Department of Mineral and Energy

Capacity Building in Energy Efficiency and Renewable Energy

Baseline Study on Wind Energy in South Africa

Final Report

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1 Introduction

This draft report "Baseline Study on Wind Energy in South Africa" has been initiated as part of the project "Capacity Building in DME in Energy Efficiency (EE) and Renewable Energy (RE)" currently being conducted by the South African Department of Minerals and Energy (DME) and Danced - Danish Cooperation for Environment and Development.

The present document is prepared by the Oelsner Group (OG) and Tripod Wind Energy ApS (TWE) for DME/Cowi and reports the results of "Assignment II, Baseline Study on Wind Energy in South Africa" as described in the Terms of Reference (ToR) as attached to this report (annex 1).

The overall objective of the project is to establish a more sustainable energy sector in South Africa, through an increased use of renewable energy and greater energy efficiency on the demand side.

The overall objective of this study is to identify and describe the present utilisation of different wind energy technologies in South Africa, to give an overview of industrial, agricultural and R&D activities related to the utilisation of wind energy in South Africa and the background for assessing the impacts of the wind energy sector on the social and economic development.

Due to the limited amount of resources allocated the assignment is primarily a desk study, which is based on existing information in reports, statistics etc. and supplemented by information from relevant companies, organisations and persons involved in the wind energy sector (listed in annex 5).

The report includes data base questionnaire forms and tables (annex 2) which can be easily and regularly updated for future changes within the wind energy sector in South Africa.

It should be noted that according to the agreed proposal, some institutional support was expected to facilitate the solving of the tasks. Unfortunately, this support has been limited and initiated at a very late stage, which has made it very difficult to obtain available information within the requested time. This version of the report is a draft, and the final report may include additional information.

The opinions expressed in this report do not represent the official view of neither Danced nor the South African authorities.

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2 Conclusion

During this Baseline Study a large quantity of information regarding the exploitation of wind energy in South Africa has been gathered from various sources, for instance the Department of Water Affairs and Forestry, the Water Research Institute, and manufactures of small wind turbines. The gathered information has been analysed in order to establish an overview of the present utilisation of wind energy in South Africa.

According to ToR the following issues have been included in the Baseline Study:

- Wind energy systems
- Market situation
- R&D activities

Wind energy systems

It has been found that the utilisation of wind energy in South Africa can be divided into four major areas: grid connected, rural min-grid, off-grid, and bore-hole windmills. Based on general technical information about the nominal capacity and by estimating a capacity factor is has been assessed that the actual annual energy production for these areas is given by:

- National Grid: 5 000 MWh
- Rural Mini-Grid: 111 MWh
- Off-Grid: 1 117 MWh
- Bore-hole Windmills: 26 000 MWh

It can be seen that the major utilisation is bore-hole windmills, which consist of more than 20 000 in use all over the country.

Market situation

There is a small emerging market for green electricity, and the market for the farm windmills is well established and spread over the whole country. The market situation for bulk wind energy electricity is very uncertain due to the unclarified situation regarding the regulatory framework.

R&D activities

Several new wind power projects – grid connected as well as mini-grid – are in the planning stage. Most of these projects include R&D activities as a major component. The major project is the grid-connected Darling National Demonstration wind farm with an expected annual production of 13 000 MWh.

2.1 Recommendations

Due to the very limited time made available for this Baseline Study it has not been possible to gather all relevant information and investigate all aspects regarding wind energy in South Africa. Therefore, it is recommended to extend this Baseline Study in order to obtain additional information on the new wind energy projects, to assess to which extent the utilisation has increased access to energy, to assess to which extent the wind energy has contributed to the stimulation of the economic development, and to investigate the general market situation more thoroughly.

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3 Methodology

In accordance with the scope of work and methodology as described in the TOR, the following activities have been undertaken:

1. Collection and processing of available statistical and other information regarding the number and types of wind energy systems at present installed in South Africa, and the distribution of these on socioeconomic sectors, i.e. industry, agriculture, public buildings, and private households. The installed capacity (water pumping or nominal electric power capacity, as defined in the TOR) will be included for all types and sectors.

2. Estimates on the total installed capacity of each type and the geographic distribution on provinces.

3. Estimates on the total annual energy production (as defined in the TOR) of wind energy systems in South Africa, for various types of systems and the distribution on sectors.

4. Description of the markets for wind energy systems in South Africa, the prices and sales volumes of the various systems, and the most likely applications of these systems.

5. Relevant regulations and standards for the installation of wind energy systems in South Africa are identified.

6. A description of the involvement of the industry in the South African wind energy sector, i.e. the number and size of manufacturers, suppliers, and O&M companies, and their levels of skills.

7. Identification and description of the commercial and R&D activities in South Africa, and a description of the involved public and private actors. The current stage of the projects and activities is included in the description.

The collection of data started with a review of existing public and organisations' studies, records, statistics, and research reports in the field of wind energy exploration in South Africa. Finally information on public regulation schemes was gathered and analysed as to the applicability for the various wind energy systems.

An appropriate database format is prepared for the data collected and processed in the above points no.1-3. All references to sources of information will be described and appear transparently. The database sheets are intended for future updates. In the database sheet the relevant presentations (figures and tables etc.) are elaborated, for use in the this report.

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4 Wind Energy Projects

The following sub clauses is a description of the implemented wind energy projects in South Africa as well as planned, committed and projects under implementation

4.1 Grid-connected Systems

4.1.1 ESKOM Klipheuwel Wind Turbine Test Facility

SABREGen (South African Bulk Renewable Energy Generation) project was initiated by Eskom in 1998. In this they proposed exploring renewable energy as an alternative generation option. The wind component of the project focuses on the feasibility of establishing a wind farm in South Africa. "The [initial] size of wind farm will depend greatly on the results of the pre-feasibility study where the size, application, location and appropriateness of the wind farm will be addressed."

This has culminated in a decision to establish an approximately 10 MW demonstration facility to be situated in the Western Cape and probably be located somewhere between Langebaan and Springbok, a region identified by Eskom as South Africa's richest in terms of wind.

The objective of this pilot plant has been stated to be to "investigate the sustainability of wind energy in an African environment and then determine scales of implementation based on information gathered".

Techno-economically an essential part of this costly experiment will have to be attempting to quantify the benefits of situating the generation facility in the local or distribution network (11 kV) or in the quantification of the distributed generation benefits of the demonstration wind farm.

Three wind turbines will be installed:

- Vestas 660 kW wind turbine with 40 m hub height
- Vestas 1750 kW wind turbine with 60 m hub height
- Jeumont 750 kW

There is provision for a three year research collaboration on the project.

The progress made at Klipheuwel will be critical considering that South Africa needs to quickly find ways to meet its demand for electricity, which is predicted to oustrip supply between 2005 and 2007. Eskom is already using 31 000 MW of its 40 000 MW installed acapacity, supplied mostly by coal fired power stations.

Estimated annual electricity generation: 5.1 GWh with average wind speed of 7 m/s (40 / 60m hub height) at a capacity factor of 20 %

Project Status: Vestas 660 installed and operating

Vestas 1750 installed still to be commissioned

4.1.2 Darling National Demonstration Wind Farm

Darling Independent Power Producer (Pty) Ltd. was incorporated in November 1997 by Hermann Oelsner and Raimund Ruethlein. Current stakeholders and directors are H. Oelsner, A. Oelsner, R. Ruethlein, Lulamile Xate and Arthur Shipalana . Co-ordinator and Managing Director is H. Oelsner.

Darling IPP was formed as a Proprietary Limited Company in order to accommodate shareholding by private individuals, companies, organisations and institutions in a wind energy electricity generator. It has already invested substantially in Research, Development and Planning in bringing the wind farm project through the stage of implementation.

The South African Government has recognized the importance of the use of Renewable Energy in the White Paper of Energy and has declared the Darling Demo Project as a National Demonstration Project which will be used as case study to formulate future energy policy.

For the the first phase of 4 x 1,3 MW AN BONUS wind turbines a new operating company has been formed with shareholders CEF (Central Energy Fund), IDC (Industrial Development Corporation) and Darling Independent Power Producer.

The main objective of this project is to establish the first wind farm in South Africa for the purpose of demonstrating the generation of electricity from wind energy and evaluating it's potential in South Africa. The project will cover all aspects of planning, design, construction, operation and maintenance of the wind farm.

Estimated annual electricity generation: 13 GWh with average wind speed of 7.5 m/s (50 m hub height) at a capacity factor of 30 %:

Project Status: Finance secured. Implementation expected to start Feb/Mar 2003

4.1.3 Military Radio Station - Farm Langefontein

The World Bank is presently financing the dismantling of military bases in South Africa as a demonstration of the transition from a situation of conflict to one of peace. Darling Sustainable Energy and Employment Scheme (Darling SEES) through the Oelsner Group have submitted a sketch proposal for peaceful use of this military base. The existing military radio station near Darling is situated on the farm Langefontein which is 2 300 hectares in extent. This base can potentially be utilised for large scale renewable energy applications including research and development as well as implementation.

The Darling SEES proposal envisages an estimated total electricity generating capacity of 200 MW derived from the following installations:

- A cluster of 50 x 2,3 MW modern wind turbines could be erected on the gentle slopes without being visible from the nature conservation area.
- Large flat areas could be used for installing solar thermal collectors, sterling engines, photo-voltaic electricity generation etc.
- The above renewable energy resources could be tested and demonstrated as hybrid systems combined with the existing diesel generators for off-grid and mini-grid test installations. Such installations could be used in rural areas where there is no electricity grid.
- An International field testing facility for large, medium and small wind turbines as well as for solar-thermal and photo-voltaic energy generation.
- A sophisticated research facility and laboratories for Renewable Energy Resources.

Estimated annual electricity generation: 300 GWh, with average wind speed of 7.5 m/s (60 m hub height) at a capacity factor of 30 %:

Project Status: Pre-feasibility study / Assessing wind potential

4.1.4 CSIR Steenbras pilot Wind Farm

The parastatal CSIR (formerly the Council for Scientific and Industrial Research) has recognised two major potential market sectors for wind energy: the grid connected market and the off-grid market.In the grid connected market they are undertaking to establish a potential wind farm in the Cape Town Metropolitan area.

This project envisaged a pilot type wind facility near the Steenbras dam in the Western Cape, with possible incorporation into the existing 180 MW pumped storage facility situated there. Although this project has not yet seen the installation of any wind based generation facilities, it has had the positive effect of creating an awareness within the Western Cape local government structures of the potential for wind based electricity generation.

Estimated annual electricity generation: unknown

Project Status: Unknown

4.1.5 Jeffreys Bay Wind Farm/Pumped Storage Project

The proponent of the project is ENERGY SYSTEMS CC.

H.A. Van der Linde is the only member of the Closed Corporation. The Kouga project has as an objective the installation of a 7 MW wind farm coupled with 5,25 MW pumped storage capacity. The project team includes Eskom Eastern Cape Regional Office, Vestas the Danish wind turbine manufacturer and the World Bank.

