generation). This site layout optimisation exercise revealed the best possible positions for the turbines, as well as the substation and other infrastructure from a technical perspective. The positioning/layout of all the components of this wind energy facility have a 90% confidence level, and will be confirmed through the results of the surveys mentioned above.

An east-west optimised layout is proposed to maximise the utilisation of the prevailing SSW winds. The site layout includes the 100 turbines in four rows which lie parallel and equidistant to one another. The first turbine row lies approximately 2 km inland from the coastline. Turbines will be sited up to 300 m apart from each other, with rows being approximately 650 m apart (refer Figure 5.1). This is to minimise wake effects and wind turbulence.

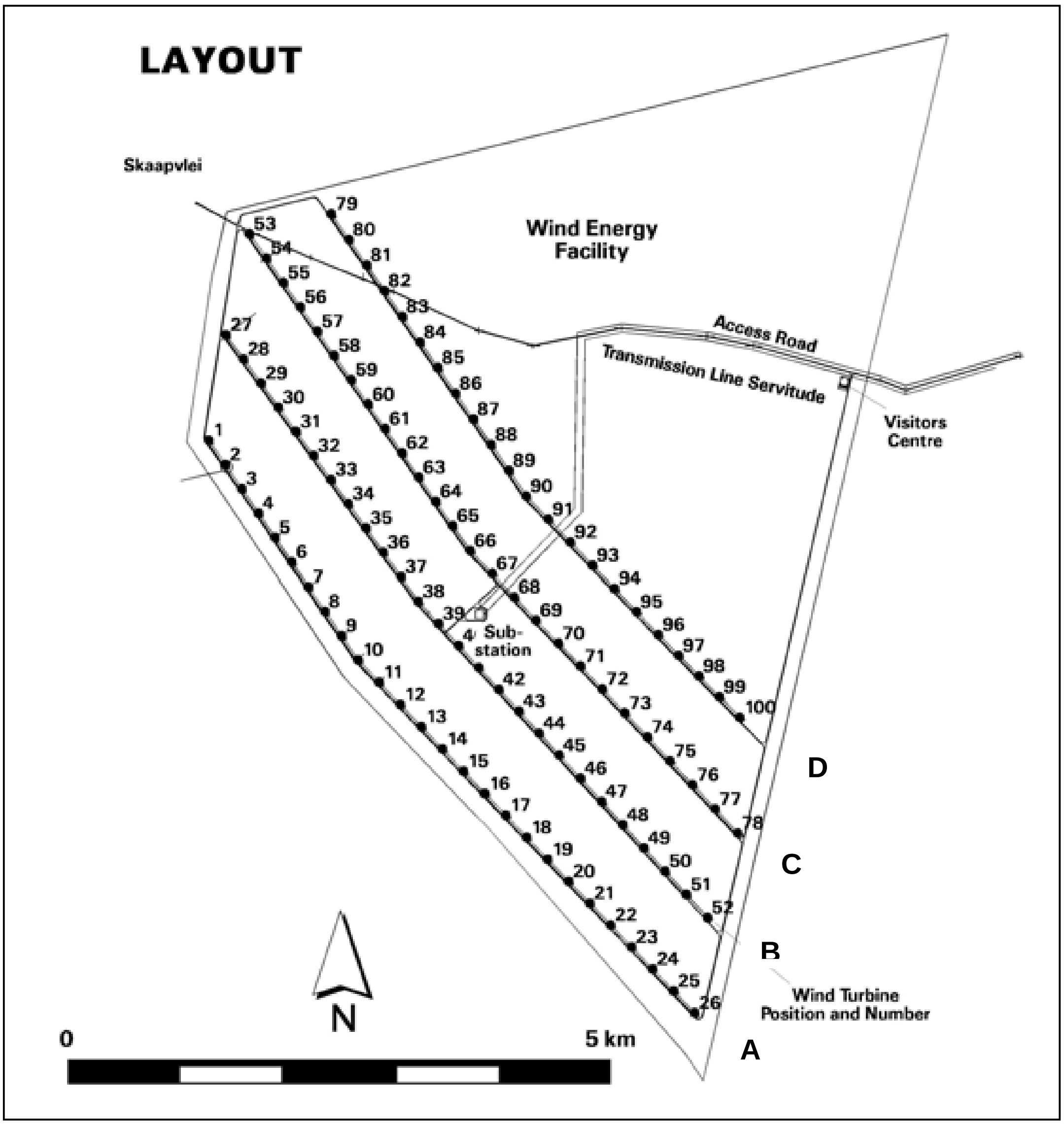


Figure 5.1: Diagrammatic representation of the proposed layout of the wind energy facility, illustrating the layout of the wind turbines and associated infrastructure

