OPPORTUNITIES IN THE RENEWABLE ENERGY SECTOR IN NAMIBIA

FINAL REPORT

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Executive summary

The renewable energy sector in Namibia is in a critical development stage. Currently the focus is mostly on eliminating barriers to making the usage of renewable energy technologies more pervasive in everyday life. The emphasis has largely been on photovoltaics and its use at the household level. Other initiatives include the Namibian Renewable Energy Programme which seeks to remove barriers to the use of renewable energies – investigating the legislative framework, the role of taxes and import duties and the removal of first costs to improve the economic viability of renewable energy technologies.

Work is starting slowly on identifying other suitable renewable energy sources in Namibia, specifically wind and bio fuels. Most of the work done in these areas is in the testing phase although licenses have been issued for the development of wind farms to be connected to the national electricity grid. There are certain factors that still hamper the development of the renewable energy sector in Namibia. These include: the lack of renewable energy specific legislation, the lack of tax incentives to incentivise the private sector to get involved in the industry and uncertainty over the role of the national power utility Nampower and its involvement in the generation, transmission and distribution of electricity.

This paper has focused on some of the areas that may be of interest to potential Indian investors in the renewable energy sector in Namibia. The development of this paper has been constrained by the lack of comprehensive terms of reference to use as a guide of what is to be expected of the output and as such the paper represents the authors own attempt at providing information to potential investors given time and budget constraints. This paper is by no means an indication of the viability of the renewable energy sector in Namibia for potential foreign investors but is meant more to serve as background and rather as a starting point for more comprehensive economic feasibility studies.

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List of acronyms

ECB	Electricity Control Board
GEF	Global Environmental Facility
GRN	Government of the Republic of Namibia
IPP	Independent Power Producer
MME	Ministry of Mines and Energy
MoF	Ministry of Finance
MTI	Ministry of Trade and Industry
MOU	Memorandum of Understanding
NAMPOWER	Namibia Power Corporation
NAMREP	Namibian Renewable Energy Programme
RE	Renewable Energy
REEE	Renewable Energy and Energy Efficiency
RED	Regional Electricity Distributor
RET	Renewable Energy Technology
SAPP	Southern Africa Power Pool
SET	Solar Energy Technology
UNDP	United Nations Development Programme
USD	United States Dollars

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1. Namibia country profile

Namibia's is a small open economy continuously attempting to diversify out of primary economic activities like mining and agriculture, with these contributing approximately 20% to GDP in 2005 (Bank of Namibia 2006). South Africa is its largest trading partner and as such the country has a host of South African multinationals operating in sectors across the economy from mining to fast moving consumer goods (FMCG) and financial services.

The country is not able to attract the kind of FDI (Foreign Direct Investment) it needs to reverse the unemployment situation from the current 36.7% (IRIN 2006). Even with developed economy type infrastructure in the form of roads, ports, power, telecoms and internet access the country still relies predominantly on primary economic activities. The recent surge in commodity prices has helped fuel growth as the mining sector (particularly Uranium) has received renewed interest from foreign mining companies due to an upswing in commodity cycles. Though welcome, as it allows for greater inflows of FDI, the mining sector is unable to provide the backbone of long-term sustainable growth as both resource reserves and commodity cycles eventually decline.

Real GDP was estimated to have slowed to 3.2 percent in 2005 after a robust growth of 5.9 percent in 2004. The slow pace of growth during 2005 was as a result of a decline in value-addition in the primary industries, particularly due to the poor performance of the mining and fishing sectors. In 2005, inflation was estimated to be 2.2 percent, the lowest inflation rate since independence in 1990, down from 3.9 percent in 2004. Inflation is currently at

The 2004/2005 financial year realised a budget deficit of 3.6 percent of the GDP, which was lower than the 7.2 percent in 2003/2004. The actual outcome during 2004/2005 was, however, higher than the 1.7 percent which was estimated in the main budget.

In December 2005, Namibia was assigned a 'BBB' rating for domestic long-term debt, and a 'BBB-' rating for long-term foreign debt by Fitch Ratings. Foreign currency reserves, expressed in terms of the Namibia dollar increased to N$1,861 million by the end of 2005. This level of reserves provides 1.3 months of import cover, slightly lower than the 1.4 months of import cover during 2004. The decline was a result of the increased costs in the import of goods due mostly to a stronger Rand.

2. Renewable energy in an African context

a. Introduction

Strong economic development in many emerging countries has triggered rapidly rising demand for electric energy and intensified competition in the oil market.

Against this backdrop of higher fossil fuel prices, supply constraints and the detrimental effects of traditional production methods on the environment the importance of renewable energy to generate electricity cannot be overstated. According to the Renewable Energy Policy Network for the 21st Century (REN21) 39 countries have defined expansion targets for renewable energy sources and introduced promotion mechanisms, nine of which are developing or emerging economies. US $ 15 billion of all new investment into renewable energy resources was invested in developing and emerging economies.

Solar photovoltaic (PV) systems are widespread in Africa, this renewable energy source is still relatively limited in Namibia. In Kenya, Zimbabwe, Senegal, Tanzania, Nigeria and Ghana the use of solar energy systems is pervasive. In Ghana, for example, the number of PV systems rose from 337 in 1991 to 3490 in 2000, or from 160kW to 693kW in total (PWC 2006).

Efficiency of photovoltaic cells has improved significantly and manufacturing costs should continue to fall internationally. However, during a UNDP Global Meeting on ICT Development on GSM coverage in Africa held in Port St. Johns, South Africa during July 2003, it was stated that solar cells by a well-known international manufacturer cost US$0.7/watt to manufacture, but sells for $3.00/watt internationally" (PWC 2006). These and other anecdotes are evidence of the decreasing cost of manufacturing brought about by increased investment in research and development by developed and developing countries alike. Figure 2.1 below gives an indication of the share of the different types of energy available in Africa by source.

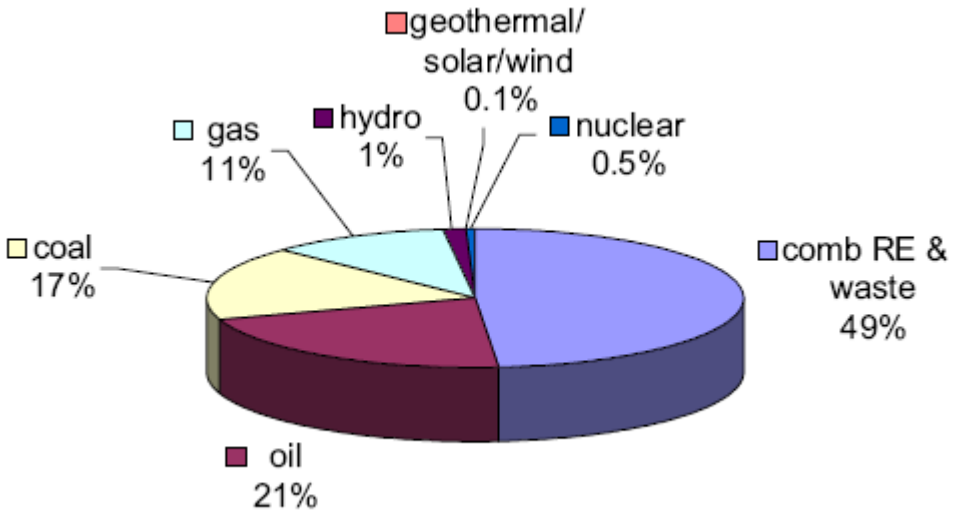


Figure 2.1: Share of total primary energy supply in Africa in 2001
Source: World Bank (2003); cited by Amigun *et al* (2006)

b. Kyoto Protocol and emissions targets in the CDM context

Namibia ratified the Kyoto Protocol on 4 September 2003. The country has yet to appoint the appropriate designated national authority (DNA). As a result no Clean Development Mechanism (CDM) projects can be implemented in Namibia, nor have any plans been laid for CDM projects involving renewable energies.

