

# PLANNING POWER:

REVIEW  
OF ELECTRICITY POLICY IN  
NAMIBIA

RESEARCH REPORT NO.11

Institute for Public Policy Research



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# **PLANNING POWER:**

## **REVIEW OF ELECTRICITY POLICY IN NAMIBIA**

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**EMBASSY OF FINLAND  
WINDHOEK**

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# FOREWORD

The idea for this review of electricity policy in Namibia emerged in 2008 – a time when talk of power shortages and possible blackouts was rife in Namibia and other parts of southern Africa. In fact, such a gloomy scenario did not develop in Namibia. However, it was clear that a review of electricity policy could be timely and helpful stimulus to further policy debate and formulation. This was particularly the case as the White Paper on Energy was more than ten years old and much had happened in the intervening years.

This report is broad in scope in that it covers various aspects of the electricity industry. The chapters draw on analyses by several electricity sector experts. Mixed in with these analytical pieces are interviews with several leading players in the electricity industry.

The report makes several recommendations which we hope will prompt further thinking, research and analysis about policy options in the electricity sector. As such the report is structured in a way that is very much in keeping with the IPPR's mission to produce independent, analytical, critical yet constructive research on social, political and economic issues that affect development in Namibia.

The IPPR would like to thank Matthias Schmidt who has coordinated and edited this publication. In addition, we would like to extend our gratitude to the authors of the various chapters – Kudakwashe Ndhlukula, Matthias Schmidt, Detlof von Oertzen, Consulting Services Africa – and the three officials who made themselves available to be interviewed – Mines and Energy PS Joseph Iita, Nampower Managing Director Paulinus Shilamba, Electricity Control Board Chief Executive Officer Siseho Simasiku.

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Any feedback on the contents of the report can be sent to the IPPR at the contact details below.

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# EXECUTIVE SUMMARY

This study assesses the status-quo in Namibia's electricity sector, and develops proposals on policy and planning that would help the country overcome the energy challenges it faces. It has two broad aims: firstly, the scope covers a variety of areas from electricity generation, to a focus on the potential of renewable energy sources, to rural electrification and demand side management issues. Secondly, the report is deliberately broad in scope and reflects different points of view by drawing on a variety of Namibian electricity sector experts. It also includes interviews with three of the most prominent movers and shakers in the sector.

The three Namibian power stations currently in operation, namely the coal-fired Van-Eck power plant, the hydroelectric power station Ruacana on the Kunene river and the diesel-fired Paratus station in Walvis Bay, only provide about half of Namibia's electricity demand, with the rest being imported from the region, mainly South Africa. In order to attain the objective of improved security of electricity supply, as proclaimed in the 1998 White Paper on Energy Policy, a number of generation projects have been pursued since the 1990s, but so far none of them have come to fruition.

There is no single supply option that optimally and simultaneously satisfies the economic, social and environmental objectives. Individually, some options are economically efficient, but they do not maximise the use of indigenous resources. Other options maximise the use of local, renewable resources, but are expensive and risky because base-load power is not guaranteed. A balanced future supply mix must consider all of these dimensions.

Developments in the Southern African Power Pool will have an impact on which domestic supply options to pursue. In particular, South Africa's investment programme in new generation capacity may render some local generation projects uneconomical. In order to diversify supply options and improve transmission, the Caprivi link is currently being built, linking the Namibian grid with Zimbabwe and Zambia. This will allow for higher import capacity, making the country less dependent on South Africa, which is also in line with the energy sector strategies put forward in the Third National Development Plan.

Sector governance has improved in recent years when, with the establishment of the Electricity Act in 2000 (comprehensively revised in 2007), the Electricity Control Board (ECB) was created as the industry regulator. The ECB controls and regulates the provision, use and consumption of electricity in Namibia, and

ensures proper functioning of the sector, including a competitive environment. A single-buyer market has been established with the national utility NamPower in the role of the single buyer. On the distribution side, Regional Electricity Distributors (RED) have been set up to take over the distribution function from local authorities, but so far only three of the five envisaged REDs are operational. A political issue that is yet unresolved is that the establishment of the REDs has undermined an important revenue stream for local authorities.

Cost-reflectivity in electricity pricing is to be achieved by 2011/12. This is seen as an important step in attracting sectoral investments. However, feed-in tariffs that incentivise the generation from renewable energy sources should also be introduced, not least now that South Africa has put them in place. The government's intention to expand the mandate of the ECB into that of a full-fledged energy regulator is welcomed from an efficiency point of view, but the costs and benefits of such a move are yet to be examined in more detail.

Although an Independent Power Producer (IPP) framework is in place, Namibia's electricity supply industry (ESI) is still dominated by the national utility NamPower. In fact, not a single IPP had been established as of June 2009, although negotiations are ongoing, and to this date sectoral investments are limited to those undertaken by NamPower. Sector growth is driven by supply uncertainties and strong demand growth, especially from the mining sector (with the exception of the economic slump starting at the end of 2008). At present, national electricity supply and generation targets only exist as an overall ratio of domestic supply to total consumption. Clearly articulated, numeric, mandatory targets could increase the urgency by which projects of national importance, such as the development of Baynes and Kudu, would be handled. ESI stakeholders should view such targets as incentives to diversify their supply arrangements, and utilise Namibia's rich endowment of renewable energy sources. In addition, targeted tax breaks for new entrants are essential if Namibia is to attract new investments to the sector.

From a social point of view, future policies need to pay more attention to local job creation before, during and after construction of generation projects. In addition, indirect job creation through the price of electricity needs to be taken into account. As can be expected, future supply options depending on

fuel imports create the least number of local jobs. In regard to the promotion of small and medium enterprises (SME), electricity generation from invader bush has the greatest potential to promote SME development, followed by the Baynes hydroelectric plant, the development of the Kudu gas field, and the implementation of an integrated solar combined-cycle hybrid power station.

The renewable energy market in Namibia holds great potential, and is currently under-utilised. If this potential is to be exploited more aggressively, investment and market conditions have to be made more attractive. In the absence of targeted incentives, and in view of the other barriers stacked against renewable energy technologies, such as high upfront costs and lacking awareness, few investors will manage to establish themselves successfully in the country's electricity supply sector. Moreover, Namibia requires an integrated resource plan which will guide the country by ranking its resources for power generation. Specific national targets on renewable electricity are needed to provide and guide the vision of the country.

By all available estimates, only a small percentage of Namibia's rural population has access to electricity. While providing rural households with electric power yields clear improvements to their productivity and quality of life, economic considerations prohibit the country's complete electrification using conventional grid electricity. Here, the roll-out of the Off-grid Energisation Master Plan (OGEMP) must be accelerated. Off-grid technologies powered by renewable energies are suitable to provide decentralised energy services

to people in areas far away from the existing national grid. However, such technologies require well-resourced and planned implementation. A continued, systematic commitment by the government to bring affordable energy services to rural Namibia is necessary, thereby also introducing new and decentralised livelihood, learning and business opportunities.

Demand side management (DSM) measures have a very low cost-to-benefit ratio and should therefore be a principal ingredient of any future supply mix. DSM has short-term advantages in that they alleviate imminent power requirements and therefore reduce system outages, while in the longer-term they reduce the need for generation capacity. Enhanced DSM is also desirable from a social perspective in that they allow people to control their electricity consumption behaviours, which is also advantageous from an environmental perspective.

The establishment of an Energy Efficiency Accord and binding targets with industry – so as to set measurable action plans – could bring further improvements. This could be supported by creating a National Energy Efficiency Agency (NEEA) to coordinate energy efficiency programmes and projects. There must be forums to share best practices across firms in the industrial sector and this could be through the NEEA. The government should further conduct energy audits of its operations and energy conservation campaigns. The inclusion of energy efficiency in budgeting and policy drafting within line ministries and local authorities is recommended.



# LIST OF ACRONYMS

<b>CBNRM</b>	Community Based Natural Resource Management	<b>NREP</b>	National Rural Electrification Programme
<b>CDM</b>	Clean Development Mechanism	<b>NTCRE</b>	National Technical Committee on Renewable Energy
<b>CFL</b>	Compact Fluorescent Light bulb	<b>OGEMP</b>	Off-grid Energisation Master Plan
<b>CNG</b>	Compressed Natural Gas	<b>PV</b>	Photovoltaic
<b>CPI</b>	Consumer Price Index	<b>RED</b>	Regional Electricity Distributor
<b>CSP</b>	Concentrating Solar Power	<b>REDMP</b>	Rural Electricity Distribution Master Plan
<b>DMP</b>	Demand Market Participation	<b>REEECAP</b>	Renewable Energy and Energy Efficiency Capacity Building Programme
<b>DSM</b>	Demand-side Management	<b>REEEI</b>	Renewable Energy and Energy Efficiency Institute
<b>ECB</b>	Electricity Control Board	<b>REFAD</b>	Renewable Energy for African Development
<b>EIB</b>	European Investment Bank	<b>REFIT</b>	Renewable Energy Feed-in Tariff
<b>EMTF</b>	Energy Ministerial Task Force (SADC)	<b>RET</b>	Renewable Energy Technology
<b>ESCA</b>	Energy Shop Coordinating Agent	<b>SADC</b>	Southern African Development Community
<b>ESCo</b>	Energy Service Company	<b>SAPP</b>	Southern African Power Pool
<b>ESI</b>	Electricity Supply Industry	<b>SHS</b>	Solar Home System
<b>ESIA</b>	Environmental and Social Impact Assessment	<b>SIDA</b>	Swedish International Development Agency
<b>GEF</b>	Global Environment Facility	<b>SRF</b>	Solar Revolving Fund
<b>GJ</b>	Gigajoule	<b>SWER</b>	Single Wire Earth Return
<b>HVDC</b>	High-voltage Direct Current	<b>SWH</b>	Solar Water Heating
<b>IPP</b>	Independent Power Producer	<b>ToU</b>	Time of Use
<b>ISLM</b>	Integrated Sustainable Land-use Management	<b>TWh</b>	Terawatt-hour
<b>kV</b>	Kilo Volt (1000 Volts)	<b>WEC</b>	World Energy Council
<b>kW</b>	Kilowatt	<b>WESTCOR</b>	Western Corridor Power Project
<b>kWh</b>	Kilowatt-hour	<b>WPEP</b>	White Paper on Energy Policy
<b>LPG</b>	Liquefied Petroleum Gas		
<b>MME</b>	Ministry of Mines and Energy		
<b>MW</b>	Megawatt		
<b>MWh</b>	Megawatt-hour		
<b>NAMREP</b>	Namibia Renewable Energy Programme		
<b>NDP</b>	National Development Plan		
<b>NEEA</b>	National Energy Efficiency Agency		



Republiek



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# 1. INTRODUCTION AND BACKGROUND



This review has been drawn up with the intention of providing an overview of different aspects of the electricity sector in Namibia, and how policy has evolved over time. A critical question in this regard is whether the plans and regulations have led to real developments “on the ground” in the sector. The aim is to provide a broad scope both in terms of the relevant issues and in the reflected points of view. It was thus decided to present the report as an eclectic compilation of thematic chapters written by experts on the Namibian electricity sector. These thematic chapters cover a variety of areas, starting with generation and supply issues; to a focus on the potential of renewable energy sources; to rural electrification; and to demand management issues.

In order to take the views of decision makers themselves into account, interviews with three of the most prominent leaders in the sector are included. These leaders are Paulinus Shilamba, the CEO of national electricity utility NamPower; Siseho Simasiku, CEO of the electricity regulator Electricity Control Board;

and Joseph Iita, Permanent Secretary of the Namibian Ministry of Mines and Energy. They provide their take on current issues and the future outlook for the sector.

## 1.1 PURPOSE OF THE STUDY

The Namibian electricity sector has undergone some profound changes over the past few years. As foreseen in the Electricity Act of 2000, a regulatory body in the form of the Electricity Control Board was created; power distribution has been placed under the auspices of Regional Electricity Distributors (REDs); and NamPower, the national energy utility, has lost its monopoly status with the establishment of an Independent Power Producer (IPP) framework and the ongoing development of a single-buyer market. An Off-grid Energisation Master Plan (OGEMP) was produced and approved by Cabinet in 2007 to support the roll-out of renewable energy systems and rural electrification. However, while these are clearly important developments, a closer look

reveals that many of them are still a long way from being completed. As of mid-2009, only three of the five planned REDs were operational, while the future of Southern RED and Central RED remains uncertain. The existing REDs are faced with criticism by local authorities regarding their pricing and service delivery. And despite the IPP framework being in place, not a single IPP power purchase agreement had been signed at the time of writing. Implementation of the OGEMP had not yet started.

The first and only White Paper on Energy Policy for Namibia was published in 1998, more than ten years ago. This White Paper laid out many of the developments the sector eventually experienced, but also some areas in which not much headway has been made. It is high time for an assessment of the status-quo in the electricity sector with regards to planning and actual progress on the ground. In different areas of electricity policy, such as supply, demand management and rural electrification, this report shall provide information and stimulate debate on how the situation in the sector now is different from when the White Paper was drawn up, and how these differences should be reflected in future policies. The review ends with some concrete suggestions for a medium-term electricity scenario, recommending concrete policy steps that would contribute to achieving that vision. In that vein, this report wants to encourage the drawing up of a new, up-dated White Paper on Energy Policy that does justice to the developments of the past few years, and captures the more recent opportunities arising as a result of a maturing carbon market.

## 1.2 DEVELOPMENTS IN THE ELECTRICITY SECTOR

A number of developments have taken place in the electricity sector since Namibia's independence, most notably on the side of regulation and distribution. On the supply side, however, it is remarkable that in the past thirty years, not a single power generation facility has been added to feed into the Namibian power grid. At the time of writing, still more than half of Namibia's electricity supply was imported, most importantly from South Africa. That said, a number of projects are in the pipeline that may come on stream over the next few years; they are described in more detail in Chapter 2. The first of the three currently installed domestic power stations is the Van Eck thermal power plant in Windhoek, which came online from 1972 to 1979 in four installations of 30MW each. At around the same

time, the then-ruling South African government on the Namibian side, and the Portuguese government on the Angolan side, agreed to construct the Ruacana hydroelectric power station on the Kunene river, which runs along the border between the two territories. The station has a capacity of 249MW and was completed in 1978. The third power generating facility is Paratus, a diesel-powered back-up generator of 24MW in Walvis Bay that was also commissioned in the 1970s. This brought the total internal electricity generation capacity for Namibia to 384MW – almost the exact same figure that still applies today.

The 1998 White Paper on Energy Policy (WPEP) stipulates a target of 75% energy self-sufficiency by 2010, which will clearly be missed. In fact, local generation in 2007/08 was 48%, only marginally more than the 47% quoted in the White Paper for 1996. The intention of increasing Namibia's generation capacity has been there, with much attention going to two large-scale projects, the Kudu gas-to-power project and a second hydropower plant on the Kunene river. However, at the time of writing Kudu seemed as elusive as ever and the hydropower plant, to be located at Baynes, is still in the feasibility study phase.

While problems with planned internal generation projects are partly to blame for the failure to expand Namibia's internal generation capacity, one of the reasons is certainly to be found in South Africa, which has been providing Namibia with some of the world's cheapest electricity thanks to low-cost coal-fired power stations. These cheap imports have made internal generation projects appear uneconomical and taken pressure off NamPower to raise their supply capacity, but the downside was felt when in 2007 and 2008 the scale of under-investment in southern African electricity generation became apparent. Namibia was largely insulated from the brown-outs that affected large parts of South Africa during that period, but it raised awareness of a potential looming energy crisis across the region.

Increasing self-sufficiency is only one objective of the White Paper on Energy Policy, but it needs to be balanced with some of the other targets the government has set for the electricity sector, such as economic competitiveness, security of supply and sustainability.

Electricity imports will most certainly feature in any future supply mix, and trading within the Southern African Power Pool (SAPP) is estimated to increase further when transmission infrastructure currently under construction is completed. The SAPP comprises all members of the Southern African Development Community (SADC) except the islands of Mauritius and

Madagascar, and is intended to promote electricity trade in a single competitive electricity market in southern Africa. It was founded in 1995 by seven out of the eleven SADC members, as what was at the time the first formal international power pool outside Europe and North America. In the same year SWAWEK, as NamPower was then still called, signed a ten-year sales agreement with South African utility Eskom, guaranteeing the secure supply of South African power to Namibian consumers. NamPower signed a new 15-year agreement with Eskom in 2006, followed up by a Supplemental Agreement in 2008.

In the country's north-east, the 400kV Caprivi Link Interconnector is being built to link the Namibian national grid with the Zambian and Zimbabwean electricity networks. Already in 2007, Namibia signed an agreement with Zimbabwe for the supply of 150MW for five years from the Hwange coal-fired power plant. While the first electricity was supplied in early 2008, the finalisation of the Interconnector should improve the agreement's economy as transmission losses due to rerouting via Botswana and/or South Africa will be eliminated.

A final element in the regional energy scene is the Western Power Corridor (Westcor), which is a joint venture between NamPower, Eskom, BPC of Botswana, ENE of Angola and SNEL of the DRC. Westcor was established in 2005 under the auspices of the SAPP, and its main purpose is to work towards the realisation of the vast Inga hydropower plant on the Congo river in the DRC.

## INSTITUTIONAL DEVELOPMENTS

Concerning regulation and institutional reorganization, the most significant year in the reform of the sector was 2000, when the new Electricity Act was promulgated. The Act paved the way for unbundling NamPower's operations into generation, transmission and distribution businesses. Five regional electricity distributors (REDs) were to be set up to streamline electricity distribution to consumers. Moreover, the Act foresaw the establishment of an industry regulator, the Electricity Control Board (ECB), to watch over competition and tariff setting. Finally, the Act made provisions for the introduction of Independent Power Producers (IPP).

The setting up of the REDs has not been without problems, and by June 2009, only three of the five envisaged distribution bodies had become operational. The Northern RED (NORED) was the first RED to be established in 2002, followed by the Central Northern RED (CENORED) in 2003 and Erongo RED in 2006.

The other two distributors, Central RED and Southern RED, are still in the process of being established, but it is unclear when this process will be completed in the absence of support by a number of local authorities, most notably the City of Windhoek. While the rationale behind establishing the REDs of consolidating the many local distributors with varying tariff structures and quality of service is undisputed, there is much criticism regarding the success of this initiative. A much-quoted point is that the REDs have led to higher costs for consumers by raising prices, but this is disputed by the REDs themselves and policy makers. They claim that the critique stems from the fact that municipalities had used the electricity tariffs as a significant revenue earner, and are now struggling to make up for the losses.