Estimated annual electricity generation: unknown

Project Status: Unknown

4.2 Rural Mini-Grid

4.2.1 Lubisi Dam Community Project

Two imported Proven Engineering 2,2 kW wind turbines together with photovoltaic panels are currently generating electricity for lighting, computers, telecommunication and small scale production facilities.

Estimated annual electricity generation: unknown

Project Status: Unknown

4.2.2 Hluleka Nature Reserve

The project is located in the Hluleka Nature Reserve near Port St Johns. 2 x 2,5 kW imported Proven Engineering Wind chargers in hybrid formation with 5 kW PV and stand-by diesel generator supplying electricity to a lodge with 12 bungalows, an administration building and water supply pumping.

Estimated annual electricity generation: unknown

Project Status: Unknown

4.2.3 Lucingweni Community Centre

The project is located in Lucingweni. 6 x 6,0 kW imported Proven Engineering Wind chargers in hybrid formation with 50 kW PV and supplying electricity to the Community Centre.

Estimated annual electricity generation: 79 MWh

Project Status: Unknown

4.2.4 SANAE IV Base in Antarctica

This project has been initiated the University of Stellenbosch, Department of Mechanical Engineering. The cost of powering Antarctic research stations by conventional diesel electric generator systems is high. In order to reduce these costs and airborne pollution due to the combustion of fossil fuels, an investigation into renewable energy sources has been conducted, with the focus on wind turbine energy generation. The aim has been to see whether a wind turbine is feasible, both

technically and economically, for partial energy production at the SANAE IV base. The existing diesel electrical generators will still be used for the base demand, when there is not enough wind or when the energy demand is more than can be produced by the wind turbine.

With the aid of the data from the 6m-wind mast, wind profiles have been established, from which Weibull distributions have been obtained, and the energy output from 5 different wind turbines, in the range between 10kW and 100kW, have been calculated. The annual energy production of the 100kW wind turbine is 430MWh with a capacity factor of 49%. The annual energy demand of the base amounts to 1153 MWh, thus the wind turbine could contribute up to 30% of the power needed at the base, taking losses into account.

Estimated annual electricity generation: 430 MWh

Project Status: Feasibility study completed

4.2.5 Darling Wind farm Visitor, Training and Education Centre

The new Visitor's Centre proposed for the forthcoming Darling Wind Farm will showcase the benefits of wind and other renewable energy sources. The building is to be carefully designed to use local building materials and techniques, so as to belong and blend into the surrounding landscape. As a low energy building it will also collect and generate all of its own water and power whilst treating its own waste for re-use. This sustainable development will clearly meet the ambitions of the Cape West Coast Biosphere, in which it is set, and support the government's renewable energy policy and targets as set out in the recent white paper. These will demonstrate different ways of making sustainable energy for all aspects of human settlement, which is particularly relevant for remote and rural communities.

The Centre will, in addition, fulfil an important role in training and education. There will be facilities for training people in the techniques of wind harvesting and will provide a venue for lectures and conferences to promote wind energy.

Electricity is largely supplied from the demonstration wind turbine". Any shortfall will be supplied from the 11 kW line running parallel to the track to Windhoek Farm. The wind turbine will be an imported Fuhrlaender FL100, with a nominal capacity of 100 kV and a hub height of 30 m.

The installation is intended to demonstrate the following:

- Mini-grid system to supply electricity to Visitor Centre and Visitor's Village.

- Hybrid constellation with Diesel/PV.

- Wind electricity generation with surplus stored in batteries

- Wind electricity generation with surplus fed into 11 kW farm grid feeder.

- Wind electricity generation with surplus used for desalination/brack water treatment

- Wind electricity generation with surplus used for hydrogen production

Estimated annual electricity generation: 263 MWh

Project Status: Feasibility Study

4.3 Off-grid Systems

4.3.1 Electric Power Generation by

4.3.1.1 Kestrel Wind Charger

The Kestrel Wind Charger is locally designed and manufactured in South Africa by

COVE PRODUCTS (PTY) LTD in Kruegersdorp.

The wind turbine generator has a nominal capacity of 600W and a 1 500 W unit is presently being developed.

Approx. 200 units have been sold in the past years, mainly for electricity generating applications with battery storage systems. 10 % of total sales are for water pumping applications.

The company is presently engaged in R&D with the Potchefstroom University to improve the design and performance of its products.

4.3.1.2 World Power Whisper Wind Charger

The Whisper Wind Charger is imported from World Power in the USA .

There are two models one with 1000 W output and the other with 3000 W output capacity.

The local representative was Nelson Adams of Cape Town who sold a total of 300 x 1000W units and 40 x 3000 W units in the past years.

The agency has now been taken over by Shell Solar South Africa.

4.3.1.3 Westland Charger

The local designer and manufacturer of the Westland 300 W wind charger is Mr Gary Eigner in Bredarsdorp.

15 units have been sold and installed in the past mainly in the Western Cape and , mainly for electricity generating applications with battery storage systems.

Mr Eigner is presently seeking a local manufacturing company to produce his units.

4.3.1.4 Marlec Rutland Wind Charger

The Rutland Wind Charger series is manufactured in the UK and mainly used for marine applications and water pumping. Previous sales volumes in South Africa are not known.

4.3.2 Mechanical Power Generation

A National Groundwater record base exists with the Department of Water Affairs. From 226 000 records 22 314 have been extracted as being equipped with windmills.This information is in strong disagreement with figures often quoted in the past and based on a paper authored by R Viljoen of the National Energy Council (1991), "THE DIFFUSION OF WIND ENERGY TECHNOLOGY IN SOUTHERN AFRICA". His estimate, that there are 300 000 windmills installed in South Africa, Namibia, Botswana and Zimbabwe, was based on personal communication with Southern Cross Windmill & Engine Co. R Viljoen's assessment "That total energy delivered by these windmills is only in the order of 50 to 75 MWh per annum" might be a printing error and should rather read GWh per annum.

There are presently two locally active suppliers namely:

- Climax from Southern Cross Industries (PTY) LTD. In Bloemfontein
- Turbex in Harrismith

Based on the assumption that the American type design of windmills used for bore hole water pumping has an average of 1000 W capacity and countrywide an average capacity factor of 25%, the estimated annual energy production amounts to 49 GWh.

Out of the 22 314 windmills, 12 071 are in use mainly for water pumping (see figure below) corresponding to a capacity of 12 000 kW an estimated annual energy production of 26 000 MWh.

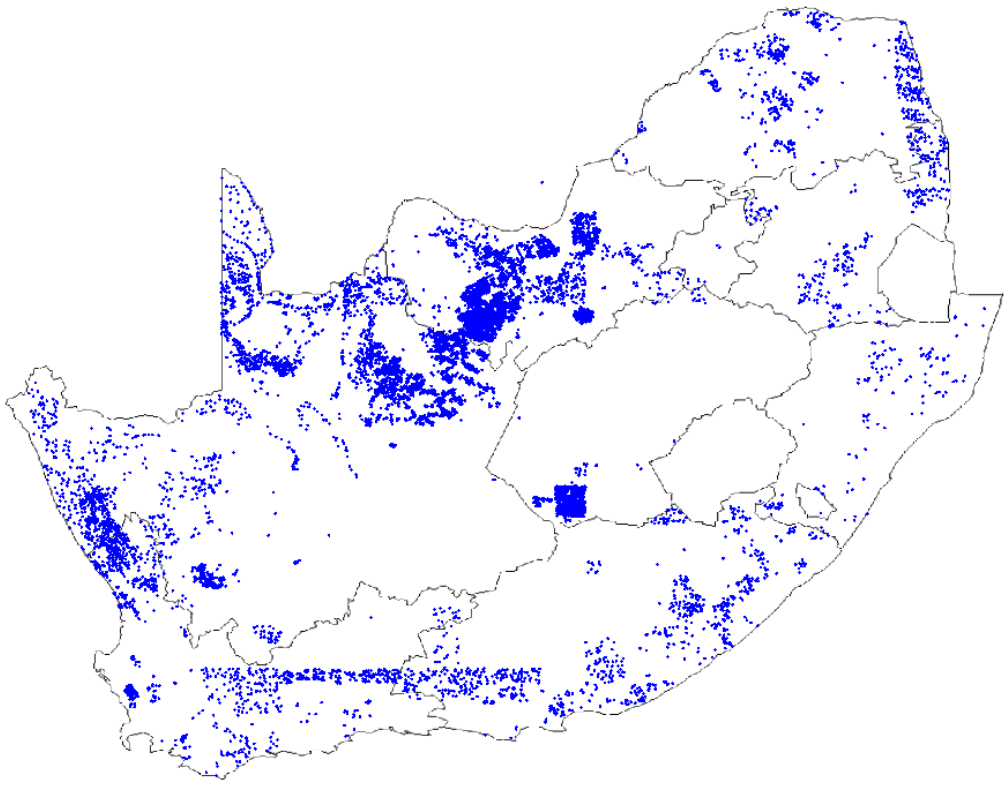

Figure 1 Windmills in use for water pumping in South Africa

4.4 Other Systems

4.4.1 Desalination/Water Purification Applications

No application known

4.4.2 Production of Hydrogen

No application known

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5 Cost per kW installed wind energy

It was not possible to obtain costs for varies installed projects except for the Darling Wind farm (ZAR 1 400/kW) and Kestrel Wind Chargers (ZAR 13 000/kW).

However, in general it is accepted:

- That the cost of Megawatt class, grid connected wind turbines is an average of US$ 1000/kW. Cost per kW various considerably with number of turbines, exchange rates and financing cost, location in relation to grid and transport and rigging requirements. In the case of Darling Windfarm this cost is even higher due to the high cost of barrier removal before implementation. The cost of the Eskom Klipheuvel project is not representative since it is a research project and consists of single different turbines preventing cost optimisation. A project like Langefontein with a size in excess of 100 MW is likely to have considerable cost reductions, which can only be assessed after completion of feasibility study.
- That the cost of small wind chargers depends on the individual application in regard to cost for different size water pumps or battery storage. Investigating the range of 200 W to 2500 W generators the cost per kW installed ranges between ZAR 20 000.- to R 30 000.- for imported equipment and ZAR 15 000.- for locally manufactured wind generators.
- That the cost for mechanical geared water pumping wind mills is estimated to be between ZAR 33 000/kW and ZAR 42 000/kW, depending on specific application conditions.

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6 Energy production by wind turbines

The total estimated capacity and estimated annual energy produced by wind turbines is shown in the table in annex 3 - inclusive projects which are planned, committed and under implementation only. The status of each of the projects is shown in paragraph 4.

The implemented capacity and corresponding estimated annual energy production can be summarized as follows:

Type	Capacity	Estimated Annual Production
National Grid:	3 160 kW	5 000 MWh
Rural Mini-Grid:	45 kW	111 MWh
Off-Grid:	510 kW	1 117 MWh
Bore-hole Windmills:	12 000 kW	26 000 MWh
Exploited Wind Energy in SA:	16 000 kW	32 000 MWh

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7 Market situation

The primary market for wind energy applications in South Africa can clearly be divided into three sections, grid connected, rural mini-grid and off-grid systems.