Article 12 of the KP provides that any Annex-I country, or any licensed legal entity of Annex-I country, is allowed to be credited for emissions reductions achieved by investing in projects located in developing (or non-Annex-I) countries. Thereby profiting from lower abatement costs in the host country. “The CDM is intended to support the sustainable development of host countries, since Annex-I countries are expected to contribute with financial resources and technology transfer in the realization of projects that would not have been implemented without the incentive of gaining tradable certified emission reductions (CERs). CDM projects are thus beneficial for both the investing and the host country but also for the whole planet, since non- Annex-I countries are not subject to binding emission ceilings and their development is still strongly coupled with rapidly increasing emissions” (Georgiou *et al* 2008).

In a study conducted in 2007 to determine whether CDM contributes to a higher internal rate of return (IRR) for wind energy projects the results of the analysis show that only a few of the examined countries fulfil the necessary conditions for being considered as potential host countries for wind energy projects. Even if the wind energy potential is sufficiently high, the overall economic return might be

low mainly because of low electricity tariffs. It is also revealed that the CDM is not effective enough to transform a project with low economic return into an appealing investment opportunity. Instead, it should be seen as an instrument to minimize the risk of relevant investments in already attractive locations. More specifically, the factors related with CDM revenues, namely the baseline emission factor and the price of CERs in the carbon market have a very small impact on the project's profitability. The performed sensitivity analysis shows that investment cost and electricity tariffs are the decisive parameters influencing economic return, together with the load factor of the specific site (Georgiou *et al* 2008).

3. The energy situation in Namibia

a. Installed capacity

The national power grid in Namibia is fed by three domestic power plants and inputs from neighbouring countries into the interconnected system. With a rating of 249 MW, the Ruacana hydroelectric power station is the largest contributor in terms of domestic capacity.

Namibia also has two thermal power stations: the coal-fired Van Eck plant near Windhoek with 120 MW, and the 24 MW Paratus plant near Walvis Bay, which has four diesel generators.

The two thermal power plants were only installed as an interim solution, because the hydropower plant at Ruacana was not completed until much later than planned. Originally it was assumed that Ruacana would be able to provide enough electricity for the entire country. However, since demand for electricity has increased rapidly since then, not only are all three plants still in operation, but roughly half of all electricity consumed in Namibia now has to be purchased from neighbouring countries (Loy 2007).

The electricity supplied by South Africa is less expensive than that generated by the country's own thermal power plants. These are therefore only used during periods of high peak load. The maximum capacity for importing electricity from neighbouring interconnected grids is 600 MW. The capacity available within the country has remained unchanged since 1999, and comprises the following:

Table 3.1: Available capacity by source, 1996 – 2006

Ruacana, hydropower	249 MW
Van Eck, coal-fired, Windhoek	120 MW
Paratus, diesel generators, Walvis Bay	24 MW
Interconnection with neighbouring grids	600 MW
Total	993 MW

Source: Nampower; cited by Loy 2007

b. *Power transmission and distribution*

Namibia has a well-developed transmission network emanating from Windhoek. The main transmission line dissects the country from north to south, because the Ruacana Hydro Power Station is situated on the border with Angola and point at which the Namibian grid connects with the South African grid is at the southern border. Due to greater transmission efficiency Namibia managed to reduce its power transmission losses from 9.8% to 5.1% between 2001 and 2005.

Table 3.2: Development of the Namibian transmission and distribution network

Transmission and distribution lines	2001	2002	2003	2004	2005
	km				
400 kV	735	988	988	988	988
330 kV	521	521	521	521	521
220 kV	1,664	1,664	1,958	1,958	1,958
132 kV	1,166	1,388	1,462	1,588	1,656
66 kV and below	13,223	14,194	16,357	20,762	22,072

Source: Ibid; cited by Loy 2007

Nampower manages the transmission and distribution system in Namibia. Their major challenges include: electricity market restructuring in the SADC Power Pool, security of supply concerns due to a shortage of generation capacity in Namibia and the resultant effect this has on Namibia and the integration of newer

generation technologies such as renewable energy. The fragility of reliance on South Africa to meet Namibia's power demand was exposed in September last year when Eskom (the South African power utility) cut its energy supply to Namibia from 238 to 208 MW.

c. *Power consumption*

Demand for electricity in Namibia has increased considerably in recent years. Contributing factors include:

- the commissioning of the Scorpion zinc mine in 2004 (the mine consumes about 25% of Namibia's overall power demand)
- inadequate planning to develop sufficient domestic capacity in time
- an over-reliance on South Africa to supply power

Table 3.3: Major electricity user groups in Namibia

Electricity sold	2001	2002	2003	2004	2005
	GWh				
Namibian users	1,981	2,082	2,117	2,301	2,349
Scorpion zinc mine	-	-	76	471	596
Botswana	2	4	7	8	12
Angola	5	6	10	12	16
Eskom (South Africa)	62	44	36	3	3
Total	2,050	2,136	2,246	2,795	2,976

Source: Nampower; cited by Loy 2007

Figures 3.1 and 3.2 below give an overall indication of the historic increasing trend of electricity consumption in Namibia.