Progress on introducing competition in electricity generation has been slow, and despite an IPP framework being in place, the ECB has to contend with the fact that not a single power purchasing agreement has been signed in the nine years since the Electricity Act.

## RURAL ELECTRIFICATION

Rural electrification has been high on the government's agenda since Independence; in 1991, the Ministry of Mines and Energy embarked on a Rural Electrification Programme that oversaw the electrification of more than 600 villages, mainly in the densely-populated north of the country. Later in the decade, NamPower and NORAD joined in the initiative with their own investment plans. The Rural Electricity Distribution Master Plan was adopted in 2000.

The Third National Development Plan (NDP3) stipulated a target of 20 percent of rural households to be electrified by 2012, around double the share estimated in 1991. Recent research findings by the IPPR (Briefing Paper 47, 2009) show that if the growth trend of the period 1993/94 to 2003/04 is maintained, then this target would be achieved even before then. However, the limits of on-grid solutions in terms of commercial viability are obvious: connecting remote, sparsely populated areas to the grid is costly in terms of infrastructure and the small number of consumers does not allow for these costs to be recouped. More cost-effective off-grid solutions have gained in prominence in recent planning documents, most importantly the Off-grid Energisation Master Plan (OGEMP), which is still awaiting implementation.

## RENEWABLE ENERGY SOURCES AND DEMAND SIDE MANAGEMENT

Namibia's potential for renewable energy sources has been recognised widely in policy documents, but cost considerations, among others, have so far prevented the large scale roll-out of green technologies. One of the White Paper's six overarching sector goals is sustainability, and renewables are identified as a key ingredient to achieving that goal. Tangible targets for renewable energy, however, are yet to be established. Bearing in mind that most of the country's internal generation capacity is hydropower – the Ruacana power station on the Kunene river produces almost two thirds of the total – new renewable energy sources such as solar power, wind and biomass have only emerged as small-scale, decentralised units. Of these small-scale renewable sources, biomass is the most important one in terms of kWhs consumed and acceptance by end-users. MME's Solar Revolving Fund (SRF), which provided financing for solar home systems and water heaters, was quickly exhausted. Given the demand for the SRF, an expansion of its small volume (only a little more than 1000 units were funded) should be considered.

In order to stimulate research in the sector, MME set up the Renewable Energy and Energy Efficiency Institute (REEEI), in cooperation with the Polytechnic of Namibia. The REEEI, as provided for in the OGEMP, is currently overseeing the establishment of energy shops across the regions, which will sell and promote off-grid energy solutions from renewable sources. The OGEMP therefore plays a pivotal role both for rural electrification and sustainability. However, attempts to develop larger projects that would feed into the national grid under the IPP framework have not yet been realised, although power purchasing agreements between NamPower and independent wind parks to be set up at the coast are under negotiation.

Demand side management (DSM) has also become a more prominent feature in the sector in recent years. The 1998 White Paper only states that government will investigate the pattern of energy use across sectors and assess and monitor energy efficiency in these sectors. In 2006 then, the ECB completed its first comprehensive DSM investigation. All members of the DSM stakeholders committee, i.e. MME, ECB, NamPower, all the REDs and the Namibian Manufacturers Association, adopted subsequently the promotion or development of the following seven DSM measures: Compact Fluorescent Lights; Solar Water Heaters; Time of use tariffs; Demand Market Participation; Ripple Control of Geysers; Energy Audits; Energy Saving Awareness Campaigns. Progress on each of these measures is described in

more detail in chapter 5. NamPower reported a decline in peak demand in 2008 compared to 2007, and gave credit to DSM measures such as the roll-out of compact fluorescent lights to private households. However, arguably the economic downturn, and in particular the decline in mining activity, played more of a role in reducing electricity demand.

## 1.3 STRUCTURE OF THE REPORT

This report is structured as follows: Chapter 2 reviews electricity supply issues in Namibia, and compares actual developments against those put forward in planning documents. It discusses the economic and technical viability of internal generation projects vis-à-vis imports from the region, and proposes a desirable and feasible electricity supply mix for the medium- to long-term. The future of regulation and competition in the industry are also examined. Following the chapter is an interview with Paulinus Shilamba, CEO of NamPower, probing his views on the Namibian electricity industry and the role of NamPower in a changing regulatory environment. Chapter 3 is an opinion piece for the use of renewable energy sources in Namibia, discussing the role they can play in the supply mix and how policy can promote their competitiveness. The chapter is followed by an interview with Joseph Iita, Permanent Secretary of the Ministry of Mines and Energy, in which he discusses some of the most pertaining issues facing the electricity sector today and in future, including renewables. Chapter 4 looks at rural electrification, including the barriers to its roll-out, the policy context and the prospects for on- and off-grid solutions. The third interview was conducted with Siseho Simasiku, CEO of the Electricity Control Board, on regulatory issues in the electricity sector, the promotion of competition, the single-buyer market model, as well as on the future role of the regulator. Chapter 5 gives an overview of demand side management in Namibia, its potential and challenges, as well as progress on policy and implementation. Finally, Chapter 6 draws together the conclusions from the various sections to come up with a scenario of what the electricity sector could and should look like, and makes concrete policy recommendations and proposes steps towards achieving this scenario.

## 2. NAMIBIA'S ELECTRICITY SUPPLY

BY DR DETLOF VON OERTZEN<sup>1</sup>



### 2.1 INTRODUCTION

Namibia's economy depends on the reliable, accessible and affordable supply of electricity. Most domestic and industrial consumers take an uninterrupted supply of electricity for granted. But, how does electricity get into our businesses and homes, and what makes it so ubiquitous that users seldom even have to think about it?

To be able to use electricity, one has to generate it. Presently, Namibia has three electricity-generating power stations. The most important is Ruacana, which is a hydroelectric power station on the Kunene River with a capacity of 249 MW. Ruacana is a run-of-river station, meaning that its ability to generate electricity remains dependent on continuous water flows from

Angola. In the absence of sufficient flows it cannot generate and feed electrical energy into the national electricity grid. The coal-fired van Eck power station just north of Windhoek has a capacity of 120 MW. It was commissioned in 1972, and today is expensive to operate; this implies that it is only started to bridge short-term supply gaps. The Paratus power station in Walvis Bay uses heavy fuel oil, and has a capacity of 24 MW. Similar to the van Eck power station, Paratus is mainly used to match short-term demand peaks.

Presently, the total installed electrical generation capacity and therefore the maximum that all Namibian power stations could supply if run simultaneously, is mostly insufficient to match Namibia's demand for electrical energy. For example, in 2008, the maximum demand was 533 MW, which is substantially more than the maximum internal electricity generation capacity of 393 MW that Namibia has at its disposal. To make

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## Measuring electricity

A common unit to measure and quantify the energy produced or used is kilowatt-hours - kWh. Typically, a medium-income Namibian household uses between 5 and 15 kWh of electrical energy per day.

To express many thousands of kWh, one often uses a different unit, namely megawatt-hours - MWh. One MWh is equal to one thousand kWh.

Yet another unit is used if millions of MWh are used or produced, namely terawatt-hours - TWh. One TWh is equal to one million MWh. Namibia consumed some 3.6 TWh of electrical energy in 2007.

In analogy to the above, electrical capacity, i.e. the ability to generate electricity, is expressed in terms of kW, MW or TW.

Namibia has a total installed electrical generation capacity of 393 MW, while its peak demand in 2008 amounted to 533 MW.

ends meet, Namibia imports electrical energy, generated mainly in South Africa and Zimbabwe, using NamPower's extensive transmission networks. Assuming that our neighbours have sufficient capacity, these electrical interconnecting power lines to across-border suppliers had a maximum capacity of 600 MW in 2008. Presently, the so-called Caprivi link is built at a cost of N\$ 3.2 billion, and will extend the Namibian transmission system using a high voltage direct current line. This new transmission line will link the Namibian system with Zambia and Zimbabwe, and will have an additional capacity of 600 MW. The line will enable NamPower to more readily trade electricity between Zambia, Zimbabwe

and other neighbouring countries, and make Namibia less dependent on imports coming from and wheeled through South Africa. Also, as a risk mitigation measure, the new transmission line will reduce Namibia's exposure and dependence on the South African transmission grid and its current constraints.

In 2007, Namibia's total annual electricity consumption amounted to 3.6 TWh, which includes transmission line losses, and is equal to an average consumption of some 1,800 kWh per person for the year. In the same year, NamPower's Ruacana hydroelectric power station supplied more than 92%, or 1.56 TWh, of Namibia's locally-generated electrical energy in that year. These numbers illustrate that the country remains import-dependent to cover more than one-half of its annual electricity requirements.

The following sections explore how Namibia's policy environment supports developments in the electricity supply sector, and investigates possible development scenarios and their implications. This chapter considers both non-renewable and renewable electricity supply options, even though renewable energies are also discussed elsewhere in this paper.

## 2.2 POLICIES OF RELEVANCE TO NAMIBIA'S ELECTRICITY SUPPLY INDUSTRY

### 2.2.1 VISION 2030 (2004)

Namibia's Vision 2030 envisages the transformation of Namibia into an industrialised nation with a viable natural resources-based export sector, and increased size of skills-based industrial and service sectors, and market oriented production [Vision 2030, 2004]. Rapid industrialisation will place significant pressure on the Namibian electricity supply industry, and challenges its growth and ability to deliver electrical energy on demand.

The opportunity to strategically incorporate the development of the nation's energy sector in general, and its electricity sector in particular – as key economic drivers of cross-sectoral significance and importance – was missed in the preparation of Vision 2030. Yet, adequately powering the nation comes with many challenges, economic trade-offs and long-term commitments, all of which need to be taken into account if the Vision is to have a realistic chance of being accomplished.

### 2.2.2 WHITE PAPER ON ENERGY POLICY (1998)

Namibia's White Paper on Energy Policy of 1998 states the following broad energy policy goals: effective governance, security of supply, social upliftment, investment and growth, economic competitiveness and efficiency, and sustainability [Energy, 1998]. The Policy also recognises the importance of renewable energies, and their potential role in realising the country's energy-related goals and aspirations.

The White Paper identifies the sector's challenges – which remain as relevant today as they were more than 10 years ago – namely: high dependence on imports, a large number of supply authorities with widely differing competence and practices, a host of technical, financial and institutional problems relating to rural electricity

supply, electricity prices that in many instances are not cost-reflective, and unclear institutional structures and arrangements.

### 2.2.3 NATIONAL DEVELOPMENT PLAN III (2008)

The National Development Plan 3 – NDP III of 2008 – recognises that the “energy sub-sector plays a pivotal role in the country’s economy and national development” [NDP III, 2008]. It states that “although electricity supply has improved since 2001, the vast majority of Namibian households still have no access to electricity, particularly in the Northern Regions. Fuel wood is still dominant as an energy source putting severe pressure on the natural environment. This situation requires enormous efforts to realise Vision 2030.”

NDP III further states that the sub-sectors’ goal is “adequate, secure and efficient supply of energy that is environment friendly and leads to a reduction in the country’s reliance on energy imports.” Specific energy-sector strategies put forward are:

- establish a strong body to regulate and monitor the whole energy sub-sector
- establish a commercial electricity trading centre
- enforce regionally harmonised tariffs for cost recovery that are socially acceptable
- increase local energy generation with conventional and renewable technologies
- improve the regional transmission network
- implement the Rural Electricity Distribution Master Plan and provide remote areas with off-grid renewable energy
- extend the urban electricity network and promote renewable energy in urban areas
- promote the efficient use of energy by introducing special technologies (such as compact fluorescent lights), programmes (such as demand side management) and public awareness campaigns, and
- increase local capacities, in particular on economic aspects of the energy sub-sector, on energy efficiency and renewable energy.

### 2.2.4 ELECTRICITY ACT (2007)

In September 2007, the Namibian President signed the Electricity Act, 2007 [Electricity, 2007]. The Act establishes the Electricity Control Board (ECB) as the country’s electricity sector regulator, and formulates guidelines for electricity sector governance<sup>2</sup> [ECB, 2009]. The ECB is responsible to control and regulate

the provision, use and consumption of electricity in Namibia, to oversee the efficient functioning and development of the industry, and security of electricity provision, to ensure that a competitive environment in the electricity industry is maintained, and to promote private sector investment in the electricity industry. The Act describes the requirements, conditions and obligations for obtaining licences to generate, trade in, transmit, distribute, import and export electricity. Amongst others, the ECB has developed guidelines to set cost-reflective tariffs, and implement an Independent Power Producer regime in Namibia, both of which are of importance in the discussions below.

### 2.2.5 CABINET DIRECTIVE (2007)

A Cabinet directive in June 2007 approved the implementation of the Off-grid Energisation Master Plan, and also directed that the hot water supply to all Government and parastatal buildings is to be met by solar water heaters only [MME, 2008]. As a demand side management measure, and potential stimulant of the solar water manufacturing industry in the country, the latter directive is significant.

The following section introduces Namibia’s electricity supply industry, and reflects on the issues and challenges that the above-mentioned policies and directives have for the sector.



<sup>2</sup> The previous Electricity Act, i.e. Act No. 2 of 2000, was repealed by the promulgation of the new Act.



## 2.3 NAMIBIA'S ELECTRICITY SUPPLY INDUSTRY

Namibia's Ministry of Mines and Energy (MME) is the custodian of the country's energy sector. The Electricity Supply Industry (ESI) is regulated by the Electricity Control Board [ECB, 2009]. The ESI's main role players are the MME, ECB, NamPower, the Regional Electricity Distributors (REDs), and a handful of municipalities and mines. The ECB sets the required licence conditions, and defines, oversees and manages the processes for the application and issuance of such licences. Amongst others, it assesses and makes recommendations to the Minister of Mines and Energy regarding the issue, transfer, amendment, renewal and cancellation of licences, and the approval of conditions on which electricity is provided by a licensee [Electricity, 2007].

In some cases in the past, the Minister of Mines and Energy has overturned the ECB's recommendations, for example when granting longer licence terms than those recommended by the ECB to Regional Electricity Distributors (REDs). Such non-automatic approval processes are indicative of the existing dialogue between the Ministry of Mines and Energy and ECB, and illustrate the important and to-be-expected tensions that occasionally exist between the regulator on the one hand, and the political establishment on the other.

NamPower, as the country's only electricity utility, encompasses three main ring-fenced businesses, namely generation, trading and transmission [NamPower, 2009]. NamPower also fulfils the role of system operator and trader, which includes the important function of balancing the supply of electricity to the prevailing demand. In addition, it is the contracting party for imports, primarily from Eskom in South Africa, the Zimbabwean power utility ZESA for supplies from the coal-fired Hwange power station, and from ZESCO in Zambia for supplies to the Caprivi region. As such, NamPower has to balance the availability of its own generation capacities with imports, which has important implications for the long-term cost-effective supply of electricity to Namibia. To undertake cross-border transactions, NamPower holds licences for the import and export of electricity, which can be divided into

those at trading level (for example the transactions with Eskom), and those at transmission supply level such as supplies to Angola and Botswana, and the supply from Zambia.

NamPower's transmission section is divided into two businesses, i.e. the wires and the supply business. The wires business is responsible for the transmission network. The supply business looks after transmission customers including some large mines, the REDs, Windhoek Municipality, and some supply points that remain connected to the transmission grid for historic reasons.



The Regional Electricity Distributors – REDs – are responsible for the distribution and supply of electricity to consumers within their respective areas. In June 2009, three REDs are established and fully operational. NORED was established in 2002, and serves the country's north-central regions. Both CENORED and Erongo RED were established in 2005, and serve the north-central and the Erongo region respectively. Two additional REDs, i.e. one for the central and one for the southern regions, may be established in future. Presently however, local and regional authorities, and NamPower, remain the licensed distributors in the areas not covered by REDs. There is considerable debate about the establishment of the central and southern REDs. Even in existing REDs the ECB's authority is challenged by some municipalities, local authorities, unions and members of the public. It appears that a political rather than a regulatory decision remains outstanding to ultimately resolve the matter.

## 2.4 DEVELOPMENTS IN THE ELECTRICITY SUPPLY INDUSTRY

This section reviews the recent and most important electricity supply sector developments, and assesses whether the goals as stated in the White Paper on Energy Policy have been achieved.

The NDP III identifies the following achievements for the second national development plan period; quoting verbatim [NDP III, 2008, p 137]:

- a. off-grid electrification using renewable energy sources, with mixed results
- b. promotion of renewable energy and energy efficiency in some parts of the country
- c. rural electrification programme under the Rural Electricity Distribution Master Plan for Namibia (2000) that specifies the off-grid and grid electrification of rural localities in each region until 2040
- d. technical assistance and training programmes to put in place the enabling laws and institutions and strengthen staff capacities, and
- e. promotion of energy conservation and the culture of regular payment of electricity charges.

NDP III further states that the following challenges were encountered during the NDP II implementation period [NDP III, 2008, p 137]:

- a. the reluctance of Regional Electricity Distributors (REDs) to take over the electricity billing and collection functions from the municipalities
- b. the need for the tariff structure to take into account the full costs of electricity generation and distribution including depreciation and other unforeseen costs, and
- c. difficulties in adapting available renewable energy technologies to fit the situation in Namibia including the lack of expertise in Namibia to design systems suitable for local conditions and their economic viability.

In terms of ESI developments, the MME's Annual Report 2007/8 observes that a total of 600 solar systems were funded within the two-year period 2006 and 2007 [MME, 2008]. The Solar Revolving Fund, that allows mainly rural inhabitants to acquire solar technologies, is said to hold a commitment of 800 backlog applications that are awaiting funding. The Report further states that renewable energy was promoted using renewable energy technologies demonstration units at regional level for all 13 regions. In particular, wooden stoves were promoted in the Hardap, Khomas and Omaheke regions. In regard to rural electrification, and in view

of Government's efforts to achieve 25% access to electricity in rural areas by the year 2012, 550 villages have so far been connected to the national electricity grid, at a total cost of more than N\$350 million. In 2007 alone, 43 additional villages in Omaheke, Omusati and Oshikoto were connected. The MME and NamPower, as part of the national demand side management strategy, distributed more than 600,000 compact fluorescent lights countrywide, which when fully completed is expected to reduce the country's peak demand by up to 20 MW.