7.1 Grid-connected System

The South African Government has recognized the importance of the use of Renewable Energy. The deregulation of the electricity industry opens the way for introducing renewable energy sources into the country's energy mix.

Wind energy is arguably world-wide the most economic renewable energy technology for bulk electricity generation.

An abundance of wind resources, combined with the availability of land and the excellent infrastructure in South Africa, have the potential for one of the most competitive economic conditions for bulk electricity generation from wind in the world.

South Africa is presently in the phase of demonstrating the technology with the Eskom Klipheuwel and Darling National Demonstration projects.

There is a small emerging market for green electricity which will, however, not be large enough to stimulate the creation of a local industry for manufacturing and exporting wind turbines and accessories.

7.2 Rural Mini-grid Systems

An unacceptable large section of the South African population is without electricity mainly in rural areas. This is one of the main development concerns of the Government.

The Department of Mineral and Energy has initiated a number of projects where specific companies are given concessions in designated rural areas to supply and maintain home solar systems for rural dwellings , where it becomes too expensive to provide electricity.

Although the capital costs of these systems (solar panel, regulator/charger, batteries and lights) are heavily subsidised by the government and external donors, the systems still have to be installed, managed and maintained, and the batteries replaced approximately every three years.

But with a capacity of 220 Wh per day under best solar conditions, the home solar system systems provide only 6 kWh power in form of low voltage DC power for about three high efficiency fluorescent lamps, a portable radio, a black and white TV set, and perhaps a cell phone charger.

Unfortunately the system cannot power any other domestic appliances such as irons, kettles, refrigerators, heaters and hotplates, let alone productive equipment such as sewing machines, pumps, welding machines etc.

The customer pays R 60.- per month which results in a cost of R 10 per kWh , being at least 20 times higher than that paid by grid-connected pre-payment electricity customers.

Since the systems are not owned by the customers there is in addition a high incidence of panel theft and damage to systems.

The obvious failure of a number of SHS electrification projects opened the way to assess the potential

of using wind electricity generation in hybrid (diesel/PV) mini-grid installations for rural community centres.

This approach looks very promising mainly because of the fact, that:

- A large number of poor and rural households are in coastal areas which are generally blessed with a high wind resource.
- capital cost for wind generators is much lower than for PV
- higher generating capacity will be installed from 2,5 kW to 100 kW, resulting in lower O&M costs compared with SHS
- higher generating capacity and storage with back-up allows to introduce commercial, economic activities.
- higher generating capacity allows for provision of basic and health services.
- Technical solutions for generators and complete systems are readily available from several countries
- South African rural market has a tremendous potential for the emerging supply of retrofit wind turbines in the range of 30 kW to 250 kW from developed countries.

The Department of Minerals and Energy has subsequently initiated a Rural Wind Hybrid development and demonstration programme together with the NER, CSIR and Shell Solar SA.

7.3 Off-grid Systems

7.3.1 Mechanical Power Generation

The mechanically generating "American design" farm windmill is well established and distributed over the whole country. Marketing, sales, operation and maintenance organisations are well established and functioning.

7.3.2 Electrical Power Generation

There are encouraging recent developments regarding the wind powered generation of electricity in rural areas for electric water pumps, provision for lighting, telecommunication, security etc.

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8 R&D activities

As South Africa is presently in an incipient phase regarding the possibilities for the exploitation of the wind energy on a large scale, most of the present wind energy projects include R&D activities as a major component.

The following wind energy projects include R&D activities:

- Eskom Klipheuvel Wind Turbine Test Centre
- Darling National Demonstration Project
- Darling Visitor, Training and Education Centre
- South African Wind Energy Project
- DME/NER/CSIR/SHELL Wind Hybrid Mini-grid Systems
- Kestrel Wind Charger
- Annex 4 shows a detailed description of the R&D activities included in these projects.

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Annex 1: Terms of Reference

Baseline Study on wind energy in South Africa

Terms of Reference

Title of Assignment Baseline study on wind energy in South Africa	**Approved by Project Manager, DME** 20 March 02.
Candidate	
Counterparts	**Approved by CTA** 19-8-02
Time frame Project duration period: 6 weeks Expected start date: 30 September 2002	**Professional input** Approximately 6 days (**8** hours per day)
Budget Ceiling: DKK 50.000	**Project Number:**

1. Background

The Department of Minerals and Energy (DME), South Africa is responsible for formulating strategies and drafting legislation for the South African energy sector.

As a result of a dialogue between the DME and Danced over the years 1999 to 2001 the Project "Capacity Building in DME in Energy Efficiency (EE) and Renewable Energy (RE)" has been formulated.

The Project aims at enhancing DME´s capacity and performance by assisting in developing programmatic approaches through strategies and actions plans for energy efficiency and renewable energy in transparent co-operation with relevant stakeholders.

The overall objective of the project is to establish a more sustainable energy sector in South Africa. through an increased use of renewable energy and greater energy efficiency on the demand side.

The immediate objectives of the project are: by the end of the project, DME and other relevant public sector bodies are resourced and capacitated to effectively and efficiently implement well publicised and broadly accepted programmes promoting renewable energy in both rural and urban areas and to sustain this resource and capacity.

In order to establish a basis for the formulation of a strategy plan for Renewable Energy in South Africa it is decided to carry out baseline studies on renewable energy in South Africa. This TOR covers a baseline study on wind energy technology.

2. Objective of the baseline study

The objectives of the baseline study are to:

- identify the present utilisation of wind energy technologies in South Africa

- assess to which extent the present utilisation of wind energy has increased access to affordable energy for disadvantaged households, small businesses, farms and community services

- assess to which extent the present utilisation of wind energy has contributed to the stimulation of economic development

- establish an overview of R&D activities and the industrial and agricultural activities related to the utilisation of wind energy in the South Africa.

The results from this baseline study shall together with the results from baseline studies concerning other renewable energy resources and cross cutting issues (energy consumption and financial and legal aspects) form the basis for the formulation of a Renewable Energy Strategy Plan for South Africa.

3. output

The output of this baseline study shall be a report containing the following:

3.1 An overview of the present installed wind energy systems in **SA** with indication of the number of installations, where the systems are installed, the time of installation, the types of systems, their capacity and the energy output. The approximate installation costs for the various systems shall be indicated where available.

3.2 **A** description of the wind energy industry in **SA,** including manufacturers, sub-suppliers and operation and maintenance companies.

3.3 Overview of organisations, institutions and companies working with wind energy technology and a description of their activities including planned, ongoing and completed commercial as well as R&D projects/studies.

4. Scope of Work

The scope of work includes - but is not necessarily limited to:

1. Collect information on the number of different types of wind energy systems presently installed in **SA.** The main data for the systems should be described (hub height, rotor diameter, number of rotor blades, application). The number and types of systems installed in different sectors shall be indicated: industry, agriculture, public buildings and private households. The installed capacity of the various types shall be identified (the definition of "capacity" is described in section 6.2).
2. Estimate the installed capacity in the various provinces as well as the total installed capacity.
3. Estimate the total annual energy production by wind energy systems presently installed in SA. The production shall be estimated for various types of systems and within each sector (the definition of energy production is described in section 6.2).
4. Describe the wind energy market in SA in terms of prices on wind energy systems and number of systems sold per year and the most likely modalities for utilisation ie. mini grids, hybrid systems, water pumping for irrigation or stand-alone etc..
5. Identification of any regulations/standards to be followed in connection with the installation of wind energy systems.

6. Describe the industrial involvement in the wind energy sector, including the number and size of manufacturers, suppliers and Operation and Maintenance companies as well as their skilled background.

7. Identify and describe public/private commercial and R&D activities in the wind energy field in **SA** and describe the actors. It shall appear from the description if the projects/activities are in the planning and preparation phase, approved for implementation, under implementation or completed and reported.

6. Methodology and Time Frames

6.1 Methodology

The baseline study shall be based on information from existing reports, statistics and information obtained from organisations/companies/persons involved in the wind energy sector. It is not envisaged that several field trips are required to prepare the output defined in these TOR. However tenderers may submit alternative tender based on several field trips. Note that alternative tender is only accepted under the condition that a tender conforming to these TOR is also submitted (ref. Instruction to Tenderers, clause 3.7).

The tenderer's methodology for the study shall be presented in the tender. The methodology includes a description of the approach for the collection and presentation of the data. The approach for the baseline study shall be planned in such a way that the present baseline study can be easily updated for future changes within in the wind energy sector in South Africa and the tenderer is requested to formulate a proposal on a procedure to ensure that changes within the sector is reported to DME.

It is the responsibility of the Sub-Consultant to collect the required information necessary to complete the baseline study.

6.2 Definitions

Below are definitions of key parameters for wind turbine capacity and performance. The definitions are given for electricity generating wind turbines and water pumping turbines, respectively.

Capacity - Electricity generating wind turbines: The capacity is defined as the nominal power of the generator. The figure is normally "stamped" on the generator's specification plate. The unit for capacity is Watt.

Capacity - Waterpumping wind turbines: The capacity is defined as the head and the maximum pumping capacity of the turbine. The unit is given by m3/hour.

Annual energy production - Electricity generating wind turbines: The annual energy production is defined as the number of kWh produced (year 2001).

*Annual energy production - Water pumping **wind** turbines:* The annual energy production is defined as the number of m3 water pumped (year 2001).

6.3 Time schedule

The baseline study shall be completed within a period of six weeks from the date of contract signing. The Sub-Consultant shall after three weeks inform on the progress of the study.

The time schedule and the milestones within the baseline study are indicated in the table below.

Milestone	Time after date of Contract signing (approximately)
Contract signing between SP and COWI/Danced	
Presentation of progress by SP	3 weeks
Draft report submitted to DME	5 weeks
Final report	6 weeks

?

Name	**Phone**	**e-mail**
Mr Tony Golding	0123179213	tony@mepta.pwv.gov.za
Mr André Otto	0123179225	andre_o@mepta.pwv.gov.za
Mr Søren Arthur Jensen	012 317 9594	saj@cowi.dk

0027.

The Sub-Consultant is responsible for supply of sufficient resources to complete the baseline study. The persons allocated to the study must have sufficient skill to undertake the activities at a satisfactory level of quality and within the specified time schedule.

The Sub-Consultant may obtain support from DME in connection with identification of relevant contact persons and/or identification of reports etc.

8. Reporting

The Sub-Consultant shall during the study inform DME on any deviations from the agreed activities.

A progress report shall be presented to the PMG approximately four weeks after the date of contract signing. The status report shall contain a presentation of the status of all the activities included in the study and a presentation of the draft results.

The report of the baseline study shall include a description of the applied approach, the sources for the collected data and information as well as a presentation the obtained results. A draft report shall be submitted to the PMG for comments approximately 5 weeks after the date of contract signing.

The format of the report shall be in accordance with the requirements set out in Annex 2. Tables and databases shall be prepared in Excel format. The draft report shall be submitted in four copies and the final report shall be submitted in four copies and in electronic format (via e-mail/on diskette).