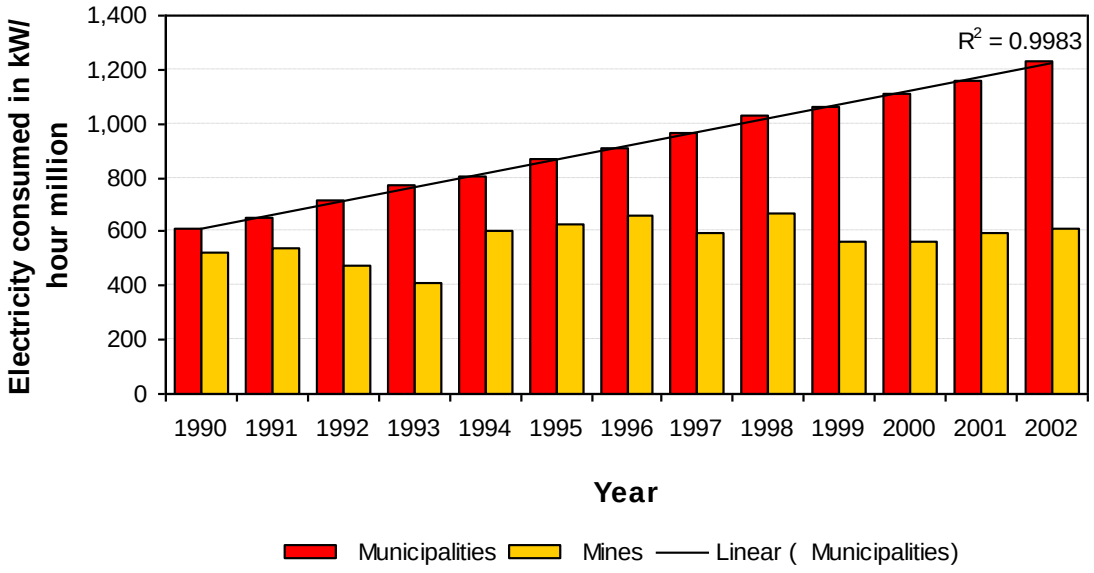


Figure 3.1: Namibia's historic electricity consumption
Source: Willemse 2004

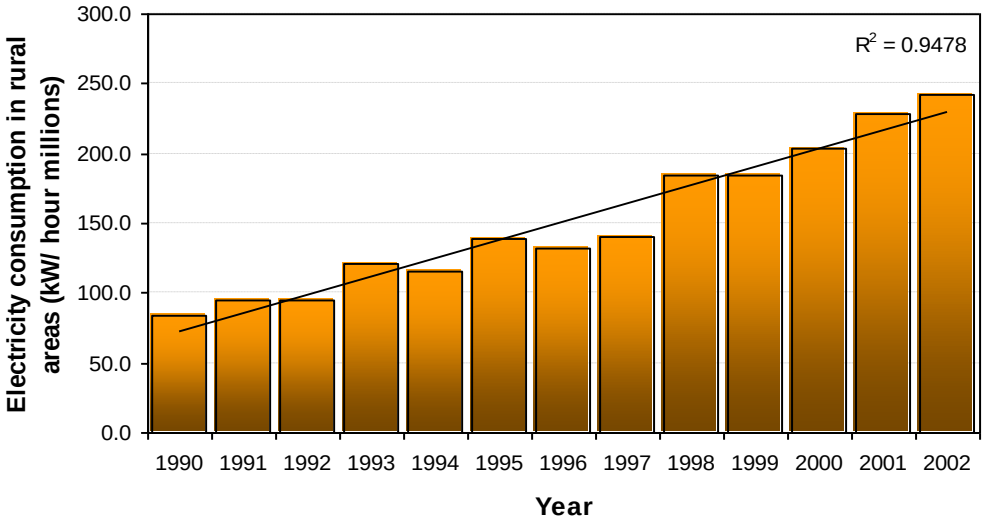


Figure 3.2: Rural historic electricity consumption in Namibia
Source: Willemse 2004

d. *Rural Electrification*

"Just fewer than 1.5 million people, or 72% of the Namibian population, live in rural areas. Of the 2,855 villages to be found in Namibia, roughly 2,400 still have no link to the national power grid. One hundred and thirty-one villages are situated in officially declared off-grid areas, but the Ministry of Mines and Energy

plans to get the remainder connected to the grid within the next 20 years" (Loy 2007).

Since independence in 1990, rural electrification has added approximately 8,330 households in 400 settlements to the national power grid. Namibia launched a rural electrification programme in 1990. The Rural Electricity Distribution Master Plan from the year 2000 covers all future electricity customers in the country that have not yet gained access to electricity. The master plan includes provision for both grid-connected power and decentralised electrification with the aid of renewable energy. Various attempts have been made at rural electrification with solar systems. These PV systems are purchased by home owners with funds secured through the Home Power! Programme.

A fee-for-service model was tested in the village of Ovitoto in 2002. 100 households were equipped with solar systems, and only the electricity consumed was paid for using a prepayment system. In such a thinly populated area of Namibia, however, system maintenance and accounting proved uneconomical. Consequently, the systems were transformed into "normal" solar home systems in 2004, and the users now pay a monthly fixed rate until the respective system is paid for in full and they assume ownership.

In addition to isolated grids and home solar systems, Namibia also has a number of off-grid areas suitable for electrification with small independent solar networks. Solar energy combined with other sources of renewable energy, such as wind energy or diesel power, present an alternative to traditional sources of energy. In 2004, the Gobabeb Desert Research Station in the Namib Naukluft Park commissioned a PV-diesel hybrid facility with a rating of 26 kW/hr to serve a network of 25 consumers (Loy 2007).

e. *Electricity prices*

Electricity prices for end-users vary slightly from region to region. The total price is comprised of a demand rate and a unit rate.

Some regional providers also levy a monthly service charge. Each kWhr of electricity purchased carries a fee equivalent to 0.0072 US cents that goes toward financing the ECB.

RED's set their own prices for their respective service areas but must have them approved by the Electricity Control Board. All providers obtain their electricity from NamPower, which charges 0.0315 USD/kWhr. The last price increase (+ 9.5%) took effect in July 2005.

f. *Future development and expansion planning*

NamPower expects peak load demand to rise to approximately 600 MW by 2011. The South African power producer Eskom supplies approximately half of Namibia's electricity requirement. The company has announced that it will no longer be able to supply electricity to neighbouring countries in the near future.

Government of Namibia is striving to become less dependent on imported electricity by securing enough generating capacity of its own to satisfy the country's needs. The most important of these efforts include the development of the Kudu natural gas field, which is situated about 130 km off the coast of Namibia (see Chapter 4 for more information on this project)

i. Restructuring Namibia's electricity sector

In 2000 Nampower started restructuring its operations. This process will be finalised with the establishment of the two remaining REDs in the southern part of the country in 2007 and 2008. The company will then comprise core areas: power production, power transmission and power trading.

Power trading will remain an independent division of the company associated with power transmission. This makes Nampower the single buyer of electricity for the Namibian market.

There is no consensus on the exact scope of activities for a single buyer. The ECB considers the single-buyer model as a transition towards a further liberalised electricity market in which producers and providers can conclude contracts of supply directly with one another. NamPower, however, believes that the single-buyer model is unsuitable for the Namibian electricity market.

Presently, the close linkage between power trading and NamPower's other two divisions (production and transmission) makes this state-owned enterprise the dominant player in the electricity market. When the restructuring has been completed Nampower will no longer be a power provider. The plants and customers will pass to the new regional electricity distributors (REDs).

No other plans to privatise the company or split off any of the division have been mooted.

g. *Market participants*

i. Nampower

Established in 1964, Nampower is now a corporation wholly owned by the Government of Namibia. NamPower operates the country's three power plants and the national power grid. The company supplies electricity directly to a number of customers who are situated beyond the reach of local power providers (these are mostly mines). As a member of SAPP, Nampower buys and sells electricity regionally through its energy trading division.

ii. Regional Electricity Distributors (REDs)

Historically Namibia's different municipalities organised the local supply of electricity to end-users.

Tariffs were set by local authorities. The restructuring of the Namibian energy sector means that the municipal power suppliers will be grouped into five large utility companies called Regional Electricity Distributors (REDs).

In their respective regions, the utilities have the status of independent enterprises managed according to market-economy principles. They are regulated by the ECB. Said regulation will include approving end-user prices and setting electricity supply standards.

The old municipal power providers will share ownership of the new REDs in the same proportions as their prior participation in the distribution of power within their respective districts. For the time being, NamPower will hold an average of 28 % ownership of all five new companies.
Three of the five REDs have already gone into business (NORED in 2002, Erongo RED and CENORED in 2005). In the regions allocated to the two remaining REDs (Southern RED and Central RED) the integration of the municipal providers is progressing well (Loy 2007).

iii. Electricity Control Board (ECB)

The Electricity Control Board was established in accordance with the provisions of the Electricity Act (Act 2 of 2000) for the purpose of regulating the electricity sector and ensuring that the electricity market develops in a manner to reflect the interests of all stakeholders.