When the more recent developments within the electricity supply sector are viewed through the lens of the sector objectives as stated in the White Paper on Energy Policy (1998), the following observations (page 13) are made<sup>3</sup>:

These considerations raise the following pertinent issues and questions:

### 2.4.1 NATIONAL GENERATION TARGETS

Presently, national electricity supply and generation targets do not exist. Clearly articulated mandatory targets would send an unambiguous signal to investors, and would also increase the urgency by which projects of national importance, such as the development of Baynes and Kudu, would be handled. ESI stakeholders should capitalise and be guided by such targets, firstly to diversify their supply arrangements, and also, as a percentage of their supplies, utilise Namibia's rich endowment of renewable energy sources.

Defining national supply targets that mandate the use of indigenous resources as well as carbon neutral technologies is both essential and long overdue. The Ministry of Mines and Energy, as the custodian of the country's energy sector, is responsible for initiating the required steps to identify and – in collaboration with the ESI – set and incentivise national supply targets.

### 2.4.2 ELECTRICITY TARIFFS

In May 2009, Cabinet confirmed that NamPower will have to introduce cost-reflective tariffs by 2011/12. This additional one-year grace period was granted to allow the utility to more gradually ramp up its supply prices. A more gradual increase of electricity prices shields consumer pockets. However, electricity sector investments hinge on attractive tariffs, and tariffs are a central pivot determining the viability of any energy business. Presently, in comparison with many other developing nations, Namibia's electricity tariffs are still

<sup>3</sup> Status: June 2009

Energy sector objectives	Features, developments and achievements
<b>effective governance</b>	<ul style="list-style-type: none"> <li>• the ECB is firmly established, and regulates the electricity sector's licensing and tariffs</li> <li>• an Independent Power Producer framework is in place, but by June 2009, no IPP has established itself in Namibia</li> <li>• the establishment of both the central and southern REDs remain unaccomplished, and the ECB's authority in this regard is challenged by various local authorities and municipalities</li> <li>• NamPower remains the country's only supplier of electricity, and controls sector-wide developments through its trading and single-buyer functions</li> </ul>
<b>security of supply</b>	<ul style="list-style-type: none"> <li>• new supply arrangements with Zimbabwe are in place and operational – however as long as the direct connection remains incomplete all loads are wheeled through South Africa which perpetuates Namibia's dependence on a functioning South African transmission system</li> <li>• the country's transmission network is strengthened through the high voltage direct current (HVDC) connection to Zambia, which will reduce Namibia's reliance on South African networks</li> <li>• new supply agreements have been entered into with Eskom – these have diminished the advantages that Namibia had under previous arrangements</li> </ul>
<b>social upliftment</b>	<ul style="list-style-type: none"> <li>• rural electrification targets are well-defined, but access to sufficient funding, systematic implementation, socio-demographic changes and developments, changing social upliftment priorities and unplanned electrification activities remain the most important challenges</li> <li>• a Solar Revolving Fund is in place and operational, but has a considerable backlog of applications due to financial constraints</li> <li>• larger-scale off-grid electrification remains largely unaccomplished</li> <li>• the viability of business models – underpinning the implementation of the off-grid energisation plan and rural energy shops – remains uncertain</li> </ul>
<b>investment and growth</b>	<ul style="list-style-type: none"> <li>• to date, investments in the electricity supply sector remain limited to those undertaken by NamPower</li> <li>• the HVDC connection to Zambia, at N\$ 3.2 billion, represents a most significant electricity sector investment</li> <li>• investments in new generating capacity in Namibia remain limited to the addition of a 4th turbine at Ruacana</li> <li>• generation licence applications for wind parks at Lüderitz and Walvis Bay have been received by the ECB. If built, these wind parks would represent the first larger-scale investment in the country's electricity supply sector by an entity other than NamPower.</li> <li>• the potential for the establishment of IPPs exists</li> <li>• sector growth is driven by supply uncertainties and strong demand growth, especially from the mining sector and particularly those in Erongo region</li> <li>• despite the prevailing constraints in the southern African power sector, few new sector entrants have established themselves – this is in part due to low regional electricity tariffs and the wider investment climate in the region</li> </ul>
<b>economic competitiveness and efficiency</b>	<ul style="list-style-type: none"> <li>• electricity tariffs are to be cost-reflective by 2011/12</li> <li>• Namibia's energy intensity is and will remain high</li> <li>• the considerable dependence on the constrained South African electricity supplies limits the local supply sector's independence</li> </ul>
<b>sustainability</b>	<ul style="list-style-type: none"> <li>• sector investments targeting transmission infrastructure are high</li> <li>• regional dependence, especially on supply capacity, remains high</li> <li>• commercial considerations and different partnership expectations continue to complicate the exploitation of the Kudu gas field</li> <li>• no larger-scale investments in the development of local sustainable energy sources have been made to date, although considerable potentials exist</li> <li>• an envisaged coal-fired power station at Walvis Bay may undermine Namibia's short- to medium-term prospects of attracting sizeable renewable energy sector investments, despite its significant resource base</li> </ul>

low, and therefore fail to attract investors. They also do not discourage the non-productive use of electrical energy.

It is concerning that Namibian electricity tariffs do not differentiate whether the electrical energy is derived from renewable or fossil fuels. Feed-in tariffs that incentivise the generation and feed-in of electricity generated from renewable energy technologies are non-existent. Now that South Africa has put such tariffs in place, few investors will be tempted to pour their monies into the Namibian electricity sector which does not offer the financial rewards and other advantages found elsewhere.

Value adding to Namibia's rich renewable energy endowment will not just happen automatically. The non-level playing field between conventional electricity and that generated from renewable energy technologies is rooted in history. But there is a way out of this situation: creating tariff structures that actively incentivise the investment and use of renewable energy technologies will foster the much-needed development of Namibia's rich diversity of indigenous renewable energy endowments [von Oertzen, 2009].

### 2.4.3 TAXES AND TAX INCENTIVES FOR CONTINUED ESI DEVELOPMENT

Tax breaks and tax incentives specifically promoting investments in Namibia's electricity supply sector do not exist. NamPower continues to be the generation monopoly provider, and enjoys access to government subsidies. Targeted tax breaks for new entrants are essential if Namibia is to attract new investments to the sector.

The lack of tax incentives available to the renewable energy sector is particularly concerning: such tax mechanisms could promote the higher uptake and greater penetration of renewable energy technologies in Namibia. For example, exempting imports of renewable energy technologies from value added tax, introducing tax breaks for renewable energy enterprises, creating tax incentives such as tax-free establishment periods for new energy sector entrepreneurs, introducing carbon taxes, and creating special-purpose supply sector incentives similar to those in free-trade zones are options to enhance the sector's attractiveness for investors.

### 2.4.4 RURAL ELECTRIFICATION

Since Independence, Namibia has made substantial progress in bringing electricity to the furthest corner of the land. In 2009, most of the lower hanging fruit in rural electrification have been picked, yet more than



200,000 households remain without access to modern energy services [Hamutwe, 2007]. The Ministry of Mines and Energy estimates that only some 17% of Namibia's rural population have access to electricity [MME, 2008]. Economic considerations prohibit the country's complete electrification using conventional grid electricity. Here, off-grid technologies powered by renewable energies are suitable to provide decentralised energy services to people in areas far away from the existing national grid [von Oertzen, 2007]. However, such technologies require a well-resourced and planned implementation.

To date, investments in off-grid energisation<sup>4</sup> in Namibia have been minor, and few real and sustainable successes can be shown. The playing field between grid and off-grid technologies remains far from level [Hamutwe, 2007]. The demand for off-grid technologies in rural Namibia remains underdeveloped, despite a number of novel attempts and support mechanisms to introduce affordable financing and bring such technologies closer to consumers [REEECAP, 2008a]. Service reliability, the long-term provision of cost-effective maintenance, and the collection of fees remain major challenges in rural Namibia. High unemployment does not help either, and limits the abilities of households to secure and service loans.

Realism in terms of which rural electrification targets are achievable, and how rural energisation can

<sup>4</sup> Energisation refers to the provision of a range of suitable energy sources and services to meet a consumer's electrical and thermal energy needs, as well as those for liquid fuels.

be incentivised, is needed. A continued commitment by Government to systematically bring affordable energy services to rural Namibia is necessary, thereby also introducing new and decentralised livelihood, learning and business opportunities. The Off-grid Energisation Master Plan is in place, but its implementation remains a challenge.

#### 2.4.5 DEVELOPING NAMIBIA'S COMPARATIVE ADVANTAGES

The abundance of Namibia's renewable energy resources, specifically those with a proven resource base including biomass, solar and wind, but also the as yet unquantified but seemingly plentiful indigenous resources such as geothermal, wave and tidal energies constitute a national comparative advantage that can and should be exploited more aggressively [von Oertzen, 2009].

It is well-known that start-up and fledgling markets and industries are vulnerable and prone to failure. The renewable energy market in Namibia is a case in point. If Namibia's comparative advantages vis-à-vis its renewable energy potentials are to be developed more deliberately, investment and market conditions have to be made more attractive. As mentioned above, if Namibia does not at least equal the in-feed tariffs as recently introduced in South Africa, few investors will find it worth their while to invest in such technologies locally. And although Namibia's tax regime is not biased against renewable energy technologies, there are also no special tax breaks to specifically promote renewable energies in Namibia. In the absence of such incentives, and in view of the other barriers stacked against renewable energy technologies, such as high upfront costs and lacking awareness, few investors will manage to establish themselves successfully in the country's electricity supply sector.

#### 2.4.6 BROADENING THE ESI'S ACTIVE STAKEHOLDER BASE

Namibia's ESI is small, and new entrants remain absent. While the transformation of an entire industry requires time, one recognises from similar experiences internationally that new supply sector entrants would invigorate old structures, and infuse a much-needed sense of urgency and competition. The reasons for an absence of new players lies, amongst others, in the issues identified above: low electricity tariffs, the lack of targeted incentives, a monopoly electricity trader, considerable leverage by NamPower as the country's generation and transmission monopoly provider, low population densities particularly in rural areas and even in most urban centres, high financial barriers, and an as

yet untested IPP framework all contribute to delay the entry of new players into the sector.

International experience shows that renewable energy industries promote local job creation, lead to enhanced local value addition, and the increased use of local resources. At the same time, because of their non-polluting nature, most renewable energy sources have a limited impact on the environment [IPCC]. Investments in low- or no-carbon energy technologies are one important step in stabilising the Earth's climate, and reduce the potentially negative implications of continued global warming. It is here where Namibia's many blessings can be further developed: increasingly there are international financial instruments becoming available that promote the development of local energy sources while benefiting from carbon revenues. Namibia's electricity supply sector is well-advised to make use of such new funding opportunities while strengthening the country's security of supply. Again, however, such new endeavours will not happen overnight, and require national commitment, supportive policy and institutional framework conditions, and a pragmatic investor-friendly context that welcomes new sector entrants, even if they are seen to compete with long-established monopoly suppliers.

#### 2.4.7 SUSTAINABILITY

Namibia's continued economic development relies on a vibrant electricity supply sector that provides reliable, affordable and accessible electrical energy. The continued reliance on fossil fuels damages the environment and leads to climate change and its many undesirable effects – this is by now a well-established fact [IPCC]. Regionally, Namibia finds itself in a situation where the projected supply arrangements no longer meet the required demand. This necessitates local electricity supply sector investments that do not only address short-term supply constraints, but will also ensure that investments take regional developments and its own sustainability into account.

To this end, the development of renewable energy technologies is of particular importance. Not only are fossil fuels finite and will eventually become too expensive to be considered the backbone of a developing nation, but our national abundance of renewable energy potentials demand that we develop these national riches more deliberately. The increased use of renewable energy technologies is an important step to limit the economic implications of climate change, while at the same time allowing Namibia to become more energy autonomous and benefit from the multitude of added value that the use and beneficiation of local resources holds.

## KUDU GAS

The Kudu gas field is located some 170 km southwest of Oranjemund, in the south western corner of Namibia's maritime border with South Africa. The field was discovered by Chevron/Soekor in 1974. In 1987/88 two more successful drillings confirmed the field's commercial potential. Proven plus probable recoverable reserves are estimated to exceed 3.3 trillion cubic feet. The reserves are located below some 170 m of water at a depth of 4.5 km, which presents a considerable challenge for their future exploitation. However, Kudu has proven reserves that could fuel an 800 MW combined-cycle gas power station for more than 20 years, and represents the single most important hydro-carbon reserve that Namibia has to offer to date.

Following Namibia's Independence, exploration licenses were granted to Shell Exploration and Production Namibia (SEPN) and Energy Africa in 1993. In 1996, the Kudu Power Project was initiated by SEPN, NamPower and Eskom, and a year later a Memorandum of Understanding (MoU) was signed to promote an 800 MW power station sited at Uubvlei, some 25 km north of Oranjemund. In 1998 the MoU lapsed as Eskom remained unconvinced about the commercial viability of the project. Alternative plans to use the gas, for example by piping it to the Western Cape, were made. Plans to establish a 400 MW generation facility at Oranjemund, and another of 1,600 MW capacity located in the Western Cape, were made. Such plans however did not lead to any firm investment decisions. Further investigations were launched to establish the feasibility of a 400 MW power plant, combined with a floating liquefied natural gas facility. However, when the results of drillings at Kudu-6 and Kudu-7 were released, both SEPN and Chevron Texaco withdrew from the concession.

In 2000, a pre-feasibility study was undertaken, and then updated in 2003. In 2004, a joint development agreement as well as a MoU regarding power purchases was signed between NamPower and Eskom. By the time, the new partners in the Kudu Power Project were NamPower, Energy Africa, and the National Petroleum Corporation of Namibia (Namcor). In July 2005 a feasibility study was launched, to assess the viability of an 800 MW closed-cycle gas turbine power station near

Oranjemund. During 2005, a full environmental impact assessment was conducted and approved by the partner organisations, and a production license was granted. During 2006, Energy Africa was purchased by Irish Tullow Oil Plc, and in April 2007 the Japanese oil company Itochu joined the project team by acquiring a 20% share.

In 2008, NamPower stated that it was keen to sell the gas in US\$, while Tullow and Eskom wanted to buy the gas in South African Rand. Neither of the parties seemed willing to accept the foreign exchange risks [New Era, 2008]. In February 2009, Tullow announced that efforts to develop the Kudu gas project were hampered by the "failure to reach commercial agreements with gas buyers" [Namibian, 2009]. In March 2009, Tullow was reported to consider alternative commercial options for the Kudu gas field, including marine compressed natural gas (CNG) exports to Namibia and South Africa [IHS, 2009]. This development is said to have arisen because of recent developments in power generation priorities in the region, and the emerging potential for supplying gas to industrial and transport markets as a replacement for diesel. CNG would be transported to shore in purpose-built shuttle tankers, rather than by conventional pipeline. This would provide the flexibility for gas to be delivered to more than one destination, and would also allow Walvis Bay to be considered as a new delivery location where gas can be used for power generation and by industrial and transport users. Pursuing the CNG option would also provide a means of delivering gas to more than one regional market [Tullow, 2009].

Tullow states that the commercial analysis of the various development options for the gas field are progressing. The company has indicated that it has the intention of presenting a proposal to the Government of Namibia in 2009, in advance of entering into more detailed negotiations with potential gas buyers. At the same time, Tullow is said to be committed to proving and commercialising the potentially significant reserves within the greater production license area, and current exploratory appraisal efforts are focused on locating extensions of the Kudu main field reservoir within the production license area.

## **BAYNES HYDROPOWER**

At the turn of the 19<sup>th</sup> century, the Kunene River's hydropower potential was recognised by the colonial powers. Since then, various dams and weirs have been constructed along the river, including the Gove Dam in Angola, the Calueque Water Scheme, and the Ruacana hydropower station on the border between Angola and Namibia. The Ruacana power station was commissioned in 1975 and completed in 1978, and has a total installed capacity of 249 MW. The absence of one or several reliable storage dams to regulate the flow of water is Ruacana's key drawback. The Kunene River's main basin is located in the highlands of southern Angola, where the rainy season only lasts between November of one year to February in the next year. The availability of water in the river has a direct influence on the quantity of electrical energy that Ruacana can generate at any given time.

In 1991, the Governments of Angola and Namibia ratified the Kunene River Agreement, accepting the Master Plan of 1969 as the official guideline for the further development of the Kunene River [NamAng, 1998 a]. In the past, political changes and instability had hindered efforts to develop additional hydropower projects in the Kunene, but with peace arriving in Angola, hopes were raised that joint development projects could now commence. A major feasibility study presented in 1993 found that "the most promising sites (for hydro power stations) are located in the lower Kunene ... from the existing Ruacana scheme to the sea level" [Norpower, 1993]. The report concluded that the Epupa site would be the most feasible. Between 1995 and 1998, NamAng conducted a full feasibility study and environmental assessment for the Epupa Project [NamAng, 1998]. During the study, all potential hydropower sites along the Kunene River downstream of Ruacana were investigated. The Epupa and Baynes sites were eventually selected as the most viable sites. The feasibility study concluded that a dam at Epupa would have the greatest storage capacity, while the Baynes site would result in a smaller social and ecological footprint. However, opposition to build a hydropower station at Epupa and critical voices from within and beyond the borders of Namibia resulted in the shelving of the project.

Presently, in view of the rapidly changing regional and national electricity generation circumstances, the Governments of Namibia and Angola through the Permanent Joint Technical Commission (PJTC) are again considering the option of building a hydropower plant on the Kunene River. The PJTC appointed the Kunene Consortium, consisting of four Brazilian engineering companies, to revise the feasibility study prepared in 1998. In addition, the PJTC appointed Environmental Resources Management to conduct an environmental and social impact assessment (ESIA). The ESIA and techno-economic teams are independent of each other, but are expected to collaborate closely to ensure that their respective studies are coherent and consistent. The main aims of the technical study, which commenced in June 2008 and is expected to be finalised in March 2010, are to consider three alternative dam locations, all within a few kilometres of the original Baynes site, and assess the feasibility of a hydropower station at the most preferred site. This final assessment will also consider the optimal dam height and associated water storage capacity, the structural and engineering requirements, and the implications for the construction and operation of the hydropower plant.