An outline of the main headings in the report is:

1. Introduction
2. Conclusion
3. Methodology
4. Systems installed
5. Energy production by wind turbines
6. Market situation
7. R&D activities

A summary containing the key figures obtained as a result of the baseline study shall be included in the Conclusion. An outline of the format of the table for presentation of the key figures is enclosed. The detailed figures shall be included in the respective sections in the report.

The report shall include a list of the references used as basis for the study as well as a list of persons met. Further all background material shall be enclosed the report in e.g. an annex.

ANNEX 2:
Project Database Questionnaire

BASELINE STUDY ON WINDENERGY IN SOUTH AFRICA

Systems connected to National grid

BASELINE STUDY ON WINDENERGY IN SOUTH AFRICA

Projects Database Questionnaire

1. **PROJECT NAME ESKOM Klipheuwel Wind Turbine Test Facility**

2. **PROJECT ID NO. ONGRID 0002**

3. **PROJECT STAGE** :

☐ N/A Conceptual ☐ Scoping ☐ Partnering ☐ Heads of agreement

☐ Pre-feasibility ☐ Feasibility ■ Implementation ☐ Completed

4. **PROJECT STATUS** :

☐ N/A ■ Active ☐ Seeking finance ☐ Suspended ☐ Discontinued ☐ Dormant

5. **PROJECT NATURE** : (please tick the appropriate box)

☐ N/A ■ New ☐ Upgrading ☐ Expansion ☐ Upgrading & Expansion

☐ Diversification ☐ Refinancing ☐ Take over

6. **FINANCE SOURCE**: (please tick the appropriate box)

☐ N/A ☐ Foreign ■ Local ☐ Foreign & Local

7. **FUNDING**: (a) Required total funding **R**
(b) Actual total funding ZA**R 50 Mio plus**

8. **PROJECT PROFILE** :

Overview:

The SABREGen wind generation facility

SABREGen (South African Bulk Renewable Energy Generation) project was initiated by Eskom in 1998. In this they proposed exploring renewable energy as an alternative

generation option (Eskom, 2001). The wind component of the project focuses on the feasibility of establishing a wind farm in South Africa. "The [initial] size of wind farm will depend greatly on the results of the pre-feasibility study where the size, application, location and appropriateness of the wind farm will be addressed." (SAWEA, 1998d). This has culminated in a decision to establish an approximately 10 MW demonstration facility to be situated in the Western Cape and probably be located somewhere between Langebaan and Springbok, a region identifies by Eskom as South Africa's richest in terms of wind.

Karottki et. al. (2001) describe the project in saying that "As part of its SABREGen project, Eskom plans to establish a wind power demonstration facility to prepare the market and the industry for energy implementation. They will be connected to the grid via the nearest Eskom substation. The objective of this pilot plant has been stated to be to "investigate the sustainability of wind energy in an African environment and then determine scales of implementation based on information gathered" (SESSA, 2001).

Techno-economically an essential part of this costly experiment will have to be attempting to quantify the benefits of situating the generation facility in the local or distribution network (11 kV) or in the quantification of the distributed generation benefits of the demonstration wind farm.

Proposed Activites

Three wind turbines will be installed:

- Vestas 660 kW wind turbine with 40 m hub height
- Vestas 1750 kW wind turbine with 60 m hub height
- Jeumont 750 kW

Estimated annual electricity generation with average wind speed of 7 m/s (40 m hub height) at a capacity factor of 20 %: **5.1 GWh**

There is provision for a three year research collaboration on the project.

The progress made at Klipheuwel will be critical considering that South Africa needs to quickly find ways to meet its demand for electricity, which is predicted to oustrip supply between 2005 and 2007. Eskom is already using 31 000 MW of its 40 000 MW installed acapacity, supplied mostly by coal fired power stations.

9. INVESTOR TYPE : (please tick the appropriate boxes)

☐ N/A ☐ National Government ☐ Provincial Government ☐ Local Government

☐ Private ■ Parastatal

10. POLICY INITIATIVES:

Integrated Energy Planning

11. GOVERNMENT INCENTIVES

N/A

12. INDUSTRY:

Sub-sector's codes:

411 (Electricity Supply & Distribution)

871 (R&D)

13. LOCATION:

Country	Region / Province	Area
South Africa	**Western Cape**	**Klipheiuwel/Durbanville**

13. OUTPUT :

Product name / Services	Target Market		
	Foreign	Domestic	Foreign & Domestic
Electricity Generation		**XX**	
Renewable Energy Research			**XX**
Construction		**XX**	

FINANCIAL STRUCTURE: (Financier name)	Type of finance	Finance Value (Rand million)
Own Research Fund	**15**	

Finance type codes:

1	Normal bank rate	9	Quasi-equity
2	IDC-normal variable rate	10	Ordinary shares
3	IDC-normal fixed rate	11	Preference shares
4	IDC-normal fixed rate (exporters)	12	IDC-leased building
5	IDC low fixed rate	13	Domestic grant
6	IDC low variable rate	14	Foreign grant
7	Domestic loans	15	Own funding
8	Foreign loans	16	Tax credits (section 37E)

16. DATES:

Date description	**Date**
Project announcement date	
Announced completion date	February 2003
Actual starting date	
Actual completion date	
Project last review date	

17. **SPONSORS/PARTNERS:**

Company	Country of Origin
ESKOM Enterprises	**South Africa**

18. IMPACT:

Description of economic impact	**Impact value**
Equity empowerment (% during construction)	
Equity empowerment (% after construction)	
Management empowerment (% during construction)	
Management empowerment (% after construction)	
Sourcing empowerment (% during construction)	
Sourcing empowerment (% after construction)	
Local labour empowerment (during construction)	
Local labour empowerment (after construction)	
Total employment (during construction)	
Total employment (after construction)	**Unknown**
Regional growth contribution (% annual)	
Annual foreign exchange contribution (Rmillion)	
Annual Turnover (full production –R million)	**R unknown million**
Cost of Capital import (R million)	

19. CONTACTS: *

Type	Person's name and designation	Telephone & fax number	Organisation address and E-mail Address
Project contact	John Smit Kevin Nasiep		Eskom Enterprises (Pty) Ltd.

=end=

BASELINE STUDY ON WINDENERGY IN SOUTH AFRICA

Projects Database Questionnaire

1. Project Name: **Darling Demonstartion Wind Farm**

2. Project ID No. **ONGR 0001**

3. Project Stage

☐ N/A ☐ Conceptual ☐ Scoping ☐ Partnering ☐ Heads of agreement

☐ Pre-feasibility ■ Feasibility ☐ Implementation ☐ Completed ☐

4. Project Status :

☐ N/A ■ Active ☐ Seeking finance ☐ Suspended ☐ Discontinued ☐ Dormant

5. Project Nature :

☐ N/A ■ New ☐ Upgrading ☐ Expansion ☐ Upgrading & Expansion

☐ Diversification ☐ Refinancing ☐ Take over

6. Finance Source: N/A ☐ Foreign ☐ Local ■ Foreign & Local

7. Funding : (a) Required total funding **R 70 million** (b) Actual total funding

8. Project Profile :

Overview:

South Africa has an energy intensive economy, highly reliant on fossil fuels, and sees economic growth based on energy intensive industries as a key means to development. The combination of theses factors has led to a high growth rate of carbon dioxide (CO_2) emissions from coal-fired power stations, making South Africans amongst the largest

contributors to climate change in the world. Despite being categorised as a Non-Annex 1 (developing) country, South Africa, is increasingly being pressured to take greater cognisance of its global environmental impacts.

Among the new Renewable Energy resources wind energy is the technology with the lowest production cost for electricity. Wind energy use in Europe, USA and India has matured and is increasingly becoming a pillar of the future electricity market. South Africa is blessed with abundant wind energy especially along its coast lines and the project aims to adapt, develop and apply existing technology to local conditions and needs.

By the nature of its structure, wind energy has many advantages over traditional fuels:

- creates more jobs in structural weak regions
- increases buying power in rural areas
- lessens the burden on the environment because it is emission-free
- ensures security of supply and conserves national resources of coal and water
- is an industrial product well-suited for local manufacture and has export value both as a commodity and in plant and machinery

The South African Government has recognized the importance of the use of Renewable Energy in the White Paper of Energy and has declared the Darling Demo Project as a National Demonstration Project which will be used as case study to formulate future energy policy.

Wind energy electricity generation is a new technology in South Africa but is already well established throughout the world. The Darling Independent Power Producer wants to introduce wind energy technology into South Africa and is planning a 13 MW Wind Farm in the area of Darling, 70 km north of Cape Town. Wind measurements were carried out and results show an excellent wind regime with a potential in excess of 7 m/s. This project will create a new industry with a potentially new market, create jobs and result in environmentally friendly power production.

The innovation of the project is to act as the first Independent Power Producer of bulk generation electricity from renewable enrgy sources in South Africa. In addition the Darling Demonstration Project has been declared a project of national importance by the South African Government and will be used to identify, develop and update the necessary strategies and regulations on how to deal in general with Idepent Power Producer issues.

The aim is the removal of obstacles for future applicants to obtain a Independent Power Producers generation license. The successful application for international grant funding is essential for the project and knowledge of these appliction processes can be used for future projects.

Darling IPP Structure:

Darling Independent Power Producer (Pty) Ltd. was incorporated in November 1997 by Hermann Oelsner and Raimund Ruethlein. Current stakeholders and directors are H. Oelsner, A. Oelsner R. Ruethlein, Lulamile Xate and Arthur Shipalana. Co-ordinator and Managing Director is H. Oelsner.

Darling IPP was formed as a Proprietary Limited Company in order to accommodate shareholding by private individuals, companies, organisations and institutions in a wind energy electricity generator. It has already invested substantially in Research, Development

and Planning in bringing the wind farm project through the stage of pre-feasibility and feasibility studies.

For the the first phase of 4 x 1,3 MW AN BONUS wind turbines a new operating company has been formed with shareholders CEF (Central Energy Fund), IDC (Industrial Development Corporation) and Darling Independent Power Producer.

Project Objectives:

The main objective of this project is to establish the first wind farm in South Africa for the purpose of demonstrating the generation of electricity from wind energy and evaluating it's potential in South Africa. The project will cover all aspects of planning, design, construction, operation and maintenance of the wind farm.

Other important objectives are:

- To contribute to the restoring of the global environment in accordance with recommendations of UNCED (Agenda 21). The project will help improve air quality, reduce carbon dioxide emissions and therefore global warming as well as other gases (sulphur dioxide and nitrous oxides) that contribute to acid rain.
- Meet demand for affordable renewable power to support needs of SA communities.
- Promote innovative financing for renewable energy.
- Capacity building for renewable energy in policy, legislation and practice.
- To contribute to Government's aim of achieving energy security in electricity supply through diversity of supply sources.
- To demonstrate the generation of electricity from wind energy, and its potential to contribute positively to the infrastructure development of South Africa within a successful and sustainable national growth and development strategy.
- To demonstrate how a South African wind energy industry could contribute to the creation and retention of jobs and skills.
- To be a model of the country's commitment to the Framework Convention on Climate Change through emission - free generation of electricity.
- To be an example of Government's commitment to working towards an investor-friendly climate in the energy sector.
- To act as a pilot project for Eskom, to resolve technical and structural issues relating to assisting Independent Power Producers (who may be or may be not foreign financed) participate in meeting South Africa's electricity generation needs.
- To promote the benefits and use of wind energy as a commercially viable way of generating electricity by running an education centre and contributing to Governments information dissemination efforts around energy matters and environmental impact.
- To act as a pilot project for legislators to identify and resolve critical issues such as transparency in the generation sector, availability of information, and non-discriminatory open access to uncommitted capacity on the national transmission network.
- To participate in the social upliftment of the Darling area by bringing jobs to, and sharing wealth with, the local community.