The ECB is responsible for issuing licenses to all market participants engaged in the generation, transmission, distribution, sale and import/export of electricity in Namibia. The application and awarding procedures were established within the ECB and are being successfully applied. To date, NamPower and the five REDs are still the most important licensees following the restructuring of the electricity sector (Loy 2007).

The ECB's independence is limited by the fact that the Ministry of Mines and Energy (specifically the Minister) is responsible for authorising the granting of all licenses. The ECB merely makes recommendations after having examined and evaluated the incoming license applications. The further fact that the ministry has in several cases disagreed with the ECB experts' recommendations leaves room for conjecture that the views of the ministry and the ECB are liable to diverge on issues regarding developments in the electricity sector (Loy 2007).

4. Energy initiatives underway in Namibia

Interest in Namibia's energy sector has grown considerably over the last three years. The reasons have included: electricity generation shortages in South Africa, an increase in the price of Uranium and favourable wind and solar regimes which make the production of renewable energy feasible. Below is an outline of some of the energy initiatives (traditional and renewable) currently underway in Namibia.

a. 400MW Base-load power station at Walvis Bay.

Due to increased demand for energy from mines in the Erongo region the region is becoming one of Nampower's larger load centres. Nampower has already issued an Expression of Interest (EOI) for interested parties to conduct a feasibility study for the proposed power plant. It is expected that the power plant will be an IPP initiative with Nampower guaranteeing off-take of electricity produced or potentially taking an equity stake.

b. Kudu gas-to-power Project.

This project is considered very important to Namibia's endeavours to secure stable supply of electricity in future. The following are the major project deliverables.

- Construction of a pipeline to pump gas from the gas-field to the onshore power plant.
- Construction of a gas conditioning plant onshore to ensure gas is delivered to specification required by the power plant.

- Construction of a 450/800MW CCGT power station on the Namibian coast just north of the Namibian-South African border.
- Construction of a GIS Substation to interconnect with transmission.
- Integrating transmission with the Namibian and South African energy grids.
- Construction of pipeline from Uubvley, Namibia to Atlantis, Cape Town to supply the new Ankerlig power station with gas.
- Conversion of the Ankerlig power station's gas turbines from OCGT to CCGT.

c. Baynes hydro-power project.

This project has been on Nampower's radar for more than five years now. It ran into trouble after it was discovered that the initial site at the Epupa Falls will have a detrimental effect on the communities living along the Kunene River. A smaller site at the Baynes Mountains has now been identified. The Namibian and Angolan governments through the PJTC (Permanent Joint Technical Commission) have initiated a feasibility study which will be completed within two years.

d. Orange River hydro-power projects.

These initiatives are at the conceptual stage and were mooted at a meeting between President Hifikepunye Pohamba and President Thabo Mbeki in mid-2007. Cooperation between Namibia and South Africa on projects on the Orange River is hampered by the unresolved issue over the location of the border between the countries. The governments are required to sign an inter-governmental MOU to allow the parties to proceed irrespective of the unresolved border dispute. This project requires monitoring and is at present not a priority.

e. Westcor

The development of the Inga-3 power station is now associated with the Western Power Corridor (WESTCOR), a joint venture company registered in Botswana. WESTCOR aims to transmit power from Inga-3 in the DRC to South Africa via Angola, Namibia and Botswana. Once the WESTCOR Joint Venture Company is formed, equal equity contributions from the five national utilities and their chosen partners will make up the equity portion and security package for the debt portion of the project financing. International financiers will be encouraged to participate and to take up debt financing. Considerable support is also expected via the NEPAD initiative. There are three main components in the implementation of the WESTCOR project:

- The development of the Inga-3 power station is estimated to cost US$3.74 billion
- Two 1,500MW converter stations will be constructed at a basic cost of approximately US$421 million each, totalling US$842 million. Upgrades for the two existing stations along the lines will be included in the HVDC installation cost.
- Converter stations - HVDC transmission lines: The two South African termination points are 3,000 to 3,500 km from Inga-3. The total estimated cost for the transmission lines, including the terminations in South Africa, is US$652 million.

Progress to date:

- An Inter-Governmental MOU on co-operation for the development of the Western Power Corridor project (Westcor). The MOU was signed on 22 October 2004 in Johannesburg, South Africa.
- Following the signing of the Inter-Governmental MOU, the Chief Executives from the five national power utilities also signed an Inter-Utility MOU.
- The Member Utilities to reaffirm their commitment of USD 100 000 as start-up capital to fund the operations of the project office and their contribution to be deposited in the Escrow Account in Botswana.
- The launch of the 20 months pre-feasibility studies at the cost of USD 2.5 m.
- Urged Member Utilities to support the launch of a 44 months feasibility studies at a cost of USD 4 mil

f. Wind Energy Projects.

- Nampower has identified sites along the Namibian coast that provide favourable wind regimes. Particularly north of Luderitz (a town along the south coast of Namibia). However, current transmission interconnections at Luderitz can only absorb a maximum of 40MW.

- Aeolus Power Generation Namibia is a joint venture between the United Africa Group and a Dutch investor. They have been granted a license to generate energy by the Electricity Control Board. They plan to establish 102 wind turbines in wind parks at Luderitz, Oranjemund, Henties Bay, Swakopmund and Walvis Bay. They expect to generate up to 92MW from these farms at a cost of N$ 0.25/KWh. They are exploring an electricity off-take agreement with Nampower at N$ 0.35/KWh. It has however been reported that the company may start with 40 MW instead of the planned 92 MW due to wind capacity constraints at its main site at Luderitz. Under the conditions of the license they have 12 months from May 2007 within which to conclude the off-take agreement with Nampower and conclude an EIA.

- Belgian company Electrawinds NV has applied to the ECB for a wind electricity generation license which will enable it to set up two farms with a

total capacity of 100 MW. The company plans to sell the generated electricity for € 0.08/kWhr, reducing this to € 0.04-0.06/kWhr.

- Testing for wind speeds at Mile 7 close to Walvis Bay has revealed positive results. It is the only network connected wind turbine generator and was erected as a JV between Erongo RED and the Danish government at a cost of N$ 2.2m. The turbine is a successful experiment to study the viability of wind farming in Namibia. It generates approximately 220kW of electricity which is used to power the town's Mile 7 water reservoir and pump stations.

g. Coal-fired power plant at Walvis Bay

BINVIS Investments 37 has applied to the ECB for a license to build a 700MW coal-fired power station at Walvis Bay. It has been reported that a feasibility study has already been concluded and found the project to be viable. The company plans to generate the electricity at a cost of N$ 0.30/kWhr and sell it for N$ 0.36/KWhr. The site identified for the plant is on the harbour premises of Namport. The license application is still being processed by the ECB.