The wind resource drops across the site with distance from the coast, therefore the best positions for turbines (from an optimal operation perceptive) are the first 26 positions in Row A, as well as the second 26 positions in Row B. Rows A and B are proposed to be constructed as Phase 1. The remaining 48 turbines have been optimally located in Rows C and D, and would be constructed as Phase 2.

The substation is positioned in a central location between Rows B and C. This is to optimise the substation position between the Phase 1 and Phase 2 developments. In addition, the central location of the substation minimises energy losses between the turbine/generator and the substation by minimising the longest cable connection.

5.1.2. Improvements to Access Road to the Site

The proposed site is in a remote location but has good access owing to the existing road network providing access to the farming and mining areas. The existing Divisional Road 2225 (known as Skaapvlei road) provides direct access to the site from the R363 main tarred road at Koekenaap. This road surface is, however, required to be improved to provide adequate access to the site (i.e. act as a haul road to accommodate abnormally loaded vehicles during the construction phase). Activities to improve the driving surface are likely to include road surface redesign to accommodate the traffic loads and move water off the road surface effectively; and resurfacing of the road with a suitable wearing course gravel to ensure an improved driving surface. When a detailed survey and analysis of the road is undertaken at the start of the construction phase, Eskom will be in a position to make a decision regarding the surface material required to ensure the longevity and endurance of the road throughout the construction period and beyond. A tarred road for the full length of Skaapvlei road will only be considered should this be deemed economically viable. The first 1 800 m is flanked by smallholdings and residences, and this section of road would be the first section considered for tarring.

Figure 5.2: Photograph indicating the existing gravel access road to the proposed site (i.e. the road to Skaapvlei from Koekenaap)

The improvements to this access road will have to be completed in advance of any sizable components being delivered to site, and will be required to be of a good riding quality after the completion of the construction phase.

All borrow material required for the activities will be sourced from commercial sources and will not require the opening of borrow pits within the area.

The Skaapvlei road passes through the site, but will remain a proclaimed divisional road with fencing on both sides.

5.1.3. Establishment of Internal Access Roads on the Site

Internal access/haul roads within the site are required to be established to each turbine position as well as to the substation. No suitable vehicle tracks currently occur within demarcated the site for use. Therefore, access roads will be required to be established between the turbines to provide access and accommodate the abnormally loaded vehicles for construction purposes.

The access to the site will be off the Skaapvlei road. A compacted permanent roadway with a surface of 6 m in width will be required to be constructed on the site. The internal road needs to be designed to accommodate the swept path (i.e. the space required in the bends and corners so that the wheels remain on the roadway) and imposed loads of all the abnormal-load vehicles. These roads will be required to be maintained for the duration of the operation of the facility to provide suitable access for maintenance. The internal service road alignment is informed by the final micro-siting/positioning of the wind turbines and substation position, and allow for circulation of vehicles on the site.

These access roads will have to be constructed in advance of any components being delivered to site, and will remain in place after completion for future access and possibly access for replacement of parts if necessary.

Abnormal vehicles with 67 to 83 ton Nacelles and crawler crane components (or GVW = 132 000 kg) may require flatter grades on site. The geometric design specifications of the internal service roads will therefore be required to be confirmed in consultation with transportation companies prior to commencing with detailed design of the roads.