At the same time, the ESIA will gather information on the social and environmental aspects required to understand the implications of the development of Baynes. The ESIA is to provide decision-makers and stakeholders with a comprehensive evaluation of the impacts of the project. The process takes place by way of scientific studies and stakeholder consultations, and is expected to include extensive public participation [ERM, 2009]. The first public stakeholder interactions have taken place in June 2009, and should allow all interested and affected stakeholders to voice their concerns, opinions and ideas with respect to the envisaged project.

A hydropower station at Baynes could have a generating capacity of some 360 MW, and because of its envisaged storage dam, could contribute some 1 TWh per annum to the national electricity mix. Such a development would provide much-needed base-load power and power on demand, provided

the dam holds sufficient water. For Namibia and Angola, the addition of a hydropower plant to the countries' supply mix would be most valuable, and reduce the reliance on electricity imports from the region. Time will tell whether the considerable obstacles that need to be overcome to build and

successfully operate a hydropower plant at Baynes will be overcome this time. For the region in general, and specifically for Namibia and Angola, getting this project off the ground would signal the start of new collaborative efforts to address the many remaining regional challenges.

## 2.5 THE REGIONAL CONTEXT

This section briefly describes the regional electricity sector developments, and reflects how these will impact on Namibia's future electricity supply. Of particular importance is Namibia's trade and interactions with the Southern African Power Pool.

Presently, Namibia's only electricity generating utility, NamPower, also has the function of a single buyer and transmission trading agent. This implies that all imports and exports, and all wheeling arrangements that utilise the Namibian transmission grid are managed and controlled by NamPower. As the sole electricity trader, NamPower effectively purchases electric power from its own plants, i.e. Ruacana, van Eck and Paratus, and on-sells power to transmission customers, such as the mines, the REDs, and a number of municipalities and water pumping schemes. In addition, there are cross-border supply arrangements where NamPower supplies power at distribution or sub-transmission level to Angola, Botswana and South Africa. NamPower has supply agreements with Eskom – largely modelled on Southern African Power Pool principles – that govern the amount, tariffs and general supply arrangements with South Africa. A new contract with Eskom has just recently been negotiated, but it no longer offers firm supply, and prices are escalating rapidly due to supply shortages experienced in South Africa. NamPower also holds power supply agreements with all its transmission and distribution customers.

The restructuring of regional electricity markets is in progress. In South Africa, which is the most dominant and important regional electricity sector player, efforts have been made to separate Eskom's generation and transmission businesses, and establish regional electricity distributors. Most southern African countries have begun to establish electricity sector regulators. In South Africa, Zambia and Namibia, the regulators are by now well-established, while Zimbabwe is in the establishment process. Botswana and Angola do not yet have electricity regulators.

The Southern African Power Pool – SAPP – was created through an intergovernmental Memorandum of Understanding in August 1995, with the primary aim to provide reliable and economical electricity to SAPP members [SAPP, 2009]. As cooperation in the electricity sector has taken place for a long time, several regional utilities came together under the auspices of Southern African Development Community (SADC) to form the SAPP, and create a common market for electricity in the SADC region. Utilities participating in SAPP have equal rights and obligations, and have agreed to act in solidarity without taking advantage of one another. Members have undertaken to share information and knowledge, and, amongst others, accept wheeling on behalf of other members when this is technically feasible [SAPP, 2008].

The SAPP, and by implication the southern African region, has not seen many investments in the power sector during the last twenty years. This is surprising as power shortfalls have been predicted for a long time. Very few projects addressing the impending electricity shortfall were approved by SAPP member states, while the implementation of approved projects has been slow [SAPP, 2008]. In April 2008, the installed capacity in the region stood at 55,032 MW, while the available capacity was 47,067 MW. A total of some 1,700 MW of new capacity was commissioned in Angola, South Africa and Swaziland in 2007, against a target of 1,925 MW. In 2008, SAPP planned to commission 1,757 MW, against a planned target of 2,014 MW. It is expected that power deficits will persist in the region until at least 2012. For example, the Democratic Republic of Congo's Inga 3 project – which forms part of the Western Corridor (Westcor) power project – is expected to have an output of 3,500 MW, while the complete Westcor project is envisaged to add some 10,000 MW, which could potentially displace the region's reliance on Eskom's coal-fired base-load capacity. Longer-term projects to be implemented in the region until 2025 are expected to provide additional power, and capacity additions of



up to 44,000 MW costing in excess of US\$ 41 billion are mentioned.

The SAPP region offers significant resource potentials for future electricity generation. However, most such projects have experienced longer-than-expected delays, which continues to cause uncertainty, and also delays other investments. The sheer scale of some of the more adventurous electricity supply schemes discussed in the region is perplexing. Effective regional integration of the supply markets is desirable, but requires trust, commitment and political stability. The SAPP will require more time to address the region's long-term power sector developments, while allowing its member states to cooperate on regional investment decisions without undermining their national development ambitions.

## 2.6 INDEPENDENT POWER PRODUCERS IN NAMIBIA

The White Paper on Energy Policy (1998) is clear about the need to create a conducive investment climate in Namibia's energy sector. As discussed in section 2.4 above, structural and institutional impediments remain in the electricity supply sector, and render Namibia's short-term investment environment less investor friendly than the ones found in some of our neighbouring countries. Also, in an energy-hungry world, prospective investors may well find that Namibian power projects lack the broad incentives found elsewhere.

On a more positive note however, the ECB's progressive pricing model which foresees the introduction of cost-reflective tariffs in the coming years is bound to lead to greater interest by potential Independent Power Producers (IPP). Also, the ECB's guidelines for IPPs have resulted in a number of prospective IPP's submitting applications for licences [ECB, 2009].

As yet, Namibia's IPP framework remains untested. Although the market is open for IPPs, and guidance for new entrants is available, a number of unresolved issues and barriers remain, and continue to delay the establishment of IPPs in the country. Of particular concern is the independence of the single buyer, and NamPower's entrenched position as a monopoly provider. For future IPPs, these two considerations alone imply that power purchase agreements, access and use of NamPower's transmission system, and trading of electricity all take place under NamPower's direct control. These realities continue to strengthen

NamPower's bargaining position and sector-wide leverage, and can complicate or even delay the establishment of an IPP.

NamPower's role in relation to a prospective IPP may take different forms: as a buyer of electricity, as a potential IPP joint-venture partner, as a wheeling agent, as a direct competitor within the sector, or as an objector to an IPP's entry into the local supply market. One can only speculate, but it is likely that NamPower will – in negotiations with prospective IPP operators – always ensure that its own generating plants are optimally utilised. Only once their own capacity is no longer sufficient will additional entrants and their respective supply capacities be favourably considered. Such vested interests are unbecoming for a liberalised electricity market, and are most likely going to impede or delay the entry of new supply sector players.

Smaller IPPs may be able to enter into power purchase agreements with the REDs, provided that NamPower's transmission infrastructure is not used in the process. From this perspective, it may seem more likely that smaller-scale IPPs will be the supply market's new entrants. However, given the fact that IPPs will most likely establish themselves where the resources and connecting infrastructure is most favourable, few such opportunities exist where new IPPs can commence with their business activities without having to deal with NamPower. And it remains to be seen if the hoped-for neutrality of the single buyer can be guaranteed if a prospective IPP offers supply profiles that are in competition with those offered by NamPower.

The strategic nature of a reliable and sustainable electricity supply industry demands that the key role players, i.e. the MME, ECB and NamPower, collaborate without undermining their own roles and mandates in the sector. To enhance transparency, the distinct roles of the ECB and NamPower should be codified. This holds particularly true for the different responsibilities that the ECB and NamPower have in respect to rendering assistance to prospective IPP operators, and negotiating power purchase agreements with them. Also, the independence of the single buyer function vis-à-vis NamPower's responsibility to ensure the availability and reliability of supplies, sector-wide cost-effectiveness, and the creation of growth opportunities, needs further clarification.

Crafting the vision for a flourishing sector, creating the associated enabling environment, and setting actionable goals and targets is the responsibility of the Ministry of Mines and Energy. In addition, a more goal-oriented collaboration between the ECB and NamPower is needed to foster a shared sense of

responsibility for the sector, and its developments. The proof that Namibia's IPP framework is indeed workable and sufficient to attract newcomers still waits to be made. Creating a common understanding and formalisation of institutional processes, for example to enable middle-management of both institutions to more effectively collaborate on day-to-day issues, would have most beneficial effects on the sector in its entirety. Not addressing these issues will perpetuate the uncertainties that prospective investors face, and stifle the ambitions of new sector entrants. As stated in the Introduction to this chapter, Namibia's economy depends on the reliable, accessible and affordable supply of electricity. What the country's electricity sector needs is bold vision, and decisive action – and all stakeholders have an important contribution to make to see this happening. The next section describes how such action could look like.

## 2.7 NAMIBIA'S FUTURE ELECTRICITY SUPPLY MIX

How could Namibia's future electricity supply mix meet the various policy goals, while effectively addressing the various constraints and considerations discussed above? Namibia's domestic electricity generation capacity is inadequate to meet its current needs. The country's envisaged socio-economic development pathway and especially the ambitious targets laid down by Vision 2030 demand that considerable electricity supply sector investments have to be made in the very near future. This necessity is accentuated when viewed against the backdrop of the regional supply constraints that exist since 2007. This section will therefore ask how investments in Namibia's electricity supply capacity could yield the largest economic and social benefits, while limiting environmental degradation.

Urgent investment decisions are required to ensure that the local demand for electricity can be met in future. Such investments can take several forms:

- a) relying on electricity imports mainly from South Africa and Zimbabwe, which implies that Namibia's transmission networks need to be bolstered, and/or
- b) limiting local demand growth, which means that some energy-intensive projects may not be undertaken, and/or
- c) building own generating capacity, taking into account that these usually have lead times of several years.

Strategically, we need to ask whether relying solely on imports can remain a realistic option for Namibia. It is noted that regional supply constraints, low investments in regional generating capacity, and much-needed economic development is at stake in every country in the region. As illustrated in 2008, particularly in South Africa's mining sector, not meeting the demand for electrical energy has had serious economic implications, and results in below-par socio-economic development. Thus, merely relying on electricity imports is economically inefficient, and is a strategic risk.

Can active demand side management (DSM)<sup>5</sup> be applied to cap the demand for electricity while still allowing the economy to grow efficiently? Currently, the key drivers of electricity demand in Namibia are the mining sector and the growing domestic sector. The mining sector in particular requires reliable power supply arrangements – necessary load shedding in South Africa in 2008 caused significant economic losses. In the domestic sector, load shedding is less costly, mainly because the cost per unmet unit of electricity is low. Not meeting the domestic demand however may in time cause political pressures and will have often unpredictable socio-economic repercussions and developments.

We conclude: while DSM is an effective tool to avoid temporary blackouts and increase consumer awareness in regard to the productive use of electricity, it will not be sufficient, even if rigorously applied, to ensure the continued growth of Namibia's main economic sectors. This implies that, while the importance of DSM will further increase and thereby promote the productive use of electrical energy, it is not a mechanism to ensure the long-term provision of electricity supply to power Namibia's much-needed growth.

Realising that the continued reliance on imports and a sharpened focus on demand side management activities are both insufficient to meet Namibia's future electricity supply requirements triggers the following question: does an economically efficient mix of different supply options exist that is cost effective, create jobs, and at the same time minimise the environmental degradation that characterises many conventional electricity supply systems?

As has been alluded to in the previous sections, Namibia's comparative advantages that can be leveraged to strengthen the country's electricity supply sector lie in its abundant renewable energy resources, i.e. its

<sup>5</sup> Demand side management (DSM) activities reduce and/or shift a consumer's demand for and therefore consumption of electrical energy. In this chapter DSM includes energy efficiency measures.

excellent sunshine resource, feasible wind resources along the coast, a significant offshore gas field, and millions of hectares of bush-infested rangelands [von Oertzen, 2009]. Also, the Kunene River holds promise for additional large-scale hydropower, while the Okavango and Orange River have some hydropower potentials too. In contrast to these natural endowments, Namibia has very limited options when it comes to generating electricity using conventional technologies. The country does not have any mine-able coal reserves and therefore must import coal. It is the driest country in sub-Saharan Africa and only has the above-mentioned hydropower options in the perennial rivers along the country's borders. And, while nuclear energy could one day supply the nation's electricity, its current scope is considerably constrained by the country's small technical skills and supply base, and very high capital costs associated with the importation of such technologies and necessary human resources.

This section considers the following future generating options as the most promising electricity supply options for the coming decades<sup>6</sup>:

- the Baynes hydroelectric power station
- a natural gas-powered combined cycle power station (CCGT), possibly at Oranjemund and/or Walvis Bay
- integrated solar combined-cycle power plant, to be fed with gas from Kudu

- wind energy power generation along the coast
- electricity generation from invader bush
- concentrating solar-thermal power plant(s)
- solar photovoltaic power plant(s)
- a coal-fired power station, possibly at Walvis Bay
- a nuclear power plant, and
- a host of demand side management options including
  - o applied energy efficiency whenever cost-effective (e.g. the use of compact fluorescent lamps, and the large-scale application of energy efficient appliances and practises including the concerted roll-out of solar water heaters), and
  - o demand side management practises such as ripple control systems (mainly to control domestic electric water heaters, and time of use tariffs).

Figure 2.1 below illustrates how soon the above supply options could be rolled out. The implementation timeline shown below takes typical lead times for the different technology options into account, noting however that the timescale used is relative and merely indicates when supply options could become available relative to one another. Investment decisions are to be based on the expected medium- to long-term demand, as well as the ever-changing regional supply situation. Because of their relatively short lead times, wind, biomass and concentrating solar power could be available most rapidly, while gas and/or integrated solar

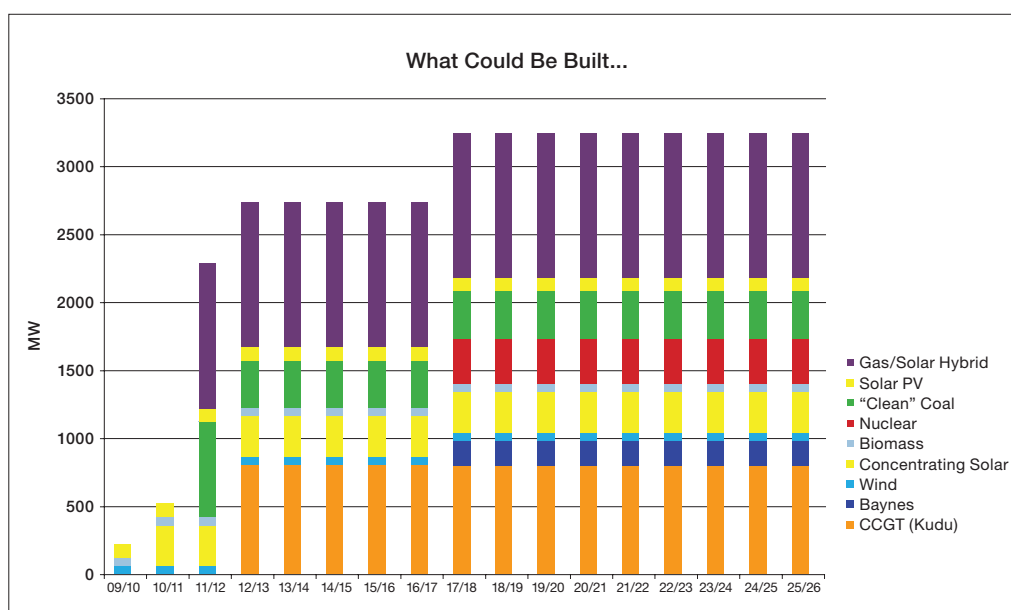


Figure 2.1: Timeline to roll out various electricity supply options [REEECAP, 2008b]

<sup>6</sup> This section relies extensively on the assessment and findings presented in [REEECAP, 2008b]

combined-cycle power plants could make substantial supply mix contributions within a few years. Once the envisaged CCGT plant fed from Kudu and Baynes become available, the southern African regional supply and demand profiles will have changed considerably too. All investment decisions will have to take regional developments into account to determine in how far additional Namibian-based generation capacity is and will remain feasible. The scenario below assumes that demand side management practices would be applied whenever cost effective.

The White Paper on Energy Policy (1998) identifies self-sufficiency, security of supply, inclusion of renewable energy sources, sustainability and cost effectiveness and efficiency as the main energy-sector policy objectives. This chapter deliberately narrows down on these policy criteria, and only considers three distinct evaluation perspectives, i.e. the economic perspective, the social perspective, and the environmental perspective. Here we ask how the different potential supply options introduced above stack up, and what their main advantages and disadvantages are.

To inform the **economic perspective**, cost-benefit analyses and macro-economic analyses are requisite tools [REEECAP, 2008b]. Cost-benefit analysis is a means of quantifying all the direct costs and all the direct benefits of a proposed undertaking and presenting these as a ratio of costs to benefits. Macro-economic analysis in turn focuses on the overall contribution of the proposed action to the national economy, and reports on contributions to the gross domestic product (GDP), job creation, tax generation, and others. In the Namibian context it is found that the generation option with the lowest capital cost is a combined-cycle gas plant, followed by wind, biomass and coal power plants. The most capital-intensive option is concentrating solar, followed by the Baynes hydroelectric power, nuclear power and solar photovoltaics. From an economic efficiency perspective it is found that a future supply that relies on a mix of the above generating options is the most desirable. Furthermore, a supply mix that maximises the use of renewable energies makes the highest contribution to GDP, resulting from the considerable construction costs associated with the Baynes power station and the significant plant size required for a concentrating solar power station.

To formulate a **social perspective** on any new electricity supply option demands an understanding of how it will impact on jobs, livelihoods, prices and perceived desirability [REEECAP, 2008b]. The following broad conclusions are made: irrespersive

of which supply option is chosen from the above list, the number of unskilled jobs created will outweigh the number of skilled jobs. More specifically, those supply options that maximise the use of Namibia's renewable energy potentials create the most local jobs – this is also confirmed by international experience. As can be expected, supply options depending on future fuel imports create the least number of local jobs. In regard to the promotion of small and medium enterprises (SME), electricity generation from invader bush has the greatest potential to promote SME development, followed by the Baynes hydroelectric plant, the development of the Kudu gas field, and the implementation of an integrated solar combined-cycle hybrid power station.