The ECB is also processing two other applications for 400 MW and 800 MW coal-fired power plants.

h. Cabinet directive on solar power

Cabinet issued a directive to install solar water heaters in all government and parastatal buildings. This is part of government's energy savings initiatives. This directive forms part of the second phase of the Namibian Renewable Energy Programme (NAMREP) and will be rolled out over 3 years at a cost of N$ 70m.

i. Diesel power plant

The ECB issued a license for a 68 MW diesel power plant to increase capacity to 210 MW by 2013. The company proposes to collect sludge (slop) from the high seas, process it to get diesel to be used to generate electricity.

j. Other developments

Nampower announced that it may mothball the Van Eck coal-fired power station if its CFL light bulb project proved successful. This plan may however be hampered by the fact that Eskom has decreased the supply of electricity to

Namibia from 238 MW to 208 MW. The Van Eck power station can generate 120 MW. The major reason for closing down the power station is the high cost of generating electricity, at 47c/kWhr it is 2.5 times more expensive than other generators which cost 19c/kWhr, in addition to being more expensive than imported electricity.

Separately, Nampower has called for tenders to begin construction on the 970km 50kV Caprivi Link Interconnector which will connect the electricity networks of Namibia, Zambia, Zimbabwe, DRC, Mozambique and South Africa. It will also make it easier for Nampower to import electricity from sources other than Eskom.

The Desert Research Foundation of Namibia (DRFN) has started a project to set up a N$ 14m power plant using invader bush. The DRFN is partnered by the Farmers' Union and the Namibian Agricultural Union in this EU funded project. The power plant will be based in the Tsumeb, Otavi, and Grootfontein triangle. One hectare of invader bush can generate between 0.5 and 2.5MW of electricity. The DRFN says that up to 3,500 gigawatt hours of electricity can be generated by this IPP.

5. Renewable energy in Namibia

The policy for the promotion of renewable energy sources are contained in the "White Paper on Energy Policy" (1998). The paper addresses issues related to planning and institutional promotion of renewable energy sources and the efficient use of energy.

In 2001, within the scope of the Namibia Renewable Energy Programme (NAMREP), with assistance from UNEP, the government planned and developed a national framework programme for the promotion of renewable energies. The programme is envisioned to include government objectives and the measures implementation of the measures required to achieve these objectives. However, the government has yet to adopt a corresponding programme.

Nampower created a new corporate division concerned with the promotion of renewable energy in July 2006. The new division will develop cooperation strategies for IPP's of renewable energy within the scope of joint ventures whilst being empowered to seal power purchase agreements with said producers. Developers and investors interested in renewable energy projects are welcome to present their development plans to this division.

In 1996 the MME started allocating money to the Solar Revolving Fund. The stated objective of the fund is to fund home solar systems. The loans are repayable over five years at an interest rate of 5%. Since 2005 the revolving fund has been administered by Konga Investment (Pty) Ltd.

The Namibian government launched the (UNDP/GEF assisted) Barrier Removal to Namibian Renewable Energy Programme (NAMREP) in 2004. The programme pursues two main objectives:

- to improve, with the aid of photovoltaic systems, access to electricity in rural areas without connection to the national power grid, and
- to help conserve fossil sources of energy while reducing Namibia's dependence on imported energy by expanding the use of solar thermal water heating systems.

The project consists of two phases. Phase 1 (promoted with USD 2.7m), which was largely completed in 2006, was devoted to eliminating organisational and technical barriers to the dissemination of solar technologies. The main barrier was a lack of both technical expertise and market opportunities for solar technology. That satisfied the prerequisites for Phase 2 (budget of USD 2.6m) which are to accelerate the roll-out of solar technologies by better accommodating available equipment and financing options matched to the actual needs of users.

Several different components are intended to help make the NAMREP programme successful, including:

- training and upgrading
- elimination of institutional, financial and technical barriers
- promotion of public awareness and social acceptance, and
- development of demonstration and pilot facilities.

The Danish Development Assistance agency (DANIDA) is cooperating with the Namibian government in the form of a bilateral Special Environmental Assistance programme, the goals of which include the sustainable production and use of energy. In 2004, DANIDA launched its three-year Namibian Renewable Energy and Energy Efficiency Capacity Building Project (REECAP), with a budget of USD 1.65m the project is focussed upon informing urban and rural populations about the opportunities offered by renewable energies while raising awareness in connection of energy efficiency.

a. Wind-powered energy

Namibia has very favourable wind conditions along the coast with wind spreads of up to 10 m per second. This makes Namibia's coastline very suitable for large-scale wind energy production. Namibia has about 30,000 wind water pumps installed throughout the country (the second highest in Africa).

The prevailing wind conditions in Namibia were investigated within the scope of a GTZ promotion programme entitled Promotion of the Use of Renewable Energy Sources in Namibia launched in 1993. In 1996 a study was commissioned by the GTZ and executed in cooperation with Nampower, detailed wind measurements were performed at two locations on the Namibian coast (Walvis Bay and Lüderitz). The purpose of these studies was to clarify whether or not the selected sites would be suitable for hosting wind farms. Meteorological and technical aspects as well as economic considerations and infrastructural matters were all given due consideration.

The Namibian wind regime is dealt with in one chapter of the InWEnt publication Wind Regimes of Africa18, where the measured data from both site studies are evaluated. The results show that Namibia has some excellent wind potentials at sites situated along its Atlantic coast.

Table 5.1: Wind measurements at a height of 50 metres

Site	Annual average wind speed [m/s]	Energy density [kWh/m²a]	Weibull parameters, A,k
Walvis Bay "Saltworks"	6.8	3,047	A=7.73 k=2.17
Lüderitz "Golf Course"	7.5	4,936	A=8.4 k=1.70

Source: Ministry of Mines and Energy; cited by Loy 2007

Analysing the recorded data, the site studies and an environmental report, NamPower decided to construct a wind farm near Lüderitz. Within the scope of a pilot project, a plant was planned with an initial rating of 3 MW and an eventual full rating of 20 MW. In December 2001, however, the Namibian Electricity Control Board refused, on economic grounds, to issue the requisite license for the project. In March 2003, the Namibian government appointed a project development team to help them define clear-cut directives regarding the production of wind-generated electricity.

The team is also tasked with spurring on the wind farm construction project in Lüderitz. It was announced in the media in early 2007 that a Danish investor is planning wind parks with a total output of 92 MW. Seventy turbines are being proposed for installation around Big Bay outside Lüderitz, and 16 each at Oranjemund and Walvis Bay. The investment outlay is in the region of USD 150 m, and the Danish Government and other donors are expected to contribute funding. An application for a power generating license has already been submitted to the ECB. Power generation is expected to cost 3.9 USD cents/kWhr and the operator is expecting NamPower to pay 5.7 USD cents/ kWhr. The plant is expected to be fully operational by 2009 (Loy 2007).