In order to accommodate the large crawler crane required for turbine assembly, a track of 12 m to 14 m in width is required to be established on the site to accommodate the passage of the fully rigged crawler crane. The total width of the crawler crane with 2 m wide caterpillar tracks is 10.8 m. In order for the crawler crane to travel fully rigged between turbine sites the roadway will need to be 12 m to 14 m wide designed to the required geometric specifications and with a pavement structure designed to support the crane tracks width and bearing pressure. To enable the assembled crawler crane to move around the site and around the base of the turbine, the gradient and crossfall can not exceed one degree or (1.7%). Where the proposed roads do not follow the contours, there will be gradients steeper than 1.7%, and cut and fill may be required (all borrow material required for the construction activities will be sourced from commercial sources and will not require the opening of borrow pits within the area). If the crawler crane cannot "walk" between turbine locations, it will need to be broken down and re-established at each location. Where the gradients are too steep to walk the crane fully rigged, the crane will need to be partially dismantled, booms removed and the superstructure can move to another location.

The worst case scenario is, therefore, a 14 m wide temporary roadway, with 6 m of this roadway permanently compacted and paved after the end of the construction period (to minimise maintenance requirements and erosion potential).

Approximately 35 km of internal roadway is required to adequately access site. Assuming that 6 m wide access roads will be constructed on the site, an area of permanent disturbance/alteration of approximately 210 000 m^2 (or 21 ha) in extent (excluding the already compacted and disturbed portion of the Skaapvlei road which bisects the site) will result. This is approximately 0.5% of the total 3 700 ha site. The additional track required for the crawler crane (at an average width of 14 m, i.e. 8 m additional to the 6 m permanent roadway) will be an area of temporary disturbance/alteration totalling approximately 280 000 m^2 (or 28 ha). This is approximately 0.75% of the total 3 700 ha site. On completion of the construction phase, this area can be rehabilitated (appropriate rehabilitation measures are detailed in the EMP included in Appendix S).

5.1.4. Undertake Site Preparation

Site preparation activities will include the establishment of internal access roads (as discussed in 5.1.3 above), clearance of vegetation and topsoil at the footprint of each turbine, establishment of laydown areas (refer to 5.1.5 below) and excavations for foundations (refer to 5.1.6 below). These activities will require the stripping of topsoil, which will need to be stockpiled, backfilled and/or spread on site. Figure 5.3 illustrates these areas.

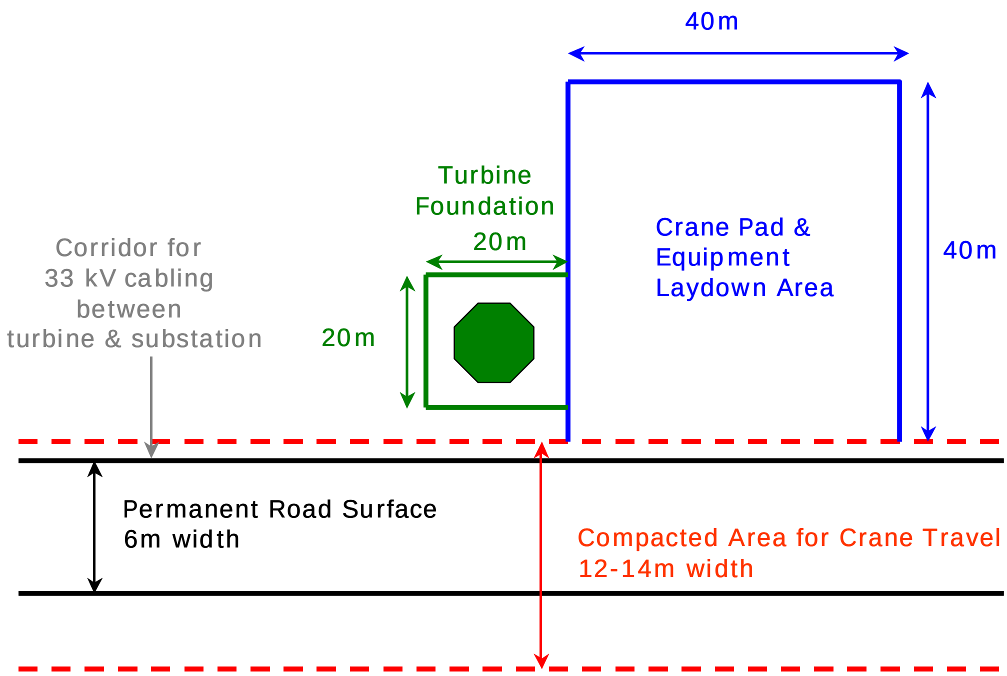


Figure 5.3: Diagrammatic representation of the proposed layout of the components

Site preparation will be undertaken in a systematic manner to reduce the risk of open ground to erosion. In addition, site preparation will include search and rescue of floral species of concern (where required), as well as identification and excavation of any sites of cultural/heritage value (where required).