From an **environmental perspective**, one needs to take into account that presently, more than one-half of the electricity consumed comes from South Africa, while in 2007, more than 92% of the electricity generated locally was from hydropower [NamPower, 2007]. A generation mix that maximises the renewable energy component of the future supply portfolio could contribute more than 90% of all of Namibia's electricity needs [REEECAP, 2008b]. Such a supply mix will, on average, have the lowest emissions. On the other hand, a broad mix of the above-mentioned supply options achieves the second lowest emissions.

A few additional observations include [REEECAP, 2008b]:

- a supply mix that maximises the diversity of supply produces smaller adverse environmental and social impacts than those found when larger centralised power stations are used
- consumers are likely to take greater ownership of the electricity they use if involved in the implementation of demand side management
- Biomass suitable for electricity generation is not always where the need for electricity is. However, distributed power supplies using Namibian biomass would avoid the high carbon footprint and cost of transporting the fuel to more centralised power stations. Smaller, localised systems can also support communities living in the area of the power station by buying fuel and/or employing people from the surrounds. If planned properly, land for biomass-for-electricity production in Namibia should not have to conflict or compete with land for food production for the country.

What do the above scenarios suggest in terms of Namibia's future electricity supply mix? In summary:

- a) If Namibia continues to rely on imported electricity and does not invest in local generation capacity, future power outages could be as high as 10% of total demand. Peaking in 2012/13, cumulative unserved demand could be almost 11% of total demand. For one 24-hour blackout occurring every month – which is the equivalent of a decrease in electricity supply of only 3% – Namibia's gross domestic product is reduced by almost 4%. This suggests that the Namibian economy would suffer dramatic consequences in case future electricity supply shortages occur.
- b) The Namibian electricity supply system requires base-load power that is relatively independent of the season and time of day. Although energy storage systems can be used to smooth out the supply of those renewable energy technologies that have a daily or season-dependent variable output, such storage systems are currently developed and substantially increase the cost of many renewable energy systems.
- c) Demand side management measures have a very low cost-to-benefit ratio and should therefore be a principal ingredient of any future supply mix. DSM measures have short-term advantages in that they alleviate imminent power requirements and therefore reduce system outages, while in the longer-term they reduce the need for generation

capacity. Enhanced DSM is also desirable from a social perspective in that they allow people to control their electricity consumption behaviours, which is also advantageous from an environmental perspective. However, DSM alone is not economically efficient.

- d) Developing future electricity supplies using Namibia's plentiful renewable resources is most desirable. The development of local renewable energy resources creates local jobs, makes an important contribution to the local economy, and ranks well from an economic efficiency perspective. It is also environmentally responsible and limits the emissions of greenhouse gases. However, in view of the base-load requirements that Namibia's future electricity supply mix has to satisfy, relying solely on variable-output technologies introduces considerable supply risks and costs.

The above scenarios, which are underpinned by detailed assessments, show that a balanced mix of generation options, incorporating both conventional and renewable energy technologies for electricity generation, and applied demand side management, constitutes the most desirable long-term future electricity supply choice for Namibia [REEECAP, 2008b]. Such a supply mix relies on the increased use of biomass from Namibia's plentiful invader bush, the development of the Baynes hydropower station, and a gas-fired power station

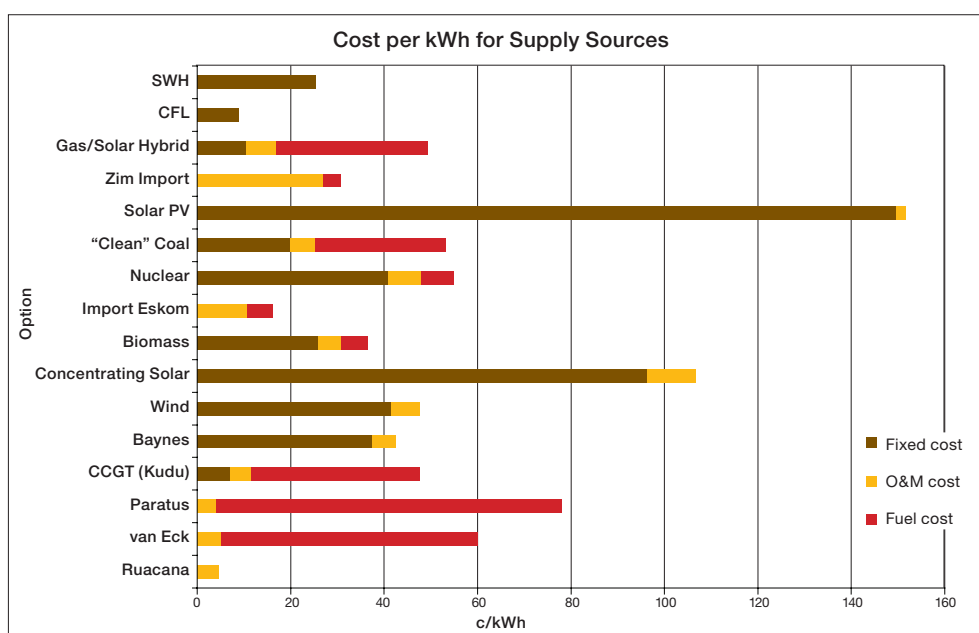


Figure 2.2: Estimated base tariffs for the different potential electricity supply options [REEECAP, 2008b]

to guarantee the availability of base-load electricity supplies. The supply portfolio is to be complemented by an array of diverse renewable generators – each limited in size – to ensure grid stability and cost effective grid integration. A strategic balance between base-load power and the more intermittent generators is essential. An optimum mix also includes a range of demand side management measures, which fosters the productive use of electricity, while maximally involving consumers in their personal electricity consumption decisions. Figure 2.2 on the previous page displays the individual cost build-up per supply and demand side management option.

The balanced supply mix described above is also the most efficient and desirable from a broad economic perspective: it creates a sizeable number of jobs, it promises to have the least power outages, it ensures low environmental emissions, and foreshadows only average future electricity price increases. It implies a lowered risk of unserved demand, achieved by way of diversification of supply. It reduces the reliance on fossil fuels, and builds increased self-sufficiency. By enhancing the use of renewable energies, Namibia's future electricity supply mix capitalises on local comparative advantages, ensures local value addition, creates local jobs and reduces future price risks for imported fuels by lowering resource dependencies. Expanding the generation capacity through smaller-scale renewable energy technologies allows Namibia to increase its supply capacity in a modular manner, in tune with increasing local demand as well as the ever-changing availability of regional supplies. Such a strategy reduces the risk of the overall supply portfolio while benefiting from cost-competitive electricity imports as and when they are again available in the region.

We conclude that there is no single supply option that optimally and simultaneously satisfies the ideal economic, social and environmental ambitions. Individually, some supply options are economically efficient, but do not maximise the use of indigenous resources. Other options have immediate capital cost advantages, but do not guarantee the security of supply, and/or have considerable long-term operating and maintenance costs, and/or introduce risky foreign exchange dependencies. Yet others maximise the use of renewable resources, but are expensive and risky

because the availability of base-load power is not guaranteed. We recognise that there are multiple trade-offs between the various supply options. The optimal timing of each supply option presents its own challenges, particularly because of regional electricity infrastructure developments that could radically change Namibia's import or export position.

Combining the above supply options into a balanced generation portfolio offers the greatest cumulative advantages. To this end, we recommend to evolve an electricity sector strategy that

1. is guided by clear policies and well-defined policy goals and targets (e.g. as part of an Energy Act and its Regulations)
2. incentivises investments in the country's electricity infrastructure
3. encourages the use of Namibia's abundant renewable and non-renewable energy resources
4. promotes energy efficiency in all public and private endeavours
5. minimises long-term foreign exchange dependencies
6. further promotes strong regional partnerships and reliable electricity trading arrangements, and
7. focuses on creating local opportunities for energy entrepreneurs and new energy-related industries, thereby promoting local job creation in the sector and its affiliated industries.



Simon Wilkie

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## INTERVIEW: PAULINUS SHILAMBA, CEO, NAMPOWER

CONDUCTED 13 MAY 2009

**IPPR: NamPower signed new 15-year agreement with South African power utility Eskom in 2007, followed up by a Supplemental Agreement in 2008. What does this agreement contain in terms of the security of supply for Namibia? What will happen at times when Eskom is unable to satisfy South African demand?**

Shilamba: We had a 10-year agreement which expired end of June 2006, whereas the new one is a 15-year agreement. It was signed during the time of crisis when there was a shortage of electricity supply. It recognises the situation we are in and regulates how we should act and work together during a time of crisis. In other words, the agreement differentiates between a crisis situation and normal times. During normal times, Eskom has a surplus capacity which can be sold to Namibia. In an event that Eskom faces supply shortages in their own country the agreement stipulates how NamPower and Eskom should work together to manage such a situation. When there is a shortfall of electricity, Eskom applies demand side management on the part of its customers, for example by reducing their consumption by 10 percent. This demand side management measure is also applicable to NamPower and its customers. For example, if we experience a shortage in Namibia, we request our customers for the same reductions in demand across the board, be it mines, Regional Electricity Distributors (REDs) or other supply authorities.

**There is a worry that following the supply shortages of late, the strong investment in generation capacity in South Africa and other parts of the region will lead us back to a period of over-capacity for years to come. How well-coordinated are generation projects within the region?**

Shilamba: One of the main purposes of creating the Southern African Power Pool (SAPP) under the the Southern African Development Community (SADC) is to coordinate development, including development in the power sector. Under SAPP we have many structures,



one of which is the Sub-Committee on Planning. That committee is currently chaired by NamPower. The Sub-committee has been doing extremely well in coordinating projects, not only in terms of planning but also in terms of implementation and resource mobilisation. Of course your concern is that everybody is looking at investment, that's true. There is nobody



with cash to invest without relying on loans. And if you want to borrow to build a power generation facility, nobody is going to give you money until they know how much you are going to generate and that there is a secured off-taker of power. No financial institution will lend you for a project that generates 800MW if you have only secured a market [demand] of 300MW. It is true that we are building a lot of power stations all over the region, but so far all these have secured a market. We don't want to end up with stranded assets.

You also have to remember that a system must have a reserve margin. If, for example, you have electricity demand of 400MW, your system must be in a position to accommodate 450MW, in case of an unanticipated step load. You must be in a position to handle that, so although we plan to satisfy the existing market we must have a margin of 20-30% on top of that to cater for the unexpected. That is how we plan in our own country and also within the region.

**The current economic slowdown, which is accompanied by falling oil prices and reduced demand for energy, has also relieved some pressure that energy supply experienced across the region just over a year ago. Does this relief have an impact on short- and medium-term energy planning in Namibia?**

Shilamba: Definitely. This situation has affected everybody including NamPower. The impact on Namibia is two-fold: Firstly, the cost of our projects has gone up, mainly because of our weakening local currency. For example, when we were planning to install the fourth turbine at [the hydropower station] Ruacana, the estimated cost was about N\$400 million. But when we reviewed the situation earlier this year, we realised the cost had gone up to over N\$700 million, merely because of the weakening local currency. So I think the challenge now to the company is how to manage our investment programme within budget. That is one way in which we are affected. The other way is that the demand for electricity has gone down, mainly among the mines. You know already that some mines have closed down completely, for example Weatherly, so that demand is not there anymore. Other mines have scaled down their operations – the Namdebs, the Rössings – and some have even gone to the extent of retrenching workers. In summary, the demand for electricity has gone down. What does this mean for our operations? It means that our revenue has dropped as we are selling less energy.

Of course, it is also true that this has reduced pressure on NamPower and other utilities to make capacity available, even at high cost, which would otherwise have been the case if demand had continued to grow. But we see this as a temporary phenomenon. All indications are that with the interventions from the international community, the situation will change over the next one-and-a-half to two years: it is our expectation that the world economy will start to recover, and that demand for electricity will pick up again. What we are seeing in terms of our load-growth scenario is that the demand curve has nearly flattened, but probably from the end of next year onwards, we see that curve going up steep, exceeding what we projected over the last two years. The message to utilities like NamPower is that we do not need to relax and sleep because demand has come down. We have to speed up all our projects and activities, so that when the economy picks up again, we are in a position to accommodate the increasing demand.

**What is the next internal generation facility to be completed? Can you make a prediction when it will be up and running?**

Shilamba: The next project to be completed will be the emergency diesel power station of up to 50MW at Walvis Bay. The tender is running at the present moment, and then depending on what you find in the market, the EPC [Engineering, Procurement and Construction] contractor will be appointed immediately after that; construction will start probably around September 2009. I expect that station to be up and running by March next year. But you have to remember: it is an emergency power station, which is using diesel. So the operational cost is going to be very high. It's a power station you don't want to run under normal circumstances because it's very expensive. It's actually more expensive than [the Windhoek-based coal-fired power station] Van Eck. It will just be a peaking power station.

To give you a complete picture: we have six generation projects, three small ones and three big ones. The small ones are the emergency diesel power station at Walvis Bay; after that the next project to come online is the fourth turbine at Ruacana, which has a capacity of 95MW and is expected to come online by January 2012; we try our level best to bring that date closer. The third small project is the small hydroelectric power stations on the Orange River with a combined capacity of 105MW, which will also come online at the beginning of 2012. Those are the small-scale projects. Then there

are the three big ones: the first is the Kudu gas-to-power project, a coal-fired plant in Walvis Bay and a large-scale hydropower plant, the Baynes Power station.

**The Kudu gas-to-power project seems as elusive as ever, reportedly due to the cost of hedging against foreign exchange risk. Is it fair to say that Kudu will not happen for at least the next 10 years?**

Shilamba: No, that's definitely not correct. The project proved to be challenging, mainly because of two issues: The first issue is the gas price, which we thought was very high at that point in time. When you have to translate the gas price into the electricity price, you end up with a very high electricity tariff that the customers may not be able to afford. The second challenge was how to manage the foreign exchange issue. The gas has to be sold to us in US dollars, but the product, which is electricity, is sold in local currency. Clearly there is going to be a mismatch, and to manage that you have to hedge. Hedging is not an easy process, especially if it covers a period of more than five years. Here we are talking of a project with a life expectancy of more than 20 years. That has been the problem we have not been able to resolve up to now.

But there are many things happening at the moment, not only with the market but also with the project itself. Firstly, when it comes to the market, the price of electricity is increasing each and every year. You've seen what happened in South Africa last year: Eskom applied for a high tariff increase, but unfortunately they were only granted around 30 percent. In Namibia, the price of electricity is also going up every year. The price of Kudu gas may become competitive if you compare it with the increasing price of electricity across the whole region. That is a favourable development for the realisation of Kudu.

Secondly, there is an interest from large customers to participate in or contribute to the success of Kudu. NamPower has been approached by nearly all the mining houses in Namibia, who indicated that preparedness to have their bills indexed in foreign currency as their revenues are in US Dollars. That is good, because if you have customers who are prepared to pay their bills in foreign currency, the exposure of NamPower to currency fluctuations will be minimal.

The other thing I have to tell you is that the upstream developers have not been quiet over the past months, they have been working very hard. They are looking at a new technology called Compressed Natural Gas (CNG). Traditionally, you develop the gas field, you

build a platform and then from there you pump the gas via a pipeline onshore to the market. That has proved challenging, so Tullow has decided to investigate a technology whereby they develop the field, but instead of building a pipeline, they compress the gas, put it in a ship and transport it to the market. They have looked at that possibility, firstly at the technical feasibility, and informed us that indeed it can work. From there they looked at the commercial part of it, which they have also completed now, and made a presentation to us confirming the commercial feasibility. What we are busy doing now is to start to negotiate different options and scenarios. I am very confident that by the end of this year, we can make a commercial decision regarding the future of Kudu.

**If the CNG scenario was chosen, would that still include the construction of a gas-fired power plant in Namibia?**

Shilamba: Yes, but the power station cannot be in Oranjemund, because there is no harbour there. It has to be at Walvis Bay for a number of reasons: first of all, Walvis Bay is a growth point, you have EPZ [Export Processing Zones] growing very fast, and logically you want a power station near the load, since transmission is very expensive, not only due to the cost of building long transmission lines but also as a result of transmission losses. So Walvis Bay is an ideal place for that power station. The other thing is that you cannot build a big power station at Walvis Bay because of transmission constraints, since the transmission line from there is only 220kV and has certain limitations. So if you decide to build an 800-1000MW power station there, it means you'd also have to build new transmission lines, which adds to the cost. We are currently looking at different types and sizes of the planned station to determine which is the most appropriate under the circumstances. We are busy negotiating and discussing to see what we will come up with. But it definitely won't be a big power station.

**Earlier you also mentioned a coal-fired power plant to be built at Walvis Bay. However, Namibia does not have any exploitable coal deposits and will have to rely on imports from Botswana and South Africa. Given the substantial transport costs involved, and the agenda of further integration of regional electricity trade, how can such a plant compete with potential coal-fired**

**plants in our neighbouring countries that do not face those transport costs?**

Shilamba: Each and every project must be proven to be feasible before it can be built. So if you want to build a coal-fired power plant in Walvis Bay it must prove itself to be feasible and that it can compete with other stations in the region. The viability will depend on a number of issues: one of the elements is how you manage environmental problems, which can add huge costs to a project. The other thing is infrastructure, transmission and so forth. Then there is the type of technology, especially when it comes to cooling. If you build a power station at the coast, for example, the cooling will be far cheaper than if you build it in Johannesburg or Botswana where there is no sea. There are many elements which will determine the final cost of the power station.



This project may actually compete very well with those other stations in South Africa or Botswana despite the fact that they have their own coal. It is unfortunately true that we don't have our own, so that coal must be imported, that is part and parcel of the whole package. You must also remember that the major cost of transporting coal to the Van Eck power plant is from Walvis Bay to Windhoek. To get it from South Africa to Walvis Bay by sea is actually very cheap; the problem lies in costly rail and road transportation. This would not apply if the station is built at Walvis Bay.

**Where do you see the Namibian power generation sector in 10 years time in terms of supply mix and competition?**

Shilamba: Maybe ten years is too far. The vision of this company and our strategy is to reach our targets

in the next five years. First of all, you want a mix of power supply sources including hydro, thermal, which can be a combination of gas and coal, and a portion of renewables. In addition, you also want some portion of imports. That is a very good combination. This company has already adopted a policy that 10 percent of the supply portfolio must come from renewables by 2011.