“Two of the strongest challenges to wind power’s future prospects are the problems of wind intermittency and grid reliability. transmission availability can be a barrier to wind power development. Favourable wind locations are often in areas distant from existing transmission. Building new transmission lines can be difficult due to planning barriers, land use rights and costs” (Georgiou *et al* 2008).

b. Solar-powered energy

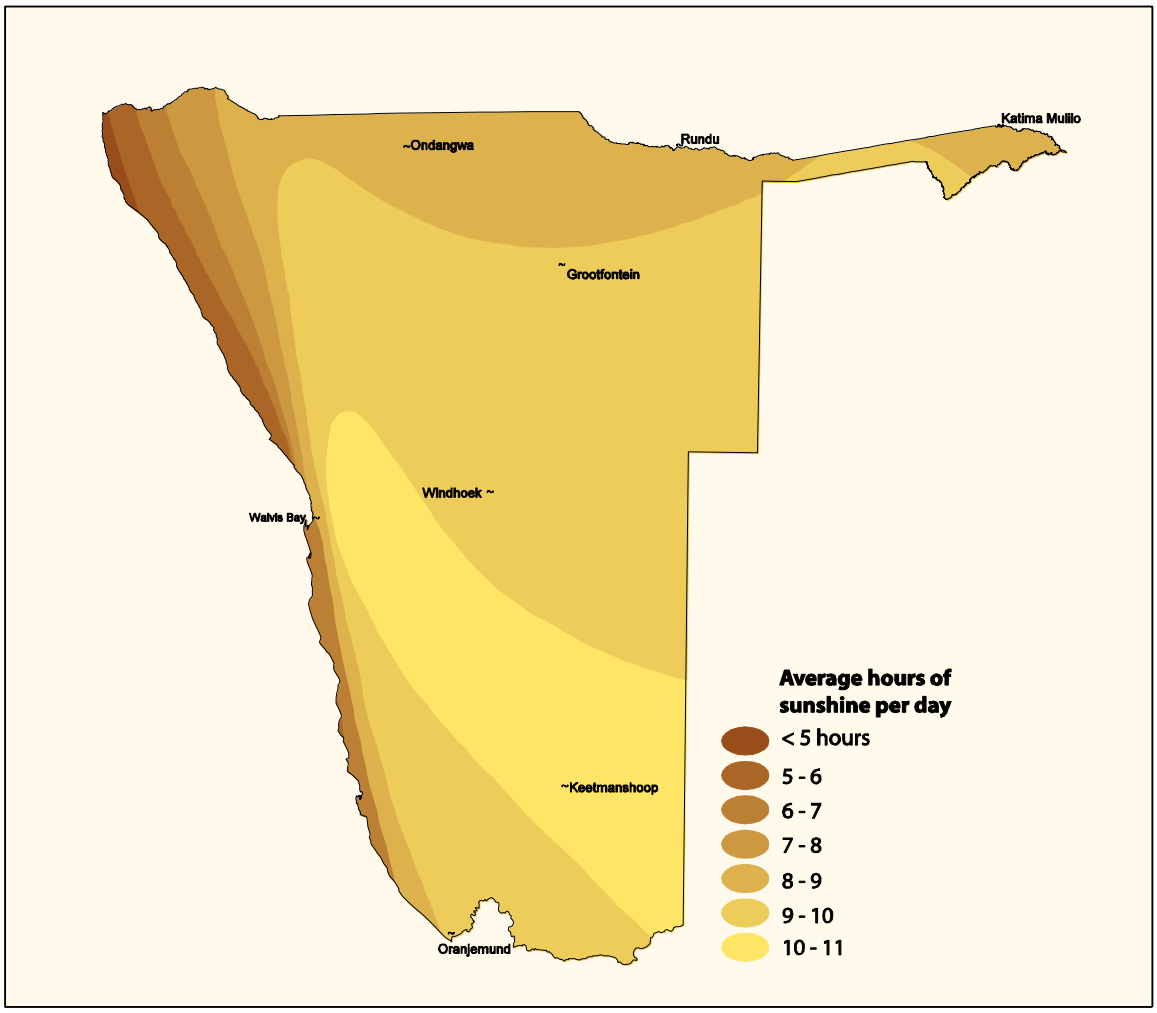
Namibia experiences one of the highest solar radiation levels in the world, averaging around 3,300 hours of sunshine per year with an annual mean solar radiation of 2,200 kWhr/m^2. The southern most parts of the country easily experiences up to 11 hours of sunshine per day (see figure 7.3 below) and recorded direct solar radiation of 3,000 kWh/m^2/year (IET 1999; cited by

Willemse 2004). These levels of radiation make the conversion of solar radiation to electric energy feasible.

In large parts of Namibia the daily insulation rate exceeds 6 kWhr/m^2. Even in the less sunny coastal regions, rates to the order of 5.5 kWhr/m^2 can be expected. The whole country experiences, on average, more than 300 days of sunshine per year. The average daily sunshine duration ranges between nine and ten hours. This gives Namibia excellent meteorological prerequisites for the utilisation of solar energy.
The Namibian government took measures, falling within the scope of the NAMREP programme to improve the conditions for harnessing solar energy.

Efforts thus far are focussed on three technologies: solar home systems (SHS), photovoltaic water pumps for wells, and solar thermal water heaters.
Market analyses, technology application scenarios, feasibility studies and technical guidelines have been developed for all three principal applications of solar energy within the scope of the NAMREP programme (Loy 2008).

Figure 5.1: Average hours of sunshine per day across Namibia
Source: Mendelsohn et al 2002; cited by Willemse 2004



i. Photovoltaic

Between 600 and 700 rural households with no access to the public power grid received small solar systems through the GRNs Home Power programme. Such systems are still being financed via small, low-interest loans from the aforementioned Solar Revolving Fund and through local commercial banks such as Bank Windhoek. According to the Ministry of Mines and Energy, more than 1000 solar home systems had been installed in Namibia by July 2006.

An on-grid photovoltaic plant with a rating of 5 kWhr was installed at the Habitat Research and Development Centre of Namibia in 2004. It is now feeding electricity into the grid operated by Nampower (Loy 2008).

ii. Solar thermal systems

In 2005 there were approximately 3,200 solar thermal water heating systems installed in Namibia, two-thirds of which were in use in private households. This relates to about 2.3% of all Namibian households with any kind of hot-water

system was using solar thermal systems. The remainder of the installed systems were serving either commercial/industrial buildings or public facilities. Between 2000 and 2005 the sale of solar thermal systems increased at an annual average rate of 16%. Now, some 200 new systems are being installed each year (Loy 2008).

The Namibian market is too small to sustain domestic production. Five different companies import solar thermal equipment from abroad, and six contractors have specialised in the installation of such systems. The main constraints to the widespread use of solar thermal systems are low electricity rates and the high first costs of the equipment (Loy 2008).
Since 2005 photovoltaic and solar thermal systems can be financed via the Solar Revolving Fund.

iii. Solar energy challenges: Financial

- High first cost of SETs;
- lack of well marketed, affordable and easily accessible financing for the purchase, installation, and maintenance of SETs;
- lack of knowledge of current and potential financiers on how to appraise applications for credit for SETs;
- lack of skills to develop business plans for the supply/manufacture and use of SETs;
- local financiers' limited knowledge of local, regional and international bulk lending facilities/modalities/instruments/lines of credit dedicated to clean development/the supply and efficient use of cleaner energy;
- lack of confidence in the returns on investment (for end-users) and loan performance (for financiers);
- comparisons of costs between SETs and business as usual technologies for equivalent energy services;
- the imposition of import/sales/installation duties/levies/taxes on SETs;
- uneven playing field between access to, and payment for, grid and off-grid electricity;
- limited linkage to sustained dedicated financing to government policy commitment to solar technologies (other than SHS);
- guarantee mechanisms are not adequate to enhance confidence in the purchase of some of the SETs, and
- inadequate financial incentives for local renewable energy entrepreneurs to bulk procure, sell, install and maintain SETs.