5.1.5. Establishment of Lay Down Areas on Site

Lay down areas (40 m by 40 m in extent) will need to be established at each turbine position to accommodate the cranes required in tower/turbine assembly. In addition, this area will be used for the storage of the wind turbine components prior to turbine erection. Assuming that 40 m x 40 m laydown areas are required at each of the 100 turbine positions, an area of temporary disturbance/alteration of approximately 160 000 m^2 (or 16 ha) in extent will result. On completion of the construction phase, this area would be rehabilitated (appropriate rehabilitation measures are detailed in the EMP included in Appendix S).

Additional small lay down and storage areas will be required to be established for the normal civil engineering construction equipment which will be required on site.

Figure 5.4: Photograph illustrating the laydown areas required during the erection of one of the turbines at the Klipheuwel demonstration facility (photo courtesy of Eskom)

A large temporary lay down area (approximately 20 m wide x 150 m long) will be required where the main lifting crawler crane will be erected and/or disassembled. This area would be required to be compacted and levelled to accommodate the assembly crane, which would need to access the crawler crane from all sides. This area could potentially make use of part of an access road to avoid additional ground disturbance.

5.1.6. Construct Foundation

Concrete foundations will be constructed at each turbine location. Foundation holes will be mechanically excavated to a depth of approximately 2 m. Concrete will be batched at an appropriate location off-site and brought to site as ready-mix when required via cement trucks. The reinforced concrete foundation of approximately 15 m x 15 m x 2 m will be poured and support a mounting ring. Therefore, for the 100 turbines, a total of 11 000 m^3 of cement is required. If it assumed that each ready-mix cement truck can carry 5,5 m^3, an approximate 20 trucks will be required per turbine foundation. It is estimated that approximately 2 570 ready-mix loads would be required for the total facility, i.e. including the cement required for the substation and visitors centre.

The foundations will be left up to a week to cure. If the geological conditions dictate, the use of alternative foundations will be considered (e.g. reinforced piles).

Figure 5.5: Photograph illustrating the construction of the foundation of one of the turbines at the Klipheuwel demonstration facility (photo courtesy of Eskom)

It is estimated that a footprint of 20 m x 20 m will be permanently disturbed/altered at each turbine position. Therefore an area of permanent disturbance/alteration of approximately 40 000 m^2 (or 4 ha) in extent will result for the 100 turbine positions. This is approximately 0.1% of the total 3 700 ha site)

5.1.7. Transport of Components and Equipment to Site

The wind turbine, including tower, will be brought to site by the supplier in sections on flatbed trucks. Turbine units which must be transported to site consist of:

» a tower comprised of 4 segments of approximately 20 m in length

» a nacelle weighing up to 80 tons (depending on the specific turbine type)
» three rotor blades (each of approximately 45 m in length).

The equipment will be transported to the site using appropriate National and Provincial routes, and the dedicated access/haul road to the site itself. The individual components are defined as abnormal loads in terms of Road Traffic Act (Act No 29 of 1989)[7] by virtue of the dimensional limitations (abnormal length of the 45 m blades) and load/weight limitations (i.e. the nacelle).

Figure 5.6: Photographs illustrating the equipment required for the transportation of turbine components to site (photographs courtesy of Eskom at during the construction of the Klipheuwel demonstration facility)

In addition, components of various specialised construction, lifting equipment and counter weights etc. are required on site (e.g. 200 ton mobile assembly crane and a 750 ton main lift crawler crane) to erect the wind turbines and need to be transported to site.

In addition to the specialised lifting equipment, the normal civil engineering construction equipment will need to be brought to the site for the civil works (e.g. excavators, trucks, graders, compaction equipment, etc.). Once this equipment arrives on site it will remain on the site for the duration of its use.

[7] A permit will be required for the transportation of these loads on public roads.

Cement will be brought to the site as ready-mix in cement trucks. It is estimated that 2 570 cement truck trips will be required over the 2 year construction period to provide cement for use at the turbines, substation and visitor's centre.