**Can you name concrete renewable energy projects that will provide this supply, and who is investing in them?**

Shilamba: The immediate one is an Independent Power Producer [IPP], so it doesn't mean we have to build all our power stations alone, but the private sector must also be invited to invest in the sector. In terms of renewable energy, we are busy discussing a purchase agreement with a Dutch company called Aeolus to set up a 40MW wind farm at Lüderitz. Those discussions are at an advanced stage and we are confident that they will be concluded very soon, after which this company will start building a commercial wind energy project, to be up and running by 2011.

**It was recently in the news that Tsumkwe is receiving an off-grid solution with a combination of solar and diesel power. Is that the future for remote areas in Namibia?**

Shilamba: Tsumkwe is a remote area very far from the grid. To connect Tsumkwe, you would have to build a very long line, which would cost about N\$80 million. That is just too expensive for this country, that's the whole Government budget for rural electrification for one year. You'd have to postpone all other projects to build this one line, which would be unfair. So I think Government has made the right decision to rather apply this type of technology, which is cheaper and more sustainable than building a line. And after all you have to remember that these are just a few houses, not major industries, so the return on investment of connecting Tsumkwe to the grid would probably not be realised in the next 100 years. I think the combination of solar and diesel off-grid power is the right technology and NamPower decided to support it. We have spent close to N\$5 million as our contribution to this project and we want to replicate that in other parts of the country where there is also no grid.

**In terms of diversification, the majority of Namibia's internal power generation comes from the Ruacana hydropower plant. With the installation of a fourth turbine, its capacity is supposed to be increased further in the near future. And then there is Baynes, which will also be located on the Kunene River. Given the variability in hydropower-generated electricity due to the seasonally fluctuating water flow of the Kunene, isn't NamPower putting too many eggs in one basket?**

Shilamba: First of all, there is no business without risk. Even to build a Kudu power station or coal-fired power plant is risky. So the question is how to manage that risk. I think the fear you mention is legitimate, but you have to remember that there are other countries that are depending on only one source of energy: for example South Africa is more than 80 percent dependent on coal. France is more than 90 percent nuclear. Some Nordic countries are even 95 percent reliant on hydropower. With Namibia, I think if we manage to build all the other power stations, like Kudu and the coal-fired plant, in addition to that element of hydro, there will be that element of balance. These are not big stations: Ruacana will give you an additional capacity of about 95MW, bringing the total capacity to about 320MW. Baynes will also not be a very big station with a capacity of about 500MW, shared equally between Namibia and Angola. So in total hydro will probably be around 400-500MW. This is compared to the load, which we predict to grow to about 800-900MW by the year 2014/15.

If you have about half hydro and half thermal, I think that's a good combination. It may look like we are putting too much in one basket, but we have to remember that we are also developing other generation projects and purchase agreements for imports from other countries. For example from the Zimbabwean thermal plant Hwange, we are importing 150MW. Ruacana is a run-of-the-river plant, meaning that you cannot regulate it. But Baynes will be a regulated power station with a big dam, with a storage capacity able generate for over than a year, even during times of drought.

**Employment creation featured as an important goal in the White Paper. Can you name examples of where NamPower has made deliberate efforts to make the sector more labour-intensive?**

Shilamba: That is a difficult one. I have to say that with conventional power stations, most of the employment is only created during construction. Once a plant is up and

running, you scale down employment. And of course given today's technology, you build power stations where there is nobody, so operating is done remotely. Unfortunately this industry is not that good in terms of job creation after the construction phase.

But there is an energy project that has got the potential to create many jobs in this country. This project also has the potential to address the issue of food security. What I'm talking about is the utilisation of invader bush to generate electricity, which has been on the table for many years and has been supported by NamPower. But its realisation depends also on many other stakeholders. The harvesting process [of invader bush] is labour intensive, but unfortunately these are small-scale projects. So in order to reduce transport costs, you have to build decentralised, small power stations. Also, the electricity generated is so little that it cannot be fed into a transmission grid. It has to be fed directly into a local distribution grid. Nonetheless, these are good projects and we fully support them by sharing our skills and experience, and we assist to make sure they are successful. They have the potential to create a lot of jobs.

One related area in which we generate employment directly at NamPower is the bush clearing under transmission lines. We have small contractors all over the country, who are employing in particular previously disadvantaged Namibians. The Caprivi Link alone has been employing 500 people for construction and clearing of the route.

**The telecommunication company CellOne, in which NamPower was a shareholder through Powercom, was sold to Telecel Globe in January 2009. Looking back, was NamPower's decision to invest in telecoms sensible, especially at a time when Government was asked to urgently provide equity injections to expand electricity supply?**

Shilamba: I have to tell you that it was a wrong strategic decision by the company to venture into telecommunications. It's not our core business and we know companies which have tried to spread their wings and came back with their fingers burning. We thought as a company that we need to rectify that and we decided to pull out of telecommunications. The most important thing is that we recovered all our cost and made a return of about 18 percent from the sale of our shares. The profit we have made will be invested in our core business of generating electricity and also in the development of new electricity projects.

## 3. OPINION: THE CASE OF RENEWABLE ENERGY

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### 3.1 INTRODUCTION

Namibia's White Paper on Energy Policy of 1998 is focussed on meeting seven energy goals; security of supply, social upliftment, effective governance, investment and growth, economic competitiveness, economic efficiency and sustainability. The same policy document states that the promotion of the use of renewable energy would be driven through the establishment of adequate institutional and planning framework, the development of human resources, public awareness and suitable financing systems. In an effort to meet these goals, a number of projects and programmes were initiated, implemented and facilitated by the Government and through partnerships with developmental organisations and the private sector.

In 1993, the Ministry of Mines and Energy launched a programme for the "Promotion of the Use

of Renewable Energy Sources in Namibia", which was supported by the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH. In 1996, the Government launched the first solar revolving fund under the Home Power Project with support from Renewable Energy for African Development (REFAD), which is a US-based development organization. Under this project, loans were granted to interested rural households for the purchase of photovoltaic solar home systems (SHS) in order to ensure the systems affordability for the entire nation, and over 600 units were sold through the programme. This was a first step to address the financing barriers associated with renewable energy technologies. Subsequent programmes followed, and these include the giant Namibia Renewable Energy Programme (NAMREP) supported by the Global Environment Facility (GEF) through the United Nations Development Programme (UNDP), and the Danish Government funded Renewable Energy and Energy Efficiency Capacity Building Programme (REEECAP). The Renewable Energy and Energy Efficiency Institute

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(REEEI) was established to facilitate and conduct research into and promote renewable energy (RE) and energy efficiency (EE).

All these and other developments have seen a big surge in both demand and installations of renewable energy technologies, especially solar home systems for solar electricity. Other technologies such as solar water pumping and solar water heating have equally benefited.

Despite all these efforts, the contribution of renewable energy to national energy mix is still negligible. Figure 3.1 illustrates that energy derived from renewable energy in 2006 in Namibia was very negligible in comparison to other resources such as petroleum and conventional electricity. In 2006, Namibia's electricity peak demand was 490MW against an available generation capacity of 393 MW, while the installed solar electricity at that time was less than 500kW (0.5MW).

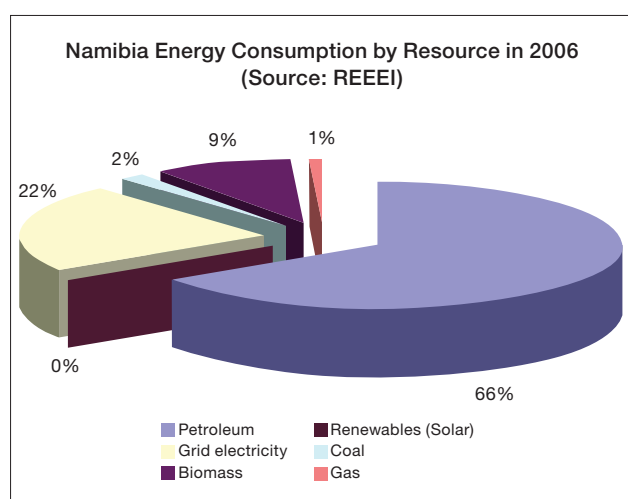


Figure 3.1: Namibia Energy Consumption by Resource in 2006 (Source; REEEI)

### 3.2 ROLE OF NATIONAL INSTITUTIONS IN SUPPORTING RENEWABLE ENERGY IN NAMIBIA

It is a Government held view that the gap in economic development and quality of life between rural and urban population in the country may be addressed through rural electrification. With the national electrification rate of 30% and rural electrification rate of less than 15% of households, rural electrification remains a challenge, although it is one of the priority issues of the national Energy Policy of Namibia. The infrastructure associated with rural electrification



is very expensive, at least in the Namibian context, largely due to the low population density (approximately 2.4 people per square kilometre) and low economic activities in the areas requiring electricity to support the cost of bringing the grid to those areas. The Rural Electricity Distribution Master Plan developed in 2000 and updated in 2005 identified areas where grid electrification will remain unfeasible in the foreseeable future. The Off-grid Energisation Master Plan (OGEMP) launched in 2007 was designed to ensure that those areas where grid electrification is unfeasible will be appropriately developed through off-grid energy solutions based largely on solar energy technologies. Barriers to renewable energy in Namibia were identified as human technical capacity; policy and regulatory framework; awareness and social acceptance of the technology; financing and institutional support.

#### 3.2.1 THE NAMIBIA RENEWABLE ENERGY PROGRAMME (NAMREP)

The Namibia Renewable Energy Programme (NAMREP) is a US\$ 14 million technical assistance project implemented by the Government with financial support from the Global Environment Facility, and implementation support from the United Nations Development Programme (UNDP). It has been addressing some of the barriers experienced in the dissemination of renewable energy technologies in Namibia. The first phase of NAMREP (2004 - 2007) looked at matters of policy and regulations governing renewable energy, removal of financial and technological barriers and capacity building

in Government, NGOs and the private sector. That phase also concentrated on raising public awareness of renewable energy technologies. The second phase (2007-2010) is aimed at speeding up the implementation of solar-energy activities that have impacts as identified in Phase I, stimulated by financing schemes for appropriate product delivery mechanisms. The activities of NAMREP may be attributed to contributing to the sudden surge in demand and subsequent deployment of renewable energy technologies in the country. Between 2004 and 2007 there was a 5 to 8 fold growth in renewable energy technologies, as shown in Table 3.1.

Technology	Year			
	2004	2005	2006	2007
Photovoltaic electricity (kW peak)	16.8	94.7	94.4	138.7
Solar water pumping (kW peak)	36.7	25	95.9	180.2
Solar Thermal (kW peak)	356	641.6	2017.6	4312.8

**Table 3.1: Solar Technologies Installed/Year in Namibia (REEEI renewable energy survey-2008)**

Securing of finance for solar home systems has always been a hurdle for those requiring the technology, partly because financial institutions have always considered that end of the market as a risky area. Punitive interest rates have dissuaded beneficiaries from accessing loans to finance their systems. NAMREP entered into an arrangement with a financial institution to guarantee loans for solar technologies, and that institution has provided loans at discounted interest rates.

Through NAMREP, over 80 solar installers were trained across the whole country on the theory, design and installation of the solar technologies. Efforts were also made to provide business management skills to the installers. Current efforts are aimed at governing the renewable energy industry through the National Technical Committee on Renewable Energy (NTCRE), which is a renewable energy industry wide representative group. The mission of NTCRE is to ensure that an environment exists for the growth of the renewable energy industry in Namibia, within a framework that protects consumers and the environment by promoting quality of renewable energy products and services. The Committee currently runs

a registration scheme for installers and suppliers of renewable energy technologies. After adopting appropriate standards, NTCRE aims to certify personnel and processes to ensure that renewable energy technologies end users receive quality products and services.

The activities and achievements of NAMREP need institutional support for sustainability beyond the end of NAMREP in 2010. It is envisaged the REEEI and the Renewable Energy Unit of the Ministry of Mines and Energy will assume that role.

### 3.2.2 THE SOLAR REVOLVING FUND

The solar revolving fund arrangement is basically to provide loans at subsidized interest rates to end users of three technologies, namely solar home systems (SHS), solar water heaters (SWH) and solar water pumps (PVP). The programme was launched in 1996 with support from REFAD. The Ministry of Mines and Energy has since been providing some money to a fund administrator to administer/manage the loan scheme. The scheme is presently overwhelmed, and cannot meet the demand for the loans. The scheme is run on the Ownership Model, where the end user purchases a solar system by making use of the revolving credit fund loan facility and thus becomes the owner of the system. In this model, the responsibility for the system and its maintenance rests with the owner.

### 3.2.3 THE OFF-GRID ENERGISATION MASTER PLAN

The Off-grid Energisation Master Plan (OGEMP) was officially launched in 2007. It will provide access to energy through an Energy Shop model. The plan is to establish energy shops within reasonable distances of the targeted communities. Private end users will access the technologies through an ownership model (described in 3.2.2) and government institutions will be energised through the current public infrastructure model. The energy shops would sell suitable, approved energy products and compatible appliances modelled as energy baskets. Emphasis would be placed on energy technologies and appliances that utilize renewable energy and energy efficiency. The energy shops would also serve as payment collection centres for the national off-grid energy financing mechanism, thus working hand in hand with the Solar Revolving Fund (SRF) administrator. It is envisaged that each region will have one energy shop in the first year of implementation. During the first two years of the OGEMP rollout plan, all the 13 regions would be focused on equally. The regions

will have more shops based primarily on the size of un-electrified areas, but with more focus on rural areas.

The OGEMP “driver” or Energy Shop Coordinating Agent (ESCA) shall coordinate with regional councils on the establishment of the energy shops, recruit the shops, organize and oversee the technology awareness campaigns, among other activities.

### 3.2.4 THE RENEWABLE ENERGY AND ENERGY EFFICIENCY INSTITUTE

The Renewable Energy and Energy Efficiency Institute was established in 2006, through a cooperation agreement between the Ministry of Mines and Energy and the Polytechnic of Namibia. The cooperation agreement mandated the Institute to facilitate and conduct research into renewable energy and energy efficiency; develop materials and standards, report and disseminate information and materials on renewable energy and energy efficiency; and facilitate cooperation between the Ministry and the Polytechnic, as a public institution, primarily responsible for clean energy technologies. The Institute was the implementer of the Renewable Energy and Energy Efficiency Capacity Building Programme (REEECAP) (2006-2008) funded by the Royal Danish Government. The objective of REEECAP was “to increase the capacity of the Namibian resource base in selected areas to enable it to contribute to the implementation of the national policies for renewable energy and energy efficiency as stated in the White Paper on Energy (1998) and the Second National Development Plan (NDP2, covering 2001-2005)”. REEECAP’s strategic focus was on enhanced capacity for both rural and urban decision makers in energy planning. A total of 21 sub-projects varying from “energy efficiency strategic plan”, “review of building codes”, to “electricity supply and demand management options” were undertaken under REEECAP.

In order to meet its mandate, REEEI needs a lot of capacity building since the Institute is envisaged to play a pivotal role in the OGEMP, take over most of NAMREP’s activities, and spearhead research in clean energy technologies in Namibia.

## 3.3 THE ROLE OF RENEWABLE ELECTRICITY IN NAMIBIA

Approximately 50% of Namibia’s electrical energy is imported from South Africa, the Southern African Power Pool (SAPP) and Zimbabwe. Total electrical energy consumption for Namibia reached 3,219GWh per annum in 2007 (excluding losses), compared to

3,163GWh in 2006 (NamPower, 2007). Considering all solar energy technologies installed in Namibia, the solar energy consumed in 2007 was approximately 6.4GWh. Despite recent Cabinet Directives<sup>9</sup> and developments on electricity tariffs where average cost of electricity has increased by over 14% per annum, the application of renewable energy technologies is still very low. The low penetration of renewable energy in the Namibian energy sector is partly due to:

- Cost un-competitiveness of renewable energy largely due to an uneven playing field,
- Low electricity tariffs in the past and the high cost of (mostly imported) renewable energy generators,
- Lack of an appropriate regulatory framework that supports renewable electricity,
- Lack of awareness regarding the cost and socio-economic advantages of generating electricity from renewable energy resources.

Recent studies by the Renewable Energy and Energy Efficiency Institute (REEEI), NAMREP, and the Ministry of Mines and Energy (MME), indicate that there is considerable potential for large-scale deployment of renewable energy.

### 3.3.1 RENEWABLE ELECTRICITY OPTIONS IN NAMIBIA

Namibia has significant renewable energy resources such as solar radiation (5.4 - 6.2kWhr/m<sup>2</sup>/day)<sup>10</sup>, wind (annual average speeds of 6.8 - 7.5m/s in Walvis Bay and Lüderitz)<sup>11</sup> and considerable biomass material in the form of invasive bush which covers over 26 million hectares of grazing land. Ironically, the contribution of renewable energy in 2006 was 8,240GJ out of a total of 57,047,895GJ (including petroleum) of energy consumed in the country (REEEI, 2008). This figure is less than 1% of total energy consumed. In Namibia, renewable energy technologies are widely being used in off-grid energisation and for domestic water heating. Potential technologies that can be deployed at large scale in the country are solar concentrating power, bush to electricity and wind. Photovoltaic technology will continue to play an important role in off-grid electrification and solar water pumping.

9 In June 2007, the Namibian Cabinet directed that all government and parastatals buildings, water heating needs must be met through the installation of solar water heaters. The 2nd directive was to the Ministry of Mines and Energy to make sufficient budgetary allocations for the implementation of the Off-grid Energisation Master Plan concept to be used for off-grid areas to get access to clean energy.

10 ACACIA sub-project E1, University of Cologne, Atlas of Namibia Project, 2002. The project was conducted for the Ministry of Environment and Tourism.

11 TERNA GTZ: Project Studies for Wind Parks in Walvis Bay and Lüderitz, 1999.





A sustainable energy policy must be based on three goals; i.e. secure supply, profitability and environmental protection. In its Millennium Statement in 2007, the World Energy Council (WEC) established three sustainability objectives, coined the three A's as the basis for its analysis of the project, "Energy Policy Scenarios to 2050" (World Energy Council, 2007). The 3A's are Accessibility to modern and affordable energy for all; Availability in terms of continuity of supply and quality and reliability of service; and Acceptability in terms of social and environmental goals. The achievement of the three A's is largely determined by the social, political, and economic environment - and the extent to which these factors facilitate or hinder sustainable energy development. High government (both central and local) engagement, high cooperation and integration are the key to a achieving a sustainable energy policy. Solar, wind and biomass are the resources that are at a level in Namibia where with appropriate policy framework they will meet the 3A's mentioned.