iv. Solar energy challenges: Technical

- non-existence of norms, standards and codes of practice for performance, manufacturing, installation and maintenance of SETs;

- non-existence of an independent SETs testing facility;
- small and dispersed size of the Namibian SETs market does not facilitate benefits of economies of scale;
- heavy reliance on imported SETs due to the limited local manufacturing capacity and infrastructure;
- manufacturers enjoy little support for local SETs development;
- conclusive techno-economic data comparing different energy technologies for equivalent energy services has not been developed locally, and international experiences are not widely known;
- little empirical knowledge of the costs and benefits of SETs is available, which often leads to decisions being made in favour of conventional energy technologies and options;
- limited availability of adequately trained human resources within the engineering consultancy, electricity utility fraternity, academia, government, financial institutions and NGOs, to undertake and provide least cost energy planning in the provision of energy services;
- energy usage patterns and associated micro- and macro-economic costs are little known and understood;
- a number of development projects in the SETs field are funded by donors, and funds are often tied to specific non-Namibian suppliers, which erodes the local demand and indigenous manufacturing capabilities; and
- due to the small market size, the industry experiences capacity and quality problems if large contracts are won.

c. Bio energy

Bio energy has a dominant position for the poorest people in the world, who are dependent on wood fuel for cooking and heating. Namibia is no exception to this fact. The country's rural population relies on wood fuel for cooking, heating water and warmth. These uses however makes use of only 5 % of the energy in firewood, and consequently the workload of collecting firewood may in many instances be reduced by introducing more efficient stove-technology.

The MME reports that approximately 80% of the rural population use biomass as their principal source of energy. Countrywide, between 15% and 20% of all primary energy consumed comes from wood. A national steering committee established in 1998 is drawing up plans for the sustainable utilisation of existing biomass resources (Loy 2008).

The National Biogas Programme launched in June 2000 is being jointly administrated by the MME and the Ministry of Agriculture. With the aid of technical assistance rendered by the Government of India, ten small biogas digesters (3-5 m^3) have been installed in Namibia as part of a model project. The systems are not producing any electricity at present.

i. Jatropha

The most advanced bio-fuels project is established in northern Namibia and involves the establishment of plantations involving local communities. The plantations are of the variety *Jatropha curcas.* The project aims to qualify for carbon credits under the Kyoto Protocol's Clean Development Mechanism. In 2006 the Namibian Agronomic Board found that *Jatropha curcas* is the most suitable crop for bio-fuel in Namibia. It was found that the crop is most suited to the Kavango area and that at least 63,000 hectares would be needed to make a large scale bio-fuel venture viable. The size of the Namibian market is approximately 22.7 million litres/year (Christian 2007). There is however considerable potential for the development of bio-fuel in the rest of the SADC region as bio-fuels are still in the early development stage in most countries in the region. Namibia's geographical position in the region and the quality of its infrastructure (port, road and rail network, telecoms) makes it an excellent location to serve as a hub for such a large scale initiative.

Jatropha curcas, which has been grown in Africa and India for centuries, is already being cultivated by Indian companies for use in the production of bio-fuel. Indian companies could use the expertise they already have in the production of bio-fuels to enter a potentially lucrative market still very much dependent on traditional sources of energy.

6. Legislative framework for renewable energy

In 1998 the Ministry of Mines and Energy issued a White Paper on Energy Policy that defined the boundary conditions for the future development of the electricity sector. A study conducted on the basis of that paper and published in 2000 now serves as the foundation for the administrative Electricity Act (Act 2 of 2000) which was adopted in 2000. Restructuring of the electricity sector is also based on that same 1998 White Paper, which therefore also still serves as the foundation for Namibia's energy policy (Loy 2008).

The Electricity Act (Act 2 of 2000) gives statutory credence to the electricity sector in Namibia. The Act gives power to the Electricity Control Board (ECB) for oversight of the electricity sector in Namibia. The Act further sets out guidelines for the application of electricity generation licenses, the obligations of licensees and other general provisions pertaining to the sector. A copy of the Act can be obtained from the Author.

There is very little in the way of direct legislative regulation of the renewable energy sector in Namibia. Currently the ECB regulates energy providers and issues licenses to prospective participants in the traditional energy and

renewable energy sectors. There is however no adequate legislation to deal with the implications of grid in-feeding of renewable energy generated, RET standards, off-grid electrification, first cost reduction of RE technologies and energy efficiency.

The development of a regulatory framework for Renewable Energy and Energy Efficiency (REEE) within the electricity sector in Namibia was implemented by the UNDP/GEF/MME Barrier Removal to Namibia Renewable Energy Programme (NAMREP) Project in 2006. The primary aim of this project was to develop a regulatory framework for renewable energy and energy efficiency in Namibia. The project findings and recommendations were presented in January 2007. These recommendations are included in Appendix 1.

7. Duties and taxes on renewable energy products in Namibia

Duties and taxes together are considered one of the major constraints in the widespread use of renewable energy products. Its imposition on these products increases the already relatively high first costs of these technologies compared to other energy generating technologies. The removal of this barrier is seen as an important step in the process to incentivise households to adopt the technology.

a. Value-added tax ("VAT")

VAT is applicable on all imports of solar energy products in Namibia. Imports of these products from other SACU member countries will be free of customs duties in terms of the SACU Agreement, but not free of import VAT. Imports from outside SACU will be subject to customs duties (if applicable) as well as import VAT.

The basis for import VAT is the free-on-board (FOB) value plus an upliftment factor of 10%. The standard VAT rate of 15% is then applied to calculate the amount of import VAT payable. A rate of 16.5% on the FOB value is therefore applicable on all imports of solar energy products (PWC 2006).

Since all importers and suppliers of these products are registered for VAT, the import VAT paid may be claimed as a credit against output VAT payable to the Ministry of Finance and import VAT is therefore not a cost on the importation of solar energy products.

As part of the NAMREP Barrier Removal programme PWC recommended in 2006 that the products mentioned in Table 7.1 below remain subject to import

VAT to avoid a situation where products that will not be used for solar energy installations are exempt from import VAT. The rationale being that import VAT will not be a cost and is therefore not a barrier in lowering prices of solar energy products (PWC 2006).

Table 7.1: Solar energy products: customs classification and tariff: SACU

Product	HS Code	Customs duties (%)	Import VAT (%)
Solar panels	854140	0	16.5
Solar regulators	850450	5	16.5
Solar batteries	850780	0	16.5
Invertors	850440	0	16.5
LED lights	85392245	20	16.5
Water pumps	841381	0	16.5
Solar water heaters	84191110	15	16.5
Refrigerators	841821	25	16.5

Source: PWC 2006

b. Possible VAT zero-rating of solar systems to residential customers.

"In terms of the VAT Act, 2000, the supply of electricity to a residential account is zero-rated, i.e. free from VAT. The Receiver of Revenue in Namibia ruled that the zoning of an area in which a particular property is situated is not an acceptable basis for determining whether an account is residential or not. The actual status of each account is to be determined by the municipality and taxed accordingly. The supply of electricity to a house in a residential suburb in Windhoek used for residential purposes only will be zero-rated for VAT purposes while electricity supplied to another house in the same suburb used as offices for a business will be subject to VAT at the current standard rate of 15%. In principle, therefore, electricity generated by a solar system for domestic purposes only in a rural area not connected to the national electricity network should also be zero-rated for VAT purposes in Namibia. A potential saving of 15% on the cost of the products could be passed on to the consumer in rural areas if the supply and installation of solar energy systems are zero rated for VAT purposes. See the following comparison in this regard.