The components required for the establishment of the substation (including transformers) as well as the power lines (including towers and cabling) will also be transported to site as required.

The dimensional requirements of the loads to be transported during the construction phase (length/height) may require alterations to the existing Provincial road infrastructure (widening on corners, removal of traffic islands), accommodation of street furniture (electricity, street lighting, traffic signals, telephone lines etc.) and protection of road-related structures (bridges, culverts, portal culverts, retaining walls etc) as a result of abnormal loading. A preliminary assessment of the transportation routes is provided within the transportation study (refer Appendix Q), and will be finalised through the completion of a detailed traffic assessment by the transport contactor appointed for the project.

5.1.8. Erect Turbines

A large lifting crane will be brought on site. It is required in order to lift the turbine sections into place. The nacelle, which contains the gearbox, generator and yawing mechanism, is required to be lifted and placed onto the top of the assembled tower. The next step will be to assemble or partially assemble the rotor (i.e. the blades of the turbine) on the ground. The blades will then be lifted up to a height of 80 m to the nacelle and bolted in place. A small crane will likely be needed for the assembly of the rotor while a large crane will be needed to lift it into place. It will take approximately 2 days to erect the turbine, although this will depend on the climatic conditions as a relatively wind-free day will be required for the installation of the rotor.

The wind turbine which will be utilised at the wind energy facility is likely to consist of a tower of approximately 78 m in height, a nacelle with hub height at approximately 80 m, and a rotor approximately 90 m in diameter.

The lifting cranes will be required to move between the turbine sites. The crawler crane is self-powered and can "crawl" between locations should the ground conditions allow. When assembled, the crawler crane has a track width of approximately 11 m, and would require a track of up to 14 m in width to move on.

Figure 5.7: Photograph illustrating the assembly of a turbine tower utilising a large lifting crane (photographs courtesy of Eskom taken during the construction of the Klipheuwel demonstration facility)

Figure 5.8: Photograph illustrating the assembly of a turbine (nacelle and blades) utilising a large lifting crane (photographs courtesy of Eskom from construction at the Klipheuwel demonstration facility)

5.1.9. Construct Substation

A substation will be constructed within the site. The turbines will be connected to the substation via underground 33 kV cabling (refer to 5.1.10 below). The position of the substation has been informed by the final micro-siting/positioning of the wind turbines. The optimum position for the construction of the substation is in a position central to the turbine field. This is key from a technical/system integration perspective as it is required to limit the longest cable length between the turbines and the substation so as to limit power losses. The substation will be constructed within a high-voltage (HV) yard footprint of up to 80 m x 80 m. This footprint of 6 400 m^2 will be permanently disturbed/altered. Associated laydown areas will be small and rehabilitated post-construction.

The substation will be a Gas Insulated Substation (known as a GIS substation). This technology is proven worldwide to be ideal for use in coastal and/or dusty environments.

The proposed substation would be constructed in the following simplified sequence:

Step 1: Survey of the site
Step 2: Site clearing and levelling and construction of access road to substation site
Step 3: Construction of terrace and substation foundation
Step 4: Assembly, erection and installation of equipment (including transformers)
Step 5: Connection of conductors to equipment
Step 6: Rehabilitation of any disturbed areas and protection of erosion sensitive areas.

5.1.10. Connection of Wind Turbines to the Substation

Each wind turbine will be connected to an optimally positioned substation by underground electrical cables (33 kV). The installation of these cables will require the excavation of trenches, approximately 1 m in depth within which these cables can then be laid. It will be a single disturbance of the ground followed by backfill and reinstatement. The underground cables will be laid alongside the internal access roads as far as possible in order to minimise linear disturbance on the site.