- To enhance competition in the South African electricity generation sector through cost-effective supply of "clean, green" cost-effective electricity to the electrical distribution grid in the Western Cape.

9. Investor Type :

N/A ☐ National Government ☐ Provincial Government ☐ Local Government

■ Private ■ Parastatal

10. Policy initiatives:

☐ N/A ■ West Coast Initiative SDI ☐ White Paper Ministry of Mineral and Energy

11. Industry:

Sub-sector's codes:

411 (Electricity Supply and Distribution),

871 (R&D,

964 (Other Recreational Activities = Tourism)

13. Location: *

Country	Region / Province	Area
South Africa	**Western Cape**	**Darling**

14. Output : products / services and target markets:

Product name / Services	Target Market		
	Foreign	Domestic	Foreign & Domestic
Electricity		**XX**	

Tourism			**XX**

15 Financial Structure:

Financier name	Type of finance	Finance Value (Rand million)
Darling IPP	6	
IDC	2	
IDC/EU Risk Fund	BEE finance	
DBSA	1	
CEF	Sub-ordinate shareholding	
DANIDA	10	

Finance type codes:

Code	Finance type
1	Normal bank rate
2	IDC-normal fixed rate
3	IDC-low fixed rate
4	IDC-low variable rate
5	Quasi-equity
6	Ordinary shares
7	Preference shares
9	Domestic grant
10	Foreign grant

15. Dates:

Date description	Date
Announced starting date	**15th February 2003**
Announced completion date	

Actual starting date	
Actual completion date	**July 2003**
Review Date	

17. Sponsors/Partners: *

Company	Country of Origin
Darling Independent Power Producer	South Africa
DANCED	Denmark
Department of Mineral and Energy Affairs	South Africa
SA Wind Energy Association	South Africa
Development Bank of SA	South Africa
GEF/UNDP	Global

18. Contacts: See attached

Type	Person's name and designation	Telephone & fax number	Organisation address and E-mail Address

-- end --

BASELINE STUDY ON WINDENERGY IN SOUTH AFRICA

Projects Database Questionnaire

1. **PROJECT NAME: Military Radio Station - Farm Langfontein**

2. **PROJECT ID NO**. **ONGRID 0003**

3. **PROJECT STAGE** :

☐ N/A ■ Conceptual ☐ Scoping ■ Partnering ☐ Heads of agreement

■ Pre-feasibility ☐ Feasibility ☐ Implementation ☐ Completed

4. **PROJECT STATUS** :

☐ N/A ■ Active ☐ Seekingfinance ☐ Suspended ☐ Discontinued ☐ Dormant

5. **PROJECT NATURE** :

☐ N/A ■ New ☐ Upgrading ☐ Expansion ☐ Upgrading & Expansion

■ Diversification ☐ Refinancing ☐ Take over

6. **FINANCE SOURCE**:

☐ N/A ☐ Foreign ☐ Local ■ Foreign & Local

7. **FUNDING**:

a) Required total funding **R 1 150 million**

b) Actual total funding _____

8. **PROJECT PROFILE** :

Overview:

The World Bank is presently financing the dismantling of military bases in South Africa as a demonstration of the transition from a situation of conflict to one of peace.

Darling Sustainable Energy and Employment Scheme (Darling SEES) through the Oelsner Group have submitted a sketch proposal for peaceful use of this military base.

Existing Infrastructure:

The existing military radio station near Darling is situated on the farm Langfontein which is 2 300 hectares in extent. This base can potentially be utilised for large scale renewable energy applications including research and development as well as implementation.

The Darling SEES proposal would make full use of the exiting buildings and existing infrastructure. Of particular importance are the following infrastructure components:

1. Electrical Installations

   - A 66 kV transformer and an 11 kV distribution grid.
   - Proximity to Eskom's 400 kV supply.
   - Two diesel generator sets of 1 850 kVA and 1 250kVa each.

2. Buildings

   The existing buildings are suitable for housing:

   - A research facility.
   - Accommodation.
   - Workshops and storage.
   - A laboratory.
   - A radio studio and administrative offices.
   - A restaurant and curio shop in an old farm dwelling.

3. Radio Masts

   The 50 m and 35 m radio transmission masts could be use for wind measurements.

4. Water Supply

   The water supply infrastructure comprises a pump house and several bore holes equipped with windmills. The farm is located 3 km from the sea which would facilitate installation of a sea water desalination plant.

Proposed Activites

1. Renewable Energy Resources

The Darling SEES proposal envisages an estimated total electricity generating capacity of 200 MW derived from the following installations:

- A cluster of large mega-watt class modern wind turbines could be erected on the gentle slopes without being visible from the nature conservation area.

- Large flat areas could be used for installing solar thermal collectors, sterling engines, photo-voltaic electricity generation etc.

- Installation of a sea water desalination plant would allow bio-mass agricultural cultivation be in established in order to feed a bio-mass electricity facility which would supply the complex's base load or be used during wind free periods. Bio-mass material could also be obtained from the surround farms.

The above renewable energy resources could be tested and demonstrated as hybrid systems combined with the existing diesel generators for off-grid and mini-grid test installations. Such installations could be used in rural areas where there is no electricity grid.

2. Other Activities

Other possible activities at the Langfontein farm are:

- An International field testing facility for large, medium and small wind turbines as well as for solar-thermal and photo-voltaic energy generation.
- A sophisticated research facility and laboratories for Renewable Energy Resources.
- Small scale farming of potatoes and tunnel farming of farm stall products utilising water from the sea water desalination plant.
- Partial integration of the farm into West Coast National Park.
- Old farm dwelling to be used as small guesthouse, restaurant and an historical bakery and flour-mill.
- Restoration of the small-scale animal kraals as part of a tea garden featuring farm animals in the pine tree area of the property.
- Establishment of a small self-contained green village of about 100 dwellings with a small lake, kindergarten school

and sport facilities on the western part of the farm bordering the R 27, which has view of the Langebaan Lagoon.

- A service station with AA emergency service, a farm stall and take away food counter facilities.
- An "AFRICA RAINESSANCE" radio station beamed at rural areas in Africa.

9. **INVESTOR TYPE** :

☐ N/A ☐ National Government ☐ Provincial Government ☐ Local Government

■ Private ■ Parastatal

10. **POLICY INITIATIVES**:

1	Unspecified IDZ	2	Unspecified SDI
3	Local Industrial parks (LIPS)	4	Clusters
5	Other	6	Fish River SDI
7	Lubombo SDI	8	Maputo Corridor
9	***West Coast Initiative SDI***	10	Wild Coast SDI
11	Platinum SDI	12	Phalborwa SDI
13	Richards Bay SDI	14	Coega IDZ
15	Greater Algoa Initiative	16	EmontiKei Initiative
17	East Londen IDZ	18	Pietermaritzburg/Msunduzi SDI
19	Durban SDI	20	Gariep SDI
21	Gauteng Special Economic Zone	22	New Town Cultural Precinct
23	Gauteng Innovation Hub	24	City Deep Container IDZ
25	Johannesburg International Airport Economic Zone	26	Germiston/Alberton Economic Zone
27	Saldanha IDZ		

11. GOVERNMENT INCENTIVES OR IDC SCHEMES THAT WILL BE UTILISED: (Please cross the number in the box below)

Tick area	Existing Incentives
1	N/A
2	(GEIS) General Export Incentive Scheme
3	(MIDP) Motor Industry Development Program
4	Duty Credit Certificate Scheme
5	Export Marketing and Investment Assistance Scheme
6	Government Procurement
7	(MDP) Manufacturing Development Program : Accelerated Depreciation
8	(MDP) Small medium manufacturing development program
9	(MDP) Tax Holiday Scheme
10	Industrial Participation
11	(TEFG) Short Term Export Finance Guarantee
12	Khula Finance
13	Ntsika Finance
14	Competitiveness Fund
15	Rebate Provisions
16	Work Place Challenge
17	Sectoral Partnership Fund
18	***SPII***
19	THRIP
20	(IDC) Normal Rates

	Existing Incentives
21	(IDC) Low Interest Rate Scheme
22	(IDC) World Player Scheme
23	(IDC) Jobs Scheme
24	(IDC) Life Scheme
25	(IDC) Multi-shift Scheme
26	(IDC) Orchards Scheme
27	(IDC) Import Finance
28	(IDC) Export Finance
29	(IDC) Eco-tourism Scheme
30	(IDC) Entrepreneurial Development Scheme
31	(IDC) Cleaner Production Scheme
32	(IDC) Venture Capital Scheme
33	(IDC) Standard Lease Factory Building
34	(IDC) Wholesale Finance Scheme
35	(IDC) Low Interest Empowerment Scheme
36	(IDC) Take –overs and acquisition Scheme
37	(IDC) Consortium Finance Scheme
38	(FDC) Fish Harvesting Scheme
39	Other Tax Incentives

12. INDUSTRY: **(** refer to the annexure A when providing the sub-sector's codes)

b) Sub-sector's codes: **111(Growing of Crops), 411(Generation & Distribution of Electricity), 420(Water Supply and Distribution), 871(R &D natural Sciences), 622(Retail Trade in Specialised Stores), 623(Other Retail in Specialised Stores), 632 (maintenance & Repair of Motor Vechiles) 635 (Retail Sale of Fuel), 642(Restaurants, Bars, & Canteens), 752 (Telecommunications), 842(Real Estate Activities), 964 (Recreational Activities)**

Country	Region / Province	Area
South Africa	**Western Cape**	**Langebaan**

13. OUTPUT : products / services and target markets: (For each product / service, tick a market)

Product name / Services	Target Market		
	Foreign	**Domestic**	**Foreign & Domestic**
Electricity Generation		**XX**	
Water Supply		**XX**	
Renewable Energy Research			**XX**
Restaurants and Bars			**XX**
Tourism			**XX**
Service Station		**XX**	
Private Accommodation		**XX**	
Radio Station			**XX**
Construction		**XX**	

14. FINANCIAL STRUCTURE: (For the type of finance, use the code number outlined in the table "finance type codes" below) *

Financier name	Type of finance	Finance Value (Rand million)
World Bank	**14**	***Unknown***

Finance type codes:

1	Normal bank rate	9	Quasi-equity
2	IDC-normal variable rate	10	Ordinary shares
3	IDC-normal fixed rate	11	Preference shares
4	IDC-normal fixed rate (exporters)	12	IDC-leased building
5	IDC low fixed rate	13	Domestic grant
6	IDC low variable rate	14	Foreign grant
7	Domestic loans	15	Own funding
8	Foreign loans	16	Tax credits (section 37E)

16. DATES:

Date description	Date
Project announcement date	
Announced completion date	
Actual starting date	
Actual completion date	
Project last review date	

17. **SPONSORS/PARTNERS:** *

Company	Country of Origin
World Bank	**Global**
Darling SEES	**South Africa**
Oelsner Group	**South Africa**

18. IMPACT:

Description of economic impact	Impact value
Equity empowerment (% during construction)	
Equity empowerment (% after construction)	
Management empowerment (% during construction)	
Management empowerment (% after construction)	
Sourcing empowerment (% during construction)	
Sourcing empowerment (% after construction)	
Local labour empowerment (during construction)	
Local labour empowerment (after construction)	
Total employment (during construction)	
Total employment (after construction)	
Regional growth contribution (% annual)	
Annual foreign exchange contribution (Rmillion)	
Annual Turnover (full production –R million)	
Cost of Capital import (R million)	

19. CONTACTS:

Type	Person's name and designation	Telephone & fax number	Organisation address and E-mail Address
Project contact	Name: M Herman OELSNER Desg: Managing Director	Tel:022-492-3095 Cell: 083-556 3095 Fax: 022-492-3095	Oelsener Group PO Box 13, Darling, 7345, South Africa E-mail: oelsnergrp@wcaccess.co.za

= end =

BASELINE STUDY ON WINDENERGY IN SOUTH AFRICA

Projects Database Questionnaire

1. **PROJECT NAME: LUBISI**

2. **PROJECT ID NO. MINIGRID 0001**

3. **PROJECT STAGE** :

☐ N/A ☐ Conceptual ☐ Scoping ☐ Partnering ☐ Heads of agreement

☐ Pre-feasibility ☐ Feasibility ☐ Implementation ■ Completed

4. **PROJECT STATUS** :

☐ N/A ■ Active ☐ Seeking finance ☐ Suspended ☐ Discontinued ☐ Dormant

5. **PROJECT NATURE** :

■ N/A ☐ New ☐ Upgrading ☐ Expansion ☐ Upgrading & Expansion

☐ Diversification ☐ Refinancing ☐ Take over

6. **FINANCE SOURCE**:

☐ N/A ☐ Foreign ☐ Local ■ Foreign & Local

7. **FUNDING**: Actual total funding **unknown R9m**

8. **PROJECT PROFILE** :

Overview:

The Lubisi Dam project is a community driven, high impact, integrative project employing a wide range of technologies to provide infrastructure and job creation opportunities to the people of 23 villages in the Lubisi area of the Eastern Cape Province in the Republic of South Africa.
The CSIR is the technology partner and implementing agency. The project is supported by the Eastern Cape Provincial Government through the Eastern Cape Development Agency. The 80 000 people of the communities are represented by the Lubisi Dam Development Forum.
The aim of the project is to employ and demonstrate the use of leading edge technologies and renewable energy to enable and accelerate development in rural areas. The project integrates a wide range of technologies to provide infrastructure, the creation of employment opportunities, the development of SMMEs, and the distribution of health, education and information services all contributing to an overall improvement in quality of life for all the people involved.
An innovative communications solution has been designed and will consist of satellite broadcasting for Internet downloads and distribution into the villages utilising wireless technology. The whole project will be powered via renewable energy such as biogas and solar power. Kiosk information terminals will provide access to multi-media public information via touch-screen technology.

Language choice will be possible and the information available from the Internet in print form. Individuals will have e-mail addresses.

Existing Infrastructure:

Two imported Proven Engineering 2,2 kW wind turbines together with photovoltaic panels are currently generating electricity for lighting, computers, telecommunication and small scale production facilities.

Proposed Activites

- Installation of appropriate information and communications infrastructure;
- Packaged information in support of rural development initiatives;
- Presentation of information in various delivery platforms;
- Presentation of the Naledi Business Unit;
- Skills transfer and training (technical skills, applications and content development);
- skills, facilitation skills, management skills (also see section on Human Resource Development below);
- Development of models for replication in other parts of the country, including the SADC region and Africa.

9. **INVESTOR TYPE** :

☐ N/A ☐ National Government ☐ Provincial Government ☐ Local Government

☐ Private ■ Parastatal

10. POLICY INITIATIVES:

11. GOVERNMENT INCENTIVES

12. INDUSTRY:

Country	Region / Province	Area
South Africa	**Eastern Cape**	**Luibisi near Queenstown**

13. OUTPUT :

Product name / Services	Target Market		
	Foreign	Domestic	Foreign & Domestic
Electricity Generation		**XX**	
Water Supply		**XX**	
Renewable Energy Research		**XX**	
Restaurants and Bars			
Tourism			**XX**
Service Station			
Private Accommodation		**XX**	

14. FINANCIAL STRUCTURE:

Financier name	Type of finance	Finance Value (Rand million)

Finance type codes:

1	Normal bank rate	9	Quasi-equity
2		10	Ordinary shares
3		11	Preference shares
4		12	
5		13	Domestic grant
6		14	Foreign grant
7	Domestic loans	15	Own funding
8	Foreign loans	16	Tax credits (section 37E)

16. DATES:

Date description	Date
Project announcement date	
Announced completion date	
Actual starting date	1994
Actual completion date	2002
Project last review date	**13 January 2003**

17. SPONSORS/PARTNERS:

Company	Country of Origin
IDRC	**CANADA**
CSIR	**SA**

18. IMPACT:

Description of economic impact	Impact value
Equity empowerment (% during construction)	LDDF partnership
Equity empowerment (% after construction)	LDDF took ownership
Management empowerment (% during construction)	LDDF partnership
Management empowerment (% after construction)	LDDF ownership
Sourcing empowerment (% during construction)	Local suppliers
Sourcing empowerment (% after construction)	
Local labour empowerment (during construction)	Mostly local labour
Local labour empowerment (after construction)	
Total employment (during construction)	50
Total employment (after construction)	**20**
Regional growth contribution (% annual)	unknown
Annual foreign exchange contribution (Rmillion)	**Small exports**
Annual Turnover (full production –R million)	**R200 000**
Cost of Capital import (R million)	

19. CONTACTS:

Type	Person's name and designation	Telephone & fax number	Organisation address and E-mail Address
Project contact	Name: Chris Morris Desg:	Tel: 012 841 2509 Cell: 082 892 9349 Fax:	CSIR PRETORIA E-mail: cmorris@csir.co.za
Sponsor's contact	Name: Designation:	Code Tel: Code: Fax: Cell:	Box: E-mail:
Financier's contact	Name: Desg:	Code Tel: Code Fax: Cell:	Box: E-mail:

= END =

BASELINE STUDY ON WINDENERGY IN SOUTH AFRICA

Projects Database Questionnaire

1. **PROJECT NAME: HLULEKA**

2. **PROJECT ID NO. MINIGRID 0002**

3. **PROJECT STAGE** :

☐ N/A ☐ Conceptual ☐ Scoping ☐ Partnering ☐ Heads of agreement

☐ Pre-feasibility ☐ Feasibility ☐ Implementation ■ Completed

4. **PROJECT STATUS** :

☐ N/A ■ Active ☐ Seeking finance ☐ Suspended ☐ Discontinued ☐ Dormant

5. **PROJECT NATURE** :

■ N/A ☐ New ☐ Upgrading ☐ Expansion ☐ Upgrading & Expansion

☐ Diversification ☐ Refinancing ☐ Take over

6. **FINANCE SOURCE**:

☐ N/A ☐ Foreign ■ Local ☐ Foreign & Local

7. **FUNDING**: Actual total funding **unknown**

8. **PROJECT PROFILE** :

Overview:

The project is located in the Hluleka Nature Reserve near Port St Johns.
2 x 2,5 kW imported Proven Engineering Wind chargers in hybrid formation with 5 kW PV and stand-by diesel generator supplying electricity to a lodge with 12 bungalows, an administration building and water supply pumping.

Existing Infrastructure:

Proposed Activites

9. **INVESTOR TYPE** :

☐ N/A ☐ National Government ☐ Provincial Government ☐ Local Government

☐ Private ■ Parastatal

10. POLICY INITIATIVES:

11. GOVERNMENT INCENTIVES

12. INDUSTRY:

Country	Region / Province	Area
South Africa	**Eastern Cape**	**Luibisi near Queenstown**

13. OUTPUT :

Product name / Services	Target Market		
	Foreign	Domestic	Foreign & Domestic
Electricity Generation		**XX**	
Water Supply		**XX**	
Renewable Energy Research		**XX**	
Restaurants and Bars			
Tourism			**XX**
Service Station			
Private Accommodation		**XX**	

14. FINANCIAL STRUCTURE:

Financier name	Type of finance	Finance Value (Rand million)

Finance type codes:

1	Normal bank rate	9	Quasi-equity
2		10	Ordinary shares
3		11	Preference shares
4		12	
5		13	Domestic grant
6		14	Foreign grant
7	Domestic loans	15	Own funding
8	Foreign loans	16	Tax credits (section 37E)

16. DATES:

Date description	Date
Project announcement date	
Announced completion date	
Actual starting date	
Actual completion date	
Project last review date	**13 January 2003**

17. SPONSORS/PARTNERS:

Company	Country of Origin

18. IMPACT:

Description of economic impact	Impact value
Equity empowerment (% during construction)	
Equity empowerment (% after construction)	
Management empowerment (% during construction)	
Management empowerment (% after construction)	
Sourcing empowerment (% during construction)	
Sourcing empowerment (% after construction)	
Local labour empowerment (during construction)	
Local labour empowerment (after construction)	
Total employment (during construction)	
Total employment (after construction)	
Regional growth contribution (% annual)	
Annual foreign exchange contribution (Rmillion)	
Annual Turnover (full production –R million)	
Cost of Capital import (R million)	

19. CONTACTS:

Type	Person's name and designation	Telephone & fax number	Organisation address and E-mail Address

Project contact	Name: Chris Morris Desg:	Tel: 012 841 2509 Cell: 082 892 9349 Fax:	CSIR PRETORIA E-mail: cmorris@csir.co.za
Sponsor's contact	Name: Designation:	Code Tel: Code: Fax: Cell:	Box: E-mail:
Financier's contact	Name: Desg:	Code Tel: Code Fax: Cell:	Box: E-mail:

= END =

BASELINE STUDY ON WINDENERGY IN SOUTH AFRICA

Projects Database Questionnaire

1. **PROJECT NAME: LUCINGWENI**

2. **PROJECT ID NO. MINIGRID 0003**

3. **PROJECT STAGE** :

☐ N/A ☐ Conceptual ☐ Scoping ☐ Partnering ☐ Heads of agreement

☐ Pre-feasibility ☐ Feasibility ☐ Implementation ■ Completed

4. **PROJECT STATUS** :

☐ N/A ■ Active ☐ Seeking finance ☐ Suspended ☐ Discontinued ☐ Dormant

5. **PROJECT NATURE** :

■ N/A ☐ New ☐ Upgrading ☐ Expansion ☐ Upgrading & Expansion

☐ Diversification ☐ Refinancing ☐ Take over

6. **FINANCE SOURCE**:

☐ N/A ☐ Foreign ■ Local ☐ Foreign & Local

7. **FUNDING**: Actual total funding **unknown**

8. **PROJECT PROFILE** :

Overview:

The project is located in Lucingweni near ……..
6 x 6,0 kW imported Proven Engineering Wind chargers in hybrid formation with 50 kW PV and supplying electricity to the Community Centre.