Since the VAT Act, 2000 does not specifically provide for zero-rating of the supply and installation of solar energy products, discussions were held with the

Department of Inland Revenue. It was advised that a comprehensive submission be made to Inland Revenue requesting an amendment to the VAT Act providing for the zero-rating of the supply and installation of solar energy systems in residential areas in Namibia. The submission should also spell out the financial implications for the Ministry of Finance (i.e. potential loss of revenue due to the zero-rating in this regard)" (PWC 2006).

Further to its work for NAMREP, PWC recommended that a comprehensive submission be drafted and submitted to the Department of Inland Revenue for the zero-rating of VAT on the supply and installation of solar energy products in residential areas in Namibia to enable the Ministry of Finance to propose the necessary amendments to the VAT Act, 2000.

8. Opportunities for Indian companies in Namibia

In more than one policy statement, the Ministry of Mines and Energy has come out openly in favour of an unfettered, market-oriented, transparent electricity market offering an attractive environment for private investment. Thanks to the licensing model that is being implemented by the ECB, independent actors enjoy open access to the Namibian electricity market. Independent power producers are able to inject their outputs into the Nampower-operated power grid.

Nampower provides little substantive information about transmission fees. This kind of protectionist behaviour will have to be overcome for potential IPPs to conduct feasibility studies on the profitability of the Namibian electricity market.

There are no political or legal barriers to prevent participation in the Namibian electricity market. The absence of a genuinely independent single buyer, however, makes it difficult for independent power producers to calculate their chances of making a profit. Potential providers are still too dependent upon which electricity prices NamPower deems appropriate and the conditions NamPower attaches to the purchase of electricity. Nampower's current role as a power producer and trader suggests that with increased competition a conflict of interest could develop. Given that the company will consider the profitability of its own power generating capacities in any type of cooperation scenario.

a. Developing a market for Indian companies in Namibia

In India the private sector is seen as one of the major driving forces for promotion of renewable energy technologies. There are numerous financial and fiscal incentives are available towards increased use of RET. These incentives include 100% depreciation of the asset in the first year of installation of the project, exemption from Excise Duty and Sales Tax and Exemption of Customs duty on certain components and concessional Customs Duty on the import of certain

components/equipment used for producing energy from renewable resources. In addition Indian states have been obligated to buy back energy produced from renewable resources at a minimum purchase price for the first 10 years. Further states are encouraged to provide liberal banking facilities at lower charges for energy produced from renewable resources (Bakshi 1998).

The incentives above are proof of the advanced stage and political commitment to the development and widespread use of renewable energy technologies. This is in stark contrast to Namibia which is still trying to figure out national policy on renewable energy. The country is still trying to understand the type and scope of financial incentives for the private sector. Recommendations to this effect were only made to the Ministry of Finance in 2007 by the NAMREP. The early stage of development of the renewable energy sector in Namibia and its resultant deficiencies can significantly affect the economic feasibility and profitability of new entrants into the market. As such a more comprehensive economic feasibility study is required to assess the risks more carefully and provide possible mitigating measures.

b. Market fit for Indian companies

Given the long history of renewable energy development in India the country is very well suited to use this competitive advantage by deploying the technologies, skills, policy, incentives and financing for the development of renewable energy industries in other countries. Specific sectors that could prove profitable for Indian companies at this stage would include:

Solar energy

Photovoltaic panels for household use in particular for off-grid electrification. If Indian companies have, through R & D, developed ways to make this technology cheaper it could most certainly compete well in the Namibian market. Large solar energy fields can also be viable provided an off-take agreement can be reached with the national power utility for the purchase of the electricity produced.

Wind energy

Several licenses have been issued by the ECB for the generation of electricity from wind farms. These are still relatively small projects but are all somewhat reliant upon off-take agreements with Nampower, which still have to be concluded. Duty free access to the Namibian market for wind energy technology and a competitive purchase price for the energy produced would be factors which would significantly influence the viability of projects in this sector.

Bio-energy

There are some pilot projects underway in this sector. The fuel price and its upward trend currently make the development of bio-diesel very profitable. In Namibia constraints would include product awareness of consumers and retailers (which is relatively low), the lack of a legislative framework and reliable sources of feedstock. Jatropha has been touted as the answer due to the hardiness of the plant and the fact that it already grows wild in Namibia. Indian companies already active in the production of Jatropha to bio-fuel would have a strong competitive advantage in what is still a virgin market.

9. Access to finance

Namibia's banking sector has traditionally been accused of conservative lending practices. Though this charge is mostly anecdotal, research would suggest that there may be some truth to the proposition. For instance the non-interest income banks earn in Namibia has grown from 47-60% of interest income between 1998 and 2003 (Boer and Sherbourne 2003). This suggests an increasing dependence on non-interest income (Boer and Sherbourne 2003) and therefore indicates reluctance on the part of banks to engage in more risky, yet higher yielding, credit provision to small scale enterprises. Put differently, there is no impetus to engage in more risky lending practices when the work that goes into evaluating loan applications is not revenue generating and does not contribute to improved credit allocation (Andongo *et al*. 2005).

Low productivity investments result from inappropriate lending policies which fail to consider the return on investment of medium and large scale projects but provide cheap credit to them regardless of the higher yielding loans they can provide to small scale enterprises who are excluded due to the higher risk involved and the lack of an adequate cash flow history (Andongo *et al*. 2005).

Agribank is excluded from this analysis due to it being a government institution with a developmental mandate in addition to lending criteria which are relaxed to enable greater participation of previously disadvantaged individuals. The bank provides subsidised credit and has had considerable losses due to a low spread on the subsidised loans and deposits, which do not cover operating costs (Andongo and Stork 2005).

The Basel II Capital Accord is making it more difficult for banks to finance riskier business projects in that it demands that banks adhere to capital requirements which are more closely linked to the specific bank's actual credit risks. In order to conform, banks have implemented risk-based capital allocation systems which reward low risk thus promoting risk-averse behaviour by banks (Andongo *et al.* 2005).

Market size, pressure on capital markets resulting in a shortage of instruments to absorb excess cash, pending changes to pension fund legislation, skills

shortages and a traditionally conservative investment community are all factors intensifying competition among non-bank lending institutions. There is increased competition in the management of money market funds from Stockbrokers who are also increasingly active in sophisticated financial services such as financial arranging and advising.

Banks have traditionally shunned the more risky untested technologies in Namibia. Bank Windhoek has however been giving loans to households who wish to install solar water heaters. Loans range between USD 1,250 and 1,900 and are generally repaid at prevailing prime interest rates (currently 15.75%) over 3-5 years. With the power situation in Namibia becoming more untenable as Nampower has started a programme of load shedding and scheduled power cuts more banks have started financing assets such as diesel generator sets and solar water heating systems.

Even though there are some financing constraints in Namibia due mostly to a conservative banking sector there is grant funding available mostly through the Global Environmental Facility and administered in Namibia by the UNDP. These are all considered on a case by case basis and has mostly focused on the requirements necessary to prepare the groundwork for the development of a renewable energy sector in Namibia.

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