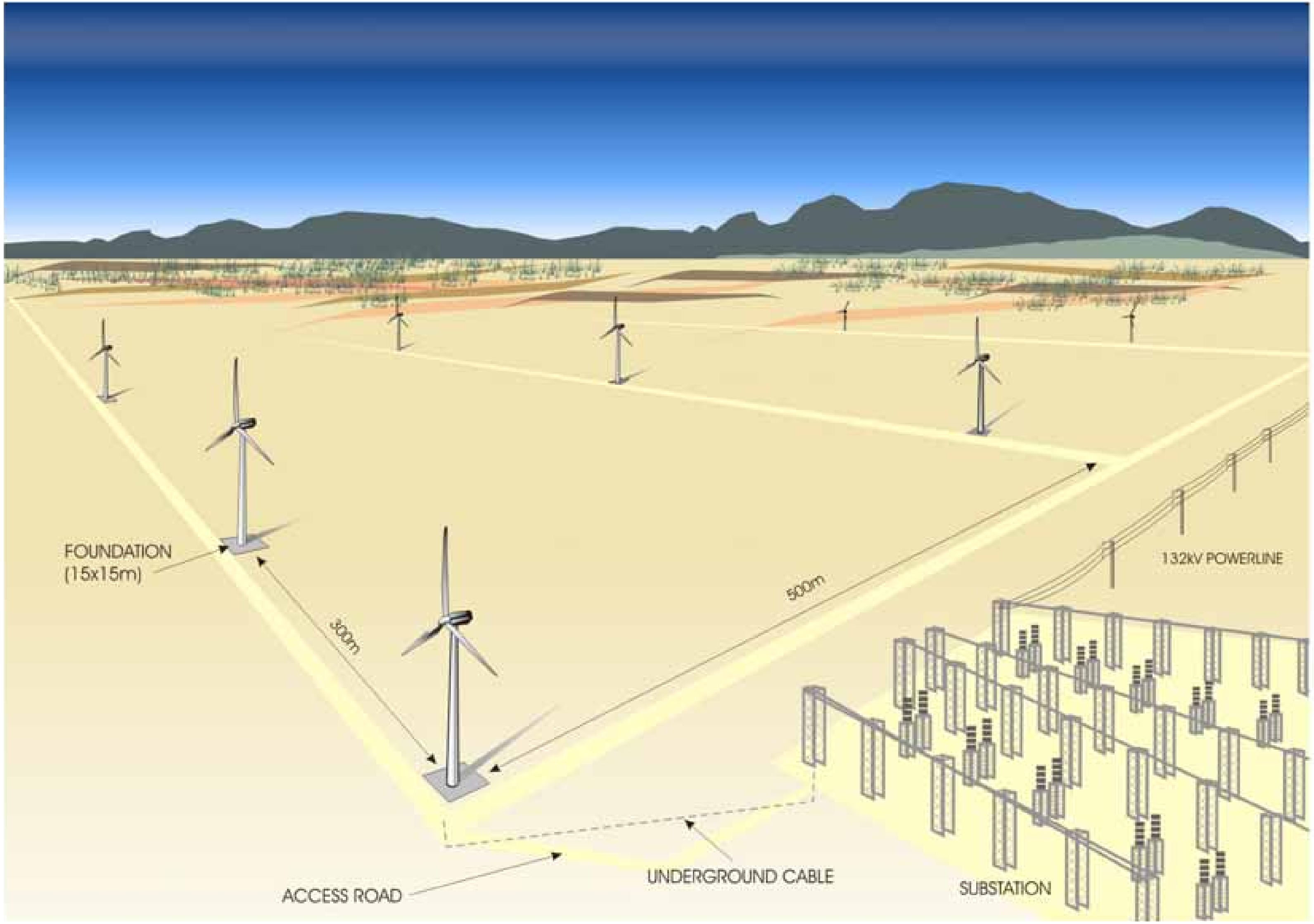


Figure 5.9: Artists impression of a portion of a wind energy facility, illustrating the various components and associated infrastructure

5.1.11. Connect Substation to power grid – construction of a power line

An overhead 132 kV power line will connect the substation at the wind energy facility site to the electricity distribution network/grid at the Juno Transmission Substation (outside Vredendal). The connection point to the Eskom power grid has been confirmed through a network planning exercise. Alternative routes for the construction of the power line are assessed through this EIA. A preferred route will be surveyed, pegged, and then ground-truthed by vegetation, heritage and avifauna specialists (i.e. conduct walk-through surveys to confirm the alignment in terms of environmental sensitivities) prior to construction. The power line servitude will follow other existing linear infrastructure (including roads and or other power lines) as closely as possible to consolidate linear infrastructure in the area, and to minimise the need for additional points of access.