Existing Infrastructure:

Proposed Activites

9. **INVESTOR TYPE** :

☐ N/A ☐ National Government ☐ Provincial Government ☐ Local Government

☐ Private ■ Parastatal

10. POLICY INITIATIVES:

11. GOVERNMENT INCENTIVES

12. INDUSTRY:

Country	Region / Province	Area
South Africa	**Eastern Cape**	**Luibisi near Queenstown**

13. OUTPUT :

Product name / Services	Target Market		
	Foreign	Domestic	Foreign & Domestic
Electricity Generation		**XX**	
Water Supply		**XX**	
Renewable Energy Research		**XX**	
Restaurants and Bars			
Tourism			**XX**
Service Station			
Private Accommodation		**XX**	

14. FINANCIAL STRUCTURE:

Financier name	Type of finance	Finance Value (Rand million)

Finance type codes:

1	Normal bank rate	9	Quasi-equity
2		10	Ordinary shares
3		11	Preference shares
4		12	
5		13	Domestic grant
6		14	Foreign grant
7	Domestic loans	15	Own funding
8	Foreign loans	16	Tax credits (section 37E)

16. DATES:

Date description	Date
Project announcement date	
Announced completion date	
Actual starting date	
Actual completion date	
Project last review date	**13 January 2003**

17. SPONSORS/PARTNERS:

Company	Country of Origin

18. IMPACT:

Description of economic impact	Impact value
Equity empowerment (% during construction)	
Equity empowerment (% after construction)	
Management empowerment (% during construction)	
Management empowerment (% after construction)	
Sourcing empowerment (% during construction)	
Sourcing empowerment (% after construction)	
Local labour empowerment (during construction)	
Local labour empowerment (after construction)	
Total employment (during construction)	
Total employment (after construction)	
Regional growth contribution (% annual)	
Annual foreign exchange contribution (Rmillion)	
Annual Turnover (full production –R million)	
Cost of Capital import (R million)	

19. CONTACTS:

Type	Person's name and designation	Telephone & fax number	Organisation address and E-mail Address
Project	Name:	Tel: 012 841 2509	CSIR

contact	Chris Morris Desg:	Cell: 082 892 9349 Fax:	PRETORIA E-mail: cmorris@csir.co.za
Sponsor's contact	Name: Designation:	Code Tel: Code: Fax: Cell:	Box: E-mail:
Financier's contact	Name: Desg:	Code Tel: Code Fax: Cell:	Box: E-mail:

= END =

Appendix 3: List of Wind Power Projects

The projects in red are in planning or feasibility status and not yet installed.

Name	Owner	Location	Capacity	Annual power production	Capacity factor (%)
National grid					
Darling National Demonstration Wind Farm	PRIV / CEF/ IDC	Western Cape	4 x 1.3 MW	13 GWh	30
ESKOM Klipheuwel Wind Turbine Test Facility	ESKOM	Western Cape	1 x 660 kW 1 x 1750 kW 1 x 750 kW	5 GWh	20
Military Radio Station - Farm Langefontein		Western Cape	50 x 2.3 MW	300 GWh	30
CSIR Steenbras Pilot Wind Farm		Western Cape	unknown	unknown	25 estimated
Jeffreys Bay Wind Farm		Eastern Cape	7 MW	15 GWh	25 estimated
Mini grid					
Lubisi Dam Community Project		Eastern Cape	2 x 2.2 kW	10 MWh	25 estimated
Hluleka Nature Reserve		Eastern Cape	2 x 2.5 kW	22 MWh	25 estimated
Lucingweni Community Centre		Eastern Cape	6 x 6.0 kW	79 MWh	25 estimated
SANEA IV Base		Antarctica	1 x 100 kW	430 MWh	49
Darling Wind Farm Visitor,		Western Cape	1 x 100 kW	263 MWh	30
Off-grid Systems					
Manufacturer	**Owner**	**Location**	**Capacity**	**Annual power production**	**Capacity factor (%)**
Wind Charger Kestrel 600 kW		Nothern Cape Western Cape Eastern Cape	50 x 600 W 50 x 600 W 50 x 600 W	66 MWh 66 MWh 66 MWh	25
World Power Whisper 1000 W		Nothern Cape Western Cape Eastern Cape	120 x 1000 W 120 x 1000 W 60 x 1000 W	263 MWh 263 MWh 131 MWh	25
World Power Whisper 3000 W		Nothern Cape Western Cape	20 x 3000 W 20 x 3000 W	131 MWh 131 MWh	25
Bore-hole Windmills					
Various – not specified		All Provinces	22 670 x 1000W	49 650 MWh	25

Annex 4: R & D activities

Eskom Klipheuvel Wind Turbine Test Centre

This project is part of Eskom's SABRE-Gen programme which aims to investigate and demonstrate the potential of renewable energy sources (i.e. wind, wave, 'bioenergy' and solar thermal electric) for bulk power generation in South Africa through identifying promising options, assessing the financial and economic viability, assessing the resource potential in the country, implementing demonstration projects to conduct operational research and providing strategies for the uptake and sustainable deployment of the technologies. (http://www.sabregen.co.za)

In the Final Environmental Impact Report for the Proposed ESKOM Wind Energy Demonstration Facility objectives and research aims are listed as follows:

"The main objectives of the ESKOM project are:

- Understanding the implications in the South African environment (natural and commercial)
- Determining the appropriate scale of effective future implementation of wind energy – business case
- Introducing the technology to South Africa
- Studying the influence of Wind Energy on Eskom's future energy mix

Various electrical and mechanical wind turbine types will be investigated in the 1MW to 2MW range (current commercial technology internationally).
Eskom conservatively believes that 500 MW to 1000 MW could be tapped on the West Coast (including land availability and grid-infrastructure). To hedge against such a US$ 1 Billion investment and roll out the following high level research questions need to be answered:

- Electrical and Mechanical performance verification under local resource conditions (20% GWh pa difference from manufacturers data)
- O & M Technology Transfer and capacity building (environment different to Europe – Condition Based rather than European maintenance contract)
- Natural Environment Response (visual, noise, birds etc.)
- Resource Modeling for Commercial utilisation;
- Stand alone application/electrification – IRD
- Power Quality (Local Distribution Infrastructure different to Europe)
- Energy Storage for dispatchability and peaking application with VRB – world first.

Darling National Demonstration Project

The White Paper on Energy Policy of the Republic of South Africa, which was approved by the Cabinet on 2 December 1998, sets objectives and specific priorities of the South African energy policy within the broader policy framework of the Government's Reconstruction and Development Programme (RDP). Among the objectives of the sector are:

1. Increasing access to affordable energy services,
2. Improving energy governance;
3. Stimulating economic development;

4. Managing energy-related environmental and health impact; and
5. Securing supply through diversity.

The Government believes that renewable energy can in many cases provide the least cost energy services, particularly when the social and environmental costs are included, and will therefore provide focused support for the development, demonstration and applications of renewable energy. Furthermore, renewable energy would lead to the introduction of a new technology and possibly new industry into South Africa with a high potential for job creation, an important goal of Government's Growth, Employment and Redistribution (GEAR) strategy.
The 12th of June 2000 the Minister for Minerals and Energy approved the following Ministerial Submission Recommendations:

The Minister of Minerals and Energy support[s] the declaration of the Darling Wind Farm as a National Demonstration Project as per... [(a) and (b) below] in a bid to develop strategies for wind energy generation in South Africa.
As a National Wind Farm demonstration Project, the Darling Wind Farm will through its implementation of the policies of the White Paper on Energy, test and or inform decisions around replicable new and or novel approaches to recognised energy and environmental problems and will act as a platform for replication by the public.
(b) According to DME Guidelines for Energy Policy Projects 1994/95:
Demonstration Projects of products, processes and technologies may be supported if the project meets the above criteria and their primary focus is to produce one or more of the following outputs:

Economically viable solution to an identified energy issue;
Formulated or implemented national energy policy;
Demonstrated operation on site under actual conditions;
Reduced barriers to market entry;
Publicized results of demonstration.

As a National Wind Farm demonstration Project, the Darling Wind Farm will through its implementation of the policies of the White Paper on Energy, test and or inform decisions around replicable new and or novel
Approaches to recognised energy and environmental problems and will act as a platform for replication by the public"

Darling National Wind Farm Demonstration Project: Rationale and objectives:

<u>TECHNICAL:</u>

? The project aims to adapt, develop and apply existing technology to local conditions and needs and to act as a pilot project for Eskom and the public, to resolve technical and structural issues relating to assisting Independent Power Producers (who may be or may be not foreign financed) participate in meeting South Africa's electricity generation and environmental conservation needs.

<u>ENVIRONMENTAL:</u>

? To contribute to the restoring of the global environment in accordance with recommendations of UNCED (Agenda 21) by identifying barriers for possible replication and provide suggestions on how those barriers could be removed.

? The project will contribute and activate replication of similar projects and together it will make a real improvement to air quality, reduce carbon dioxide emissions and therefore global warming as well as other gases (sulphur dioxide and nitric oxide) that contribute to acid rain.
? To be a showcase and example of the Government's commitment to the Framework Convention on Climate Change through emission - free generation of electricity and working towards an investor- friendly climate in the energy sector.

SOCIAL:

? To promote the benefits and use of wind energy as a commercially viable way of generating electricity by running an Education Centre and contributing to Governments information dissemination efforts around energy matters and environmental impact.

? It will demonstrate and provide a planning framework for the Government how to approach an equitable balance between priorities for developing (RDP) and environmental conservation.

? To demonstrate how a South African wind energy industry could contribute to the creation and retention of jobs and skills.

? To participate in the social up-lifting of the Darling and surrounding areas by bringing jobs to, and sharing wealth (e.g. equity share holding) with, the local community.

? To include and provide capacity to previously disadvantaged persons (economic empowerment) as equity shareholders and be appointed to the board of directors for decision making and capacity building processes.

FINANCIAL & ECONOMIC:

? It provides an ideal case study and opportunity for South African banking and investment sector e.g. Development Bank of South Africa (DBSA) and a platform for international funders (e.g. Global Environmental Facility (GEF) and the Danish Cooperation for Environment and Development (DANCED) for promotion, facilitating and testing of innovative renewable energy financing options.

MARKET:

? To demonstrate the generation of electricity from wind energy, and its potential to contribute positively to the infrastructure development of South Africa within a successful and sustainable national growth and development strategy.