A study by EMCON Group for REEECAP titled, "Electricity Supply and Demand Management Options for Namibia-A Technical and Economic Evaluation" identified and ranked different renewable energy technologies in Namibia in terms of benefit-cost-analysis as well as other parameters like technological maturity. According to the study the use of some renewable resources is economically efficient and that within a

balanced generation mix up to 20% of demand could be met by renewables excluding hydro power.

Hydro electricity projects in Namibia are subject to intense geo-political considerations because all the rivers with current and potential hydro power generation are situated along international boundaries and their sources of origin are outside Namibia. Sites under consideration are Baynes (400MW), and Orange River (mini hydro stations of up to 105MW). The cost of Baynes is estimated at USD\$640million (SAPP, 2008) and the plant will be operated as base-load to mid-merit<sup>12</sup>. The Baynes power station may be used as load-following plant since it is much easier to operationally regulate a hydro power plant.

Bush-to-electricity has wide social and economic acceptance. The estimated cost of bush encroachment to the national economy was N\$700million per year in 2004. This cost comes from reduced livestock grazing land. Farmers use different methods of combating bush encroachment from mechanical cutting, slash burning, charcoal production to herbicides. Electricity may be generated from this particular plant material through gasification or directly fed into boiler furnaces. However, there is still need of a detailed investigation into technical and socio-economic aspects of bush

<sup>12</sup> Mid-merit plants are designed to cover electricity supply above the base-load but below peak level.

to electricity. The investigations should look at the optimal generator types and sizes, appropriate methods of harvesting the bush, operation and management of the generating plants and grid stability arising from distributed generating plants. Harvesting the bush by manual means has the potential to create considerable unskilled job opportunities. Biomass based electricity generating plants have an advantage of being dispatchable due to the stored energy in the biomass, which allows the power plant to be utilised as base-load to mid-merit plant. Emcon (REEECAP Study, 2008) estimated investments costs for gasification plant and grid integration hardware at NAD 16.7 million/MW in 2007.

Wind power has great potential along Namibia's coastline, most notably in Walvis Bay and Lüderitz due to the availability of the required connection infrastructure. Given the current grid, between 40 and 80MW can be generated from wind with added benefits of direct and indirect jobs being created. The most likely direct jobs in Namibia are in the installation and maintenance of the wind turbines. The jobs will be by utilities, developers, installers and maintainers, consultants, as well as in research and development (R&D). In the EU, with an installed capacity of 56 GW of wind in 2007, the sector directly employed approximately 108,600 people in that year (EWEA, 2009). For a country with the capacity to design and manufacture wind turbines and related components the jobs in the wind energy sector will come to 15.1 jobs/MW (EWEA, 2009). Namibia does not have the capacity to manufacture turbines and components, meaning that the sector may only generate up to 6.2 jobs/MW (EWEA, 2009). Local economies at the towns of Walvis Bay and Lüderitz will definitely be transformed with wind developments, as is the case with Schleswig-Holstein in Germany and the region of Navarre in Spain, which are the wind pioneering regions. The overnight cost of wind power plant is in the range of US\$1.7million/MWe but this varies greatly with factors such as cost of land, labour, and the cost and size of wind converters and related equipment.

Concentrating Solar Power (CSP) is emerging behind wind as a significant potential source of large scale renewable electricity with an installed global capacity of 431MW in 2008. Projects of 4500MW capacity are currently at various stages of planning and implementation from Spain, United States of America and North Africa. Ideal conditions for CSP plants are: high direct insolation (>2000kWh /m<sup>2</sup>/year with minimal cloud cover), flat topography, close to a load centre or transmission lines and water for steam

generation and cooling. Namibia's solar radiation is exceptionally high, averaging 2300 kWh /m<sup>2</sup>/year in the south of the country which is generally flat. Considering investments for CSP plants, the solar field takes between 50% and 70% of total investment costs followed by storage and the power block (RENAC, 2009). Investments costs for CSP plants vary between US\$3million to US\$7million/MWe. CSP technology is receiving a lot of attention from utilities to equipment suppliers and researchers such that costs are expected to considerably come down in the next 5 to 10 years.

Integrated Solar Combined Cycle technology is a *hybrid* of solar thermal technology (CSP) and natural-gas-fired combined cycle, which is gaining popularity with utility and energy developers to ensure 24 hour operation cycle of the power plant without necessarily investing in expensive storage systems for the solar component. Kudu gas could be combined with the CSP technology to provide the required base-load station for Namibia.

Other technologies such as geothermal and ocean energy require detailed and intensive research before they can be considered as medium term power supply options. For geothermal there is need for further exploratory work by the Geological Survey, research institutions and investors. Ocean energy covers a series of emerging technologies that use the power of ocean temperature gradients, currents, waves, and tides to create energy. While very few of these technologies have been implemented on a commercial scale worldwide, they show much promise for future development. Further technological research is required.

### 3.4 POLICY RECOMMENDATIONS ON RENEWABLE ELECTRICITY IN NAMIBIA

There are as many barriers to the entry of renewable energy into mainstream energy economies as there are different such technologies. Conditions that are necessary for the large scale deployment of renewable energy are; government policy covering issues such as tax credits and import duty; a conducive regulatory framework with market instruments such feed in tariffs -and quota systems and mandates; and skills to research on and manage the technologies, advise on policies and implement the designed policies.

One undisputed fact is that those countries that have experienced phenomenal growth in these technologies and managed to successfully install megawatts (MW) of renewable electricity have done so behind a massive

energy policy shift. They have moved towards market based instruments to reduce the costs of promoting pre-commercial stage technologies. The main instruments are the renewable energy feed in tariff (REFIT) law and a quota system with green trading certificates. The REFIT law has allowed countries such as Germany, to capture a huge chunk of the global renewable energy market, allowed its citizens, farmers, businesses and community groups to invest in renewable energy successfully and easily, created towards a quarter of a million jobs, and saved millions of tons of greenhouse gases each year (BMU, 2007).

The various intervention and support mechanisms for renewables from the Government of the Republic of Namibia mean that there is recognition that market forces alone cannot enable such technologies to gain ground and contribute significantly without deliberate support mechanisms in one form or the other. Current positive initiatives on developing a new Energy Regulatory Framework provide an opportune window to introduce suitable mechanisms such as REFITs or quota system or both. Other traditional instruments such as tax exemptions, soft loans, investments grants, etc, compliment these two principal instruments. Feed in laws must be designed with a country's specific resources, renewable energy targets, social systems, and electricity systems, institutional and technological structures in mind. The introduction of REFITs should be done in such a way that Namibians themselves benefit by becoming power producers themselves. It must be an opportunity to economically empower Namibians.

Besides these regulatory instruments, Namibia requires an integrated resource plan which will guide the country by ranking its resources for power generation and guide investors in making their decisions in line with the country's priorities. Specific national targets on renewable electricity are needed to provide and guide the vision of the country. For instance South Africa has a national target of 10TWh to come from renewable energy in 2013.

For concrete results in renewable energy promotion, Namibia requires to design a three level policy scheme, like in China and the United States of America. The central government establishes the first two levels of policy. Local governments, including regional and municipal governments, establish the third level of policy with overall direction from the central government. **First-level policies** will provide general direction and guidance, as outlined in the short-term national development plans and long term plans relating to the global environment. **Second-level policies**

will specify goals or objectives and development plans, and focus on rural electrification, renewable energy-based generation technologies and biofuels utilization. These policies attempt to standardize the directions, focal points, and objectives of renewable energy development from different viewpoints. Some departments propose concrete policies and regulations. According to the National Renewable Energy Laboratory, **Second-level policies** have played a very important role in promoting renewable technologies in China. **Third-level policies** consist of practical and specific incentives and managerial guidelines. These outline specific supporting measures for developing and using renewable energy such as subsidies, tax relief, feed in tariffs, etc. These third-level government policies provide crucial support to help develop renewable energy in its early growth stages.

### 3.5 CONCLUSION

Renewable energy not only has the potential to satisfy Namibia's increasing electricity demand in a sustainable manner; it could also become a significant and vital stimulus to its economy. Greater energy independence, lower energy costs, reduced or avoided future risk of increased fuel prices; improved competitiveness; reduced greenhouse gas emissions; increased technology exports and major employment opportunities are among the low-hanging fruits the technology has to offer. Conventional plants generating power from fossil and nuclear fuels use large amounts of water for cooling; wind turbines do not use water on top of other environmental benefits. With specific policies and firm targets, solar, wind and bush (biomass) are the renewable resources with great potential to be readily harvested and contribute significantly to electricity generation in Namibia. These resources are abundant and the accompanying technologies are mature.

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## INTERVIEW:

# JOSEPH IITA, PERMANENT SECRETARY, MINISTRY OF MINES AND ENERGY



Simon Wilkie

as well a number of [legislative documents] in the petroleum sector; the Electricity Control Board (ECB) and Renewable Energy and Energy Efficiency Institute (REEEI) were created as a result of it; and we have come up with an Off-grid Energisation Master Plan. To be sure, this document is a living document and at the moment we are reviewing the whole sector. [An area] which was maybe not emphasised enough in the 1998 White Paper is a concentration on renewable energy, and also on nuclear energy.

**Government is investigating that option of nuclear power at the moment. Can you already say by when preliminary findings will be reached and whether this is something Namibia will go ahead with?**

Iita: As a government, we have made headway in determining our policy options with regards to nuclear energy. We are in the process of investigations in order to come up with a nuclear policy and legislation, which will culminate in the establishment of a nuclear regulatory body, among other things. Our intention is not to start with a nuclear power station, but with a programme, and that has to commence with proper legislation and a policy to be in place. We are doing that in conjunction with the International Atomic Energy Agency, and there are quite a lot of interested parties that would like to invest here.

**The 1998 White Paper sets a target of 75% energy self-sufficiency by 2010. However, local generation in 2007/08 was 48%, only marginally more than the 47% quoted in the White Paper for 1996. Has Government's policy regarding self-sufficiency changed since then?**

Iita: No, government's policy with regard to self-sufficiency has not changed. First of all, there are different sources of energy, and the best and cheapest in the long run is always hydro. Namibia was unable to reach that level [of 75% self-sufficiency], because the country does not have any [perennial] rivers inside its borders. There are only those along our borders; the Kunene river [for example] is shared with Angola.

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CONDUCTED 18 JUNE 2009

**Has the 1998 White Paper delivered what it promised? How would a new Energy Policy White Paper today be different from the previous one?**

Iita: The answer is definitely yes, it has delivered on its promises in the sense that through the White Paper on Energy Policy we have devised for example the Rural Electrification Distribution Master Plan; we have come up with legislation in the electricity sector,

There were discussions for quite a long time to develop [the hydro-power plant on the Kunene river at] Epupa, but there were two different opinions: the Namibian position was to develop it, as it had more power output [than the other options], but the Angolans favoured [a different location in the river] Baynes because of environmental considerations. The discussions dragged on for quite a long time and it was only at the end of 2006 that the two governments agreed to go ahead with Baynes. However, [this station at] Baynes has not been developed yet.



Kudu gas-to-power, which was supposed to have been developed, has also not been realised. First there was Shell [holding the rights to the Kudu gas field], who wanted to come up with a floating LNG [liquid natural gas] platform. But when they could not find the type or size that they wanted, they withdrew. Then came Chevron-Texaco. We told them we wanted the gas to be converted to power. They were also dilly-dallying, so we gave them a deadline and they left. Then came Energy Africa, which was bought by Tullow Oil of Ireland, who are still [holding the exploration rights at Kudu]. Then people have been talking about wind power. A number of licenses have been given to private companies to start IPPs, but those have not been set up either. So, the reason why we have not been able to [achieve our target for self-sufficiency] is because no new generation capacity has been created in Namibia. However, the situation may change in the next two or three years.

Currently we are busy with techno-economic studies, as well as environmental impact assessments [for Baynes]. Nothing has been built yet, but these studies will inform decision makers regarding what needs to be done. There is also a real possibility that we

will use Kudu to put up a gas power station in Namibia, so within the next two or three years [there could be a significantly higher internal generation capacity].

Since we don't have [abundant conventional] energy sources such as coal, the country decided to connect itself to the SAPP as well as internally. The only part of Namibia that was not connected to the rest of the country was Caprivi, which borders Zambia and is close to Zimbabwe and Botswana. That's why after the completion of the Caprivi Interlink Connector, if we are not self-sufficient we will be able to import power from anywhere in the region. And when we build all this capacity [I mentioned before] and have excess power, we'll be able to export electricity to the rest of the region. As a policy option we are also considering nuclear power, in fact we are quite serious about that. After the legislation is in place, we will begin a capacity building programme, and we may come up with a small-size nuclear power station. I think within ten years we can be there, but the whole process, including drafting the policy and legislation, will have to start early.

#### **Where do you see the Namibian electricity sector in ten years time in terms of supply mix and upstream competition?**

Iita: In ten years time I see Namibia having 100% self-sufficiency in electricity supply. The basket of energy sources will definitely include hydropower, with Baynes and a number of mini-hydro power stations on the Orange River. There is an issue with South Africa drawing the border on the northern [Namibian] bank of the river, so we'll have to find a resolution of this boundary issue first, or we can build on our friendly neighbourly relations. Kudu gas will definitely play a role in electricity generation. We will have an emergency coal-fired power station in Walvis Bay, which can generate between 50 -100 MW. As mentioned, I also see the possibility of a nuclear power station.

Renewables will be part of the mix, not only in terms of home solar systems and solar water heaters, but I think we may even have one or two photovoltaic power stations of up to 2MW feeding into the national grid. We are also rolling out the Off-grid Energisation Master Plan, which has already been budgeted for. We have appointed the REEEI to do the roll-out, which includes putting up solar shops in every region, as well as wind mills.

With some of this we're looking [for assistance from] the private sector, but sometimes companies come here [to Namibia] to set up a power plant and the ECB

grants them a license, but then nothing happens. Some of these companies complain that they can't obtain a power purchase agreement from NamPower, which of course they need. But we cannot force NamPower to enter into an agreement if [the terms] are not in the best commercial interest of the company.

**But so far not a single power purchase agreement has been concluded...**

Iita: NamPower knows how to protect itself, if you look at their due diligence documents. That may mean that they sometimes chase away companies, but it may also be good for the company. There are different types of investors; some of them come here and say a lot of good things, so ECB gives them a license. But their main intention may be to raise money, and once they have done that nothing is being set up here. Therefore I think that for NamPower to sign a power purchase agreement, they must also be convinced that there is going to be a power station. If the investor is serious about setting up a power plant, nothing prevents them from approaching the mines [as electricity consumers] directly. There are experiences that some investors use licenses only to go to the stock exchange, make their money, but in the case of mining for example, they never do any exploration.

**The 1998 White Paper on Energy Policy contained the target of promoting renewable energy sources, and your Ministry embarked on a five-year renewable energy master plan, which started in 2005. Nonetheless, it appears that little has been implemented in terms of concrete measures to encourage their use. What is government doing to better promote renewables?**

Iita: I don't agree that nothing much has been done. Within the Ministry, we have created a division of renewable energy. Secondly, we have trained renewable energy technicians in all the regions, who are ready to install the systems. These [technicians] have been linked to the Solar Revolving Fund, which is run by Conga Investments, and also to facilities that were created at the banks, like Bank Windhoek and as of recent also First National Bank. These technicians are further linked to the manufacturers and big suppliers [of renewable energy technology] in Windhoek.

We have also established the REEEI at the Polytechnic of Namibia to do research in the area. Coupled to that, in consultation with the United Nations

Development Programme and the Global Environment Facility, we had a lot of studies done with respect to identifying barriers to renewable energy, including technical, financial and perception barriers. There has even been an awareness campaign so that people better understand these renewable energy systems, especially solar. As a result, the [Solar Revolving] Fund was overwhelmed, which is why we went for the [Off-grid Energisation] Master Plan. It is true that the Master Plan has not yet been implemented, because it was only approved in 2007, and then we only got the budget for the first time last financial year. The budget is now with the REEEI to roll out the energy shops, which offer a basket of energy products and technical advice.

**When can we see the first energy shops springing up around the country?**

Iita: This year still. We have a budget for this financial year for purchasing the [shop installations] and giving out loans. We've already given the money to REEEI, so this financial year we will have at least one energy shop per region. Eventually there will be many of them in all regions.

**Can you provide us with an update on current developments regarding policy and legislative documents?**

Iita: In order for us to streamline policies in the entire energy sector, we have set up a committee between the Ministry of Mines and Energy and the ECB, chaired by the [ministry's] Director of Energy. This committee is for example looking at the upstream and downstream petroleum sector to write the relevant legislation into one piece, because currently there are too many acts with amendments. It is also finalising the gas bill which we have been working on.

Regarding regulation, I personally feel that a country like Namibia doesn't need too many bodies, so we're working on legislation that will turn the ECB into an energy regulator, including gas, but not petroleum [which is currently regulated by the ministry]. We are also currently reviewing the 1998 White Paper to bring it in line with modern trends. We further want to come up with Integrated Resource Planning in the energy sector, but that is very expensive. Renewable energy sources are important in all these initiatives. For example, we have become observers in the International

Renewable Energy Agency (IRENA) set up by a German government earlier this year.

But there are also fanatics who want to rely exclusively on renewables. I believe that a developing country like Namibia cannot only rely on them, especially photovoltaic systems. These will never develop your industries, you cannot run a smelter on solar systems. The problem is electricity storage, which so far has not been solved. Once that is done, then there is a future [for the large scale application of renewables]. We do not want to remain behind [on industrial development], but we also have to keep our institutional learning up to date so we have the capacity to roll out new technologies when they emerge.

**The Ministry of Mines and Energy has given out special loans for the purchase of solar water heaters by households. How many loans have been extended since their inception?**

Iita: I'll have to separate that [into two components]: The solar water heaters are a recent addition, whereas previously only Solar Home Systems were included, of which so far 1300 systems have been installed with the support of the Ministry. The new solar water heaters have so far only been installed 90 times through the programme, along with 110 photovoltaic pumping systems.