The power line will be constructed utilising a monopole structure/tower with stand-off insulators and will be approximately 25 m in height. The power line will be a double circuit power line (i.e. two 132 kV circuits carried by a single tower structure), and will require a servitude of approximately 32 m in width. Examples of the tower type proposed for use are illustrated in Figure 5.10 below.

Figure 5.10: Examples of the proposed 132 kV monopole double circuit power line tower type.

5.1.12. Commissioning

Due to the nature of the plant and the process of construction, it is proposed that the facility be constructed and commissioned in two phases. The first phase of the wind energy facility is proposed to comprise approximately 50 turbines (that is, approximately fifty 2 MW to 2,5 MW industry standard turbines with a generating capacity of approximately 100 MW). The remainder of the turbines would be built and commissioned in a subsequent phase.

Prior to the start up of a wind turbine, a series of checks and tests will be carried out. This will include both static and dynamic tests to make sure the turbine is working within appropriate limits. Grid interconnection and unit synchronisation will be undertaken to confirm the turbine and unit performance. Physical adjustments may be needed such as changing the pitch of the blades. The schedule for this activity will be subject to site and weather conditions.

5.1.13. Establishment of Ancillary Infrastructure

An office and workshop structure and visitors centre will be constructed at the entrance to the wind energy facility. These structures within the visitors centre complex would occupy a footprint of approximately 400 m^2 under roof, with additional areas for parking for visitors and Eskom employees. An area of approximately 1000 m^2 will be permanently disturbed/altered. The establishment of these buildings will require the clearing of vegetation and levelling of the development site and the excavation of foundations prior to construction. A small lay down area for building materials and equipment associated with these buildings will also be required.

A normal fence would be erected for access control purposes. The substation will be fenced off and have limited access only for safety and security reasons. Each turbine is secure, and would not require any fencing around a single turbine unit.

5.1.14. Undertake Site Remediation

As construction is completed in an area, and as all construction equipment is removed from the site, the site will be rehabilitated where practical and reasonable. On full commissioning of the facility, any access points to the site which are not required during the operation phase will be closed and prepared for rehabilitation. Due to the mobility of the sandy soils, and as rehabilitation and recovery of vegetation on the site will be slow, rehabilitation activities will (as far as possible) be carried out at each turbine location once construction of that particular turbine is completed. Appropriate rehabilitation measures are detailed in the Environmental Management Plan included in Appendix S.

5.2. Project Operation Phase

Once operational, the wind energy facility will be monitored remotely. It is estimated that the operational phase of the project will provide employment for approximately 6 skilled staff members, who will be responsible for monitoring and maintenance when required. No permanent staff will be required on-site for any extended period of time.

Each turbine within the wind energy facility will be operational except under circumstances of mechanical breakdown, extreme weather conditions or maintenance activities. The following operation/maintenance activities have been considered as forming part of the project scope of the Wind Energy Facility on the West Coast.

» The wind turbine will be subject to periodic maintenance and inspection.
» Periodic oil/grease/lubrication changes will be required.
» Any waste products (e.g. oil) will be disposed of in accordance with relevant waste management legislation.

5.3. Decommissioning

The turbine infrastructure which will be utilised for the proposed wind energy facility on the West Coast is expected to have a lifespan of 20 to 30 years (with maintenance). Equipment associated with this facility would only be decommissioned once it has reached the end of its economic life. It is most likely that decommissioning activities of the infrastructure of the facility discussed in this EIA would comprise the disassembly and replacement of the turbines with more appropriate technology/infrastructure available at that time.

The following decommissioning activities have been considered to form part of the project scope of the Wind Energy Facility on the West Coast.

5.3.1. Site Preparation

Site preparation activities will include confirming the integrity of the access to the site to accommodate required abnormal load equipment and lifting cranes, preparation of the site (e.g. lay down areas, construction platform) and the mobilisation of construction equipment.

5.3.2. Disassemble and Replace Existing Turbine

A large crane will be brought on site. It will be used to disassemble the turbine and tower sections. These components will be reused, recycled or disposed of in accordance with regulatory requirements. All parts of the turbine would be considered reusable or recyclable except for the blades.