POLICY:

? Capacity building in the implementation of the Energy White Paper renewable energy in policy, legislation and aim of achieving energy security in electricity supply and environmental restoration through diversity of supply sources.

? To act as pilot project for legislators to identify and resolve critical issues such as transparency in the generation sector, availability of information, and non-discriminatory open access to uncommitted capacity on the national transmission network

INSTITUTIONAL:

? The project provides an opportunity for interested parties e.g. NER, DBSA, DEAT, DME, Swartland Municipality, DARLIPP etc. to share the risk in the development process which otherwise would not have been possible to be carried alone.

? The Darling Demonstration Project adheres to the DME Energy Guidelines for demonstration projects and presents an ideal case study as a demonstration project with national spin-offs to the country.

? As this is a demonstration project and no similar activity has been undertaken in South Africa to learn from, considerable cost (approximately R5 mil project value) and time has been contributed by stakeholders and investors and is going into the development process.

? This investment in Darling IPP is a so-called Ethical Investment and all investors are participating and taking risks "for the better". The financial model allows only for a very low return in order to be able to sustain itself.

? The development process is open, transparent and the outcomes are available to form a basis for others to learn from how to replicate similar activities cost and time efficiently in South Africa.

The following Research Activities have been proposed by the Oelsner Group:

Possible Joint Research between Darling Independent Power Producer (Pty) Ltd. and Eskom:

- Energy Yield Forecasting
- long term forecasting (years)
- short term forecasting (months)
- forecasting from weather reports (24 hours)
- Energy Yield Monitoring and Evaluation
- Effects of wind farm generation on the grid .
- grid supply study evaluate real time data
- detail study of wind farm output characteristics
- 12 months study of rapid wind power changes (ramp rate)
- analysis of power out-put changes over 10 min periods in order to: .meet reserve requirements
- establish control area margins
- Investigation into Eskom's possible additional regulation requirements to accomodate WF varying output
- grid demand study
- Establish necessity for short-term variations
- monitor customer demand variations
- domestic
- commercial light industrial
- Example Iscor Saldhana Steel Mill
- monitor output from conventional generators
- Project results from variation study to future increase of wind farm capacity from 5,2 MW to 13 MW
- Power metering .
- Power wheeling .
- Power banking

Darling Visitor, Training and Education Centre

The following possible Joint Activities on DARLING SEES Renewable Energy Visitor-, Education- and Training Centre

. **Information Dissemination to the Public** .

- Establish library

- literature and brochures .,
- visual presentations
- exhibition models for wind, wave, PV, solar theffi1al, hydro power generation systems
- wind farm guide tours for national and international visiting groups .mini conferences and seminars

Development and Implementation of Renewable Energy Systems

- .small scale wind power innovation and design
- wind hybrid systems, diesel PV *I* solar thermal .
- rural wind mini-grid systems
- wind/fog water recovery systems
- bulk energy battery storage *I* Vanadium Redox .
- farm bio-gas design and demonstration
- CO2 neutral transportation with hydrogen and plant oil
- solar architecture and integration of solar cells in buildings

.

Training Courses

- wind measurements
- wind power generation yield assessment .site selection
- wind farm planning
- How to build a small wind generator
- erection of small wind generators and PV systems .--1

South African Wind Energy Project

Project objectives

The overall project objective is to identify and to the extent possible remove the barriers to large-scale commercial utilisation of wind energy for on-grid power generation in South Africa. This will be assisted by UNDP/GEF and DANCED who are jointly undertaking this initiative and as such their activities have been designed complementary to each other.
Specific objective of the proposed initiative is the preparation of a UNDP/GEF full-size project brief, through analysis of the existing barriers, followed by the design of a programme that reduces these barriers related to the following areas:
Mechanisms to cover incremental costs of commercial wind farms (e.g. CDM, green power market);
Commercial requirements for grid connection (Power Purchase Agreements, Power Wheeling and/or Banking agreements);
Availability and accessibility of investment capital;
Financial intermediation for the first wind Independent Power Producer (IPP);
Pipeline development of (future) wind energy projects; and
Requirements to replicate the first wind IPP.
In addition a DANCED project document will be prepared that will result from their preparatory activities (similar to the UNDP/GEF PDF B) related to the following areas:
Wind measurements and wind resource assessment for the site according to internationally accepted quality levels;
Lay-out of the wind farm and production estimate;
Key technical aspects of grid connection;
Environmental Impact Assessment (EIA); and
Full cost accounting exercise, which compares the first wind IPP costs against the marginal costs associated with new generation capacity.

Global significance

The Republic of South Africa ratified the United Nations Framework Convention on Climate Change (UNFCCC) on 29 August 1997. The Government states that the ratification "confirms South Africa's standing within the international arena as a country that is responsible for environmental management and sustainable development and that commits itself to those parts of the Convention which apply to developing countries."

Total primary energy supply in South Africa in 1997 was 4,552,174 TJ. This consists mostly of coal (74%) and crude oil (12%) and thus contributes significantly to global CO_2 emissions. The electricity production in 1997 was 179,450 GWh. The electricity is generated mainly using coal (92.9%) and nuclear energy (6.4%). The CO_2 emissions resulting from the electricity generation can be estimated to be in the order of 180 million tons, which is about one quarter of the whole of Sub-Sahara Africa's CO_2 emissions from the energy sector.

Wind power has substantial potential in South Africa to substitute conventional coal-fired electricity generation and hence to reduce the growth of CO_2 emissions from power generation in South Africa. Especially on the West Coast of the country, the wind regime seems good and the there seems to be a relatively good correlation between wind and load. Wind power thus presents a possibility to reduce South Africa's dependence on fossil fuels, especially coal. This will bring along various

local and global benefits. Firstly, the objectives of South Africa's energy policy regarding increased competition within the power sector, reduced environmental impact of the sector and increased energy security through diversity and optimal use of the network (distributed generation) will be promoted. Secondly, future growth of the greenhouse gases from power generation will be reduced thus mitigating potential global climate change.

For a 5 MW wind farm, which will be developed under this project, about 325,000 tons of CO_2 during its estimated lifetime (25 years) will be reduced. Furthermore the removal of barriers for (future) commercial wind farms for distributed generation will lead to reductions that are many-folded in comparison to this. Apart from the distributed generation and stand-alone systems, the national utility ESKOM is investigating the possibility to install large-scale wind farms (20 MW and 100-200 MW pump-storage scheme) with input into the transmission networks. More detailed estimates for potential reduction in CO_2 emissions will result from the PDF B activities.

In addition to the project's potential to reduce the long-term growth of CO_2 emissions in South Africa, it also has wider regional repercussions. South Africa is a unique developing country with industrialised world technical skills and infrastructure in certain areas. In this context, it has a great potential to become a regional leader in wind power development within the Southern African Development Community (SADC). This will have both regional and global positive impacts.

DME/NER/CSIR/SHELL Wind Hybrid Mini-grid Systems

R & D content of this National Programme is not known yet.

Kestrel Wind Charger

Together with the Potchefstroom University, Cove Products is developing and improving generation capacity and blade design of the Kestrel 600 W. Development covers an upgrade to 8oo W output and also the design of a 1,6 kW wind charger.

Appendix 5: List of Contacts – Baseline study wind

Company/Institute	Info	Contact
BOREHOLE WATER ASSOCIATION		TEL: 011 447 0853 boreholewater@mweb.co.za
Cove Products	Kestrel wind turbine	Mr James Carpy Tel: 011 397 3147 Cell: 083 268 4254 Johannesburg
CSIR		Mr Chris Morris Tel: 012 841 2509 Cell: 082 892 9349 c.morris@csir.co.za
DANIDA – Danish embassy		Mrs Jackie Friedenthal Tel: 021 430 9340
Department of Agriculture		Malmesbury
Department of Minerals and Energy		Mr Andre Otto Tel: 012 317 9225 Pretoria
Department of Water Affairs and Forestry		Mr Wessel Wentzel Tel: 082 555 4466 Mr Mike Swart Tel: 082 808 0437 Belville
Department of Water Affairs and Forestry		Minister and DG office Tel: 021 464 1500 Cape Town
Department of Water Affairs and Forestry		Mrs Lorraine van Rensburg wbl@dwaf.gov.za Pretoria
Eskom		John Smit
Farmers Weekly		Charline Tel: 011 889 0836
Grundfos DK A/S South Africa	Water pumps with solar and small wind turbines Import from Denmark	Tel: 011 902 7703 Fax: 011 902 7706 atheron@grundfos.com
Hensol Windpump Werke	Climax Windmills	Tel: 051 44-88091/3
Institute van Landbou		Mr Piet Maritz Tel: 012 842 4279 Fax: 012 842 4282 pietm@nda.agric.za
Marlec Engineering Co.	Ruthland Wind chargers	Mrs Teresa Auciello UK
Mr E.D. Lugg	Has manufactured turbines at home.	Durban
National Electricity Regulator		Dr. W. Barnard Tel: 012 401 4616
Nelson Adams Ruud de Vaal	Ex-local agent of World Power Technologies, the manufacturer of the WHISPER range of windchargers. There range include models from 500W to 4.5	Mr Nelson Adams Tel: 021 982 3775 nelson_adams@hotmail.com http://users.iafrica.com/a/ar/artech/adams/

	KW.	Cape Town
Power People Manufacturing		Mr Willem Pretorius Tel: 011 86811154
Powervision		Mr Duncan Kerridge Tel: 09263 4 771581 power@harare.iafrica.com Zimbabwe
Proven Engineering		Mr Gordon Proven Scotland
Referal		Mr Jaques de Wet Tel: 023 231 0055
S.E. Systems	Windseeker WT AIR wind modules Hybrid Power Systems	Mr Peter Holford Tel: 27 11 465-7341 Fax: 27 11 465-7306 info@sesystems.co.za www.sesystems.co.za
Shell S.A.		Mr Herman Bos Tel: 031 266 1282 Cell: 083 632 0395 meterexp@iafrica.com Mrs Elize Gothard Tel: 031 265 1260 Cell: 082 452 8232
Shell Solar		Morne Biegemann Mr Barry Fontini Mr Werner Greet Tel: 011 315 5590
Solarwind	Solarpanels + small wind turbines (300 Watt to 50 kW)	Tel: 011 396-2275 Fax: 011 396-2248 info@solarwind.co.za (Nancy)
SOUTHERNN CROSS INDUSTRIES/CLIMAX	Local manufacturer of windmills. Partner of CLIMAX!	info@southx.co.za
Spektrogen	Locally manufactured waterpump/airlift water pumping	Mr Dawid de Beer Tel: 0151 6527
Stewart&LLoyds		Mr Gilbert William Tel: 016 421 3260
Turbex	Water windmill import from USA	Tel: +27 827738496 Fax: +27 58 6222019
WATER RESEARCH INSTITUTE		Dr. Backeberg Tel: 012 330 0340
West Land Charger	Locally manufactured 300W charger – currently looking for partner to manufacture	Gary Eigner Tel: 02842 42587
“WINDMILL” Museum in Loerifontein		Mrs. LOUW Tel: 027 662 1074