**Does the government have further plans in the pipeline to improve demand management? Could you imagine subsidies for energy-saving technologies?**

Iita: As a practical example, we wanted to introduce a subsidy on solar systems in the form of VAT zero-rating, but the Ministry of Finance did not support the initiative. VAT zero-rating is normally targeted to assist poor households, and some of these systems are not necessarily affordable by the poor. I think when it comes to energy-saving devices, the same principles might be applied. I will definitely fight for [VAT zero-rating of such devices] if we were to have factories here producing these systems, because then you'd be subsidising Namibian producers. At the moment, however, most of them are imported and you would deny revenue to the receiver.

So far we have implemented demand side management funded by NamPower, which included the replacement of light bulbs with low-energy bulbs. The municipality has introduced ripple control, especially

in Windhoek. Here you're not actually controlling your own geyser at home, but it is being switched off by the municipality during certain periods without you even knowing it. I understand the time-of-use tariff is also being introduced soon. Then there is the issue of load-shedding, which we escaped 100 percent last year, while [South African utility] Eskom was suffering. We were actually the only ones in the region not affected by load-shedding. But the collapse of Weatherly's operations and scaling down of some mining companies also helped us to reduce electricity demand.

**Speaking of regional electricity trading, the Southern African Power Pool (SAPP) was mandated, through directives of SADC energy ministers in April 2007 as part of the SADC Regional Infrastructure Development Master Plan, to pursue energy projects that would transform the region and attract foreign investment. What has happened since on a regional level?**

Iita: One of the developments immediately after then, five of the SAPP members, namely South Africa, Namibia, Angola, Botswana and DRC, came together and formed a company called Westcor. This company was intended to develop a huge hydropower station at Inga in the DRC. That power would then be transmitted through Angola, Botswana, Namibia and South Africa, in what is called the Western Corridor. The company was established, and things were moving very rapidly, but not anymore. The development has stalled because of problems in the host country [DRC] that we were not aware of. The other regional project that I am convinced will move very fast is Zizabona, which entails transmission lines between Zimbabwe, Zambia, Botswana and Namibia. This project is progressing nicely, even the inter-governmental memorandum of understanding is already drafted and should be signed soon. The inter-utility agreement is already finished and there is also a team [in place], led by Namibia. There are even already tenders going out for the construction of the first phase, which is Zambia-Zimbabwe, then Zimbabwe-Botswana and Botswana-Namibia. Each country will be responsible for the costs in its own territory. That is an example of a project of a regional nature.



## 4. RURAL ELECTRIFICATION

BY CONSULTING SERVICES AFRICA



### 4.1 REVIEW OF 1998 WHITE PAPER WITH REFERENCE TO RURAL ELECTRICITY ACCESS

#### 4.1.1 OVERVIEW

The 1998 White Paper on Energy Policy devotes two sections to rural and peri-urban energy needs, looking at the status of access to electricity, challenges faced within this sector and strategies for policy development to address needs in rural energy access.

At the time of writing of the White Paper, only 8 to 9% of rural households had access to electricity. It was established in Chapter 2, section 2.3 of the Policy, that rural populations were predominantly dependant on wood fuel as well as other forms of biomass (such as crop residues, animal waste etc.) and also on paraffin and candles as sources of energy for heating, cooking and lighting. The White Paper indicated a general awareness that these sources of energy are the most popular in rural Namibia, given the various

socio-economic and cultural factors. Further, it was recognised in the Paper that these could not easily be replaced in the short to medium term, due to the population demographic. It was therefore proposed that an integrated approach be taken: more efficient use of renewable and non-renewable resources would be promoted, while at the same time increasing access to electricity.

The Paper identified the peri-urban demographic group as those not easily categorised as either urban or rural and proposed that the appropriate strategies from either of the latter two categories be applied as required.

Women were singled out in the Paper, based on their key roles and responsibilities in the rural areas. Women's energy needs would be addressed through participatory processes allowing [rural] women to take part in the design of energy programmes and projects that support them. They would also find support through Government initiatives that educate the public and raise awareness about energy interventions and their effectiveness.

#### 4.1.2 GENERAL APPROACH TO RESOLVE RURAL ENERGY ISSUES

The Paper recognised the link between poverty and unsustainable resource use practices, and concluded that any rural energy policy would have to take a holistic approach by including social upliftment with rural development. It therefore singled out the following key areas to be addressed:

- Appropriate fuels and appliances
- Control, responsibility and management (Such as communal management of forest resources)
- Coordination and integration (via cooperation of the various government institutions involved, such as National Planning Commission, Directorate of Forestry etc.)
- Capacity building (specifically, the methodologies to be employed in achieving the stated goals are defined as communication, training and participatory approaches)
- Evaluation and monitoring (to inform policy and practice and for future planning)

Under the heading of “Sustainable use of biomass fuels” the White Paper identifies the following tasks to be undertaken by the Namibian Government: assessment of the status and use of biomass resources; moving of wood resources; and promotion of fuel-efficient cooking technologies. Additionally, Government would undertake to establish inter-sectoral mechanisms to improve rural development through coordination and integration to realise the full benefits of energy services. Inter-Ministerial mechanisms for the integration of wood fuel needs into Forestry policies would be established in support of this drive.

Government would have to ensure that safe and appropriate energy services are affordably made available to rural people, through effective distribution networks and by offering credit facilities to enable or stimulate purchases. Rural electrification through the extension of conventional electricity distribution networks was acknowledged as being unable to service all rural community’s needs: some form of renewable energy technology(ies) would need to be employed to satisfy the greater demand.

The Namibian Government was to undertake the development of strategies to build capacity and disseminate energy information on the safe and sustainable use of energy.

In terms of evaluation and monitoring, Namibia’s Government would establish a research strategy which would aim to quantify rural household energy use and

which would provide information for energy policy review.

#### 4.1.1 REVIEW OF THE WHITE PAPER OBJECTIVES IMPLEMENTATION

*Analysis of the White Paper’s proposal for an integrated approach*

At the time of writing this report, off-grid [renewable] energy projects had not yet been implemented on a national scale, apart from the Government initiative to facilitate preferential financing of the same. Grid based electrification had been effectively implemented over a long period of time and resulted in the electrification of some 30,000-40,000 households. Various community based initiatives had been launched to address sustainable natural resource management.

The level and effectiveness of inter-departmental coordination has not always been clear, but the fact remains that Namibia’s Government has successfully addressed rural energy issues in a small number of localities. There still remains a great deal of work to be done and a large number of human settlement areas that still have to be serviced in one way or another.



### *Status of the dissemination of appropriate fuels and appliances*

The Namibian Ministry of Mines and Energy (MME) through its NAMREP programme have launched several initiatives to promote efficient biomass utilisation, particularly in application to food preparation. Stove producing SMEs have been founded and promoted (through training and advertising) as part of these initiatives. At the time of writing, five Government-founded stove producing SMEs and at least three commercially-founded stove companies were successfully operating in Namibia. The impact of these entities has, for the most part, been relatively small compared to the potential size of the market. Fuel distribution had not significantly changed since the writing of the White Paper, and most disappointingly, the abundant invasive bush species resources had not yet been extensively exploited in some form of fuel distribution programme (an aim set out in Item 2.3.2.2 of the White Paper). LPG and paraffin distribution networks remained mostly unchanged.

MME launched the Solar Revolving Fund (SRF) to provide financing facilities to those who are unable to afford solar energy technologies (now also including solar water heating and solar water pumping). The fund has been successful, but due to its limited capacity it has struggled to meet the overwhelming demand.

No financing structures have yet been specifically developed to assist the rural poor with the acquisition of appropriate fuels and / or appliances.

### *Status of initiatives to ensure control, responsibility and management*

The Namibian Government has set out to promote sustainability. There are various governmental and non-governmental initiatives to promote and support such programmes. Integrated Sustainable Land-use Management (ISLM) and Community Based Natural Resource Management (CBNRM) projects are regularly conducted and have met with good success in certain, smaller areas throughout the country.

### *Capacity building initiatives and information dissemination*

Certain activities, such as ISLM or CBNRM, inherently require capacity building and training for any measure of success. Conversely, grid electrical infrastructure requires no technical capacity amongst beneficiaries for successful erection of such infrastructure, and so information dissemination initiatives have been limited. Informing beneficiaries regarding the actual use of newly installed equipment



(installed as part of electrification programmes) is generally left to the infrastructure contractors, who don't have a contractual obligation to do so, and local government. The lack of overall programme integration may be to blame for this shortcoming, but more likely it is due to limited funding availability.

It is not immediately apparent that capacity building initiatives have specifically targeted women more than other groups, though these initiatives inherently addressed certain issues that rural women struggle with daily, such as having to cover great distances to gather wood fuel. Also, through efficient cooking technologies, women are freed from the burden of having to gather [as much] resources.

### *Status of evaluation and monitoring*

Studies have been made to characterise and assess the availability and / or status of biomass resources, and have provided accurate information for planning and further decision making. Also, since the compilation of the White Paper, greater understanding has been gained on the profiles of energy use of rural households in Namibia.

### *Rural electrification*

The Namibian Government has conducted grid-extension based rural electrification projects since 1990 and continued to do so after the White Paper had been compiled, thus addressing the objectives set out therein. From 1990 to 2000, electrification was executed as part

of the National Rural Electrification Programme (NREP), with limited formal guidelines and planning. After the year 2000, electrification was continued according to the newly completed Rural Electricity Distribution Master Plan (REDMP). The REDMP included formal guidelines for network planning, financial planning, implementation planning, and priority listings for localities to be electrified, including designation of off-grid localities and implementation planning for those. Prioritisation was done according to a well specified framework based on the size of the locality, its proximity to the existing grid and public infrastructure at the locality. Long term planning in the REDMP indicated that over the 20-year horizon of the planning, the number of localities that could be economically connected to the grid, would steadily diminish. At the same time, the net present values of capital expenditures would have to remain more or less constant or increase slightly. Historically though, the funding made available for these projects have remained constant, in terms of future value, or have decreased.

The White Paper also recognised that the majority of settlements could not be economically serviced with grid electrical connections.

The Off-grid Energisation Master Plan (OGEMP) was commissioned in 2005 and approved by Cabinet in 2007. The OGEMP detailed the establishment of energy shops that would distribute solar energy and other technologies in rural Namibia, while facilitating the revolving loan scheme (the scheme would be managed by a third party or Government). The OGEMP therefore designated key, central localities to be “furnished with” energy shops that would distribute to the surrounding communities, with the long term aim of establishing a relatively dense network of energy shops that could service outlying rural areas. The master plan did not detail the exact methodology for the setting up and operation of these energy shops and distribution networks. However, despite the completion of the OGEMP, no national initiative for the distribution and installation of solar energy technologies has been successfully launched yet. The Namibian Ministry of Mines and Energy, through the Ministry of Finance, called for tenders for the implementation of the OGEMP in 2008. The process was subsequently halted due to restructuring of the intended financing arrangement(s). At the time of writing this report, there are talks of MME conducting the programme wholly through the Renewable Energy and Energy Efficiency Institute (REEEI) of Namibia.

## 4.2 RURAL ELECTRIFICATION PROGRAMME PROPONENTS

### 4.2.1 OVERVIEW

Rural electrification has consisted of two main phases. Between years 1990 and 2000, rural electrification was executed under the NREP. This programme initially targeted the largest and densest population centres in the central-northern areas. In each subsequent year, a different region(s) was focused on. In all cases there was no formal prioritisation of localities, and work was planned on an ad hoc basis. In 1996 MME instituted a revolving fund for solar home systems in an attempt to allow affordable energy access to remote households. Both MME and NamPower were involved in the funding and execution of projects during this period. Norway granted considerable funding during this period also, and Northern Electricity (Pty) Ltd. (no longer operational) contributed a significant amount of funding over the five year period 1996 to 2000.

The MME commissioned the compilation of the Rural Electricity Distribution Master Plan (REDMP) in 1998, mainly to supplant and address the shortcomings of the NREP. The plan was completed in 2000 and has since guided the further implementation of rural electrification activities; it was revised in 2005. Again, both MME and NamPower were the major players in this programme, though NamPower decreased its commitment after 2002.

In both cases the physical project implementation was almost exclusively executed by competitively contracted private companies.

### 4.2.2 MINISTRY OF MINES AND ENERGY (MME)

The Namibian Government, through MME, has made annual allocations in its budget for the implementation of rural electrification. Up to the beginning of 2008, a total of approximately N\$310million had been invested in rural electrification through annual budgetary allocations by the Namibian Government. At the time of writing this report, Government continues to allocate funding for this purpose, but apparently in decreasing amounts and less than what was envisaged in the Master Plan.

The NREP placed focus foremost on the electrification of key public infrastructure in rural areas. A constraint placed on the electrification of private dwellings was that, in order to qualify for electrification, such a dwelling would have to be within a certain distance to the key public buildings / services

(i.e. 500m). The electrification of rural residences was done within strict constraints for several reasons, including the need to manage [limit] costs and to avoid disputes. Even so, costs were often high due to the dispersed nature of many settlements. These planning constraints were carried over to the REDMP.

### 4.2.3 NAMPOWER

NamPower has assisted the Ministry of Mines and Energy in implementing both the NREP and REDMP. NamPower, as the sole electrical utility in Namibia has, prior to the founding of the Regional Electricity Distribution companies (REDs) and other electricity distribution cooperatives, been responsible for all intermediate and higher voltage transmission networks. Even to date, NamPower remains responsible for all infrastructure rated at 66kV and higher, with some exceptions. Rural electrification, however, does not normally require these technologies. Therefore, subsequent to the formation of the REDs (that is after year 2002), NamPower has refrained from funding the rural electrification projects other than in areas where it was still the owner of the electrical infrastructure.

The company established a subsidiary called Premier Electric Pty Ltd, specifically to address rural electrification on behalf of the National Rural Electrification Programme. Premier Electric also held under its auspices the "Home Power!" solar home system revolving fund and loan scheme initiated by the Ministry of Mines and Energy in 1996.

NamPower has in the past received foreign concessionary loans that incorporated obligation elements requiring the funding (by NamPower) electricity supply and distribution networks in the rural areas of Namibia.

In terms of a five year agreement between the Namibian Government and NamPower, the utility undertook to invest N\$10million annually in rural electrification for the duration of the agreement (1996-1999). This was largely used for rural electrification. The performance agreement was extended for another three years in 1999 and the annual commitment was increased to N\$12.5million; which was increased again in 2002 to N\$15 million for that year. After 2002, NamPower reduced its annual commitment to approximately N\$4million or less. Their total contribution up to 2008 totalled approximately N\$116million.

### 4.2.4 OTHER ENTITIES INVOLVED IN RURAL ELECTRIFICATION

The Norwegian donor NORAD provided grant funding to enable the rapid roll-out of the NREP programme between 1991 and 1998. Their contribution over this period totalled approximately N\$75million.

Northern Electricity entered into a five year contract that required the company to invest about N\$3million in rural electrification. Beyond this obligation, the company invested some N\$14million in network extensions and customer connections, totalling an N\$17million investment in the rural electricity infrastructure.

In 1998, the rural electrification programme was granted a concessionary credit from the European Investment Bank (EIB), the Swedish International Development Agency (Sida) and the African Development Bank, as part of financing arrangements for a 400kV interconnection power line to South Africa (a NamPower project). The loan subsidy was to the value of N\$200million over a 20 year period and was first used in 2002.

The German Gesellschaft für Technische Zusammenarbeit (GTZ) also provided funding, mainly focussing on off-grid electrification.

### 4.2.5 SUMMARY

The grid based electrification approach practiced to date has been effective in providing easy access to electricity to a significant portion of the Namibian rural population. Cost-benefit analyses have shown a "benefits to investment- and running-costs" ratio of 2:1. Electrified rural households apparently enjoy a generally high-quality energy service, with good lighting as one of the most important benefits. Most households perceive the electricity service to be worth the cost, which is supported by a relatively high household consumption and low non-payment. The rural health sector and secondary schools have benefited too: access to electricity apparently has improved telecommunication, refrigeration of vaccines, and water supply. Promotion of business development seems to have been lacking though, due to various other external and internal factors.

It is clear, however, that the trend of grid-based electrification cannot continue, since the remaining rural settlements are increasingly remote and, with minor exceptions, small. The cost-benefit ratios are thus getting larger for the remaining localities.

There have also been drawbacks in the execution of these programs. At times, coordination and communication presented problems that caused

infrastructure to go unused for long periods of time, and also suffer damage. In a small number of cases lack of information and education at grassroots level has caused resistance to electrification projects, especially those relying on solar home systems, as well as an improper or inefficient use of the available grid electricity.

Electrification has, for the most part, not reduced biomass use for cooking and heating. This stems from various socio-economic and cultural factors. It seems to indicate that the coordination between forestry management training and electrification is not as effective as it could be. Deforestation apparently also continues unabated in some electrified locations; especially where there has been no follow-up with forestry skills training programmes.

One of the possible shortcomings of the electrification programme was that it did not comprehensively stem urbanisation. There are two likely reasons for this, namely the limited extent of household electrification (due to the 500m radius limit discussed previously) and secondly, not extending and / or maintaining electrical networks in areas previously serviced through the electrification programme or through other initiatives. The problem is that the capital costs for connecting houses to the grid have generally been unaffordable to the rural inhabitants who were not connected in initial electrification rounds.

These problems could also have been mitigated using a more integrated approach. Settlements could have been provided with advance notice of electrification, by their respective Regional Councils, and given enough time and resources to re-settle some or all households to economise the distribution infrastructure while servicing more households. There have been some cases where this has happened, through effective local government intervention, and with good results.

Nearly all of the investment funds that have gone into rural electrification have been allocated to grid extension. However, in future, off-grid electrification is expected to play an increasing role given the endorsement of the Off-grid Energisation Master Plan (OGEMP) and the decreasing benefit to cost ratio of grid based solutions.

### 4.3 BARRIERS, OPPORTUNITIES AND THREATS

To date the Off-grid Energisation Master Plan (OGEMP) has not been implemented. The Rural Electrification Distribution Master Plan (REDMP) has been run successfully for a number of years, despite



the various challenges, some of which are: the vast distances between settlements in Namibia, the high cost of bulk electrical connections (through high voltage lines tied into the national network and installed to the settlements), high-level coordination requirements, and limited annual funding. Considering these items separately:

#### 4.3.1 DISTANCE

Distance is almost always a limiting factor in the Namibian context, due to the sheer size of the country (hence low population density), and a tendency of rural populations to settle in an unplanned manner (both on an “inter-settlement” and “inter-house” scale). There is no simple solution to this problem. One aspect of the MME rural electrification programme is to promote decentralisation. In certain areas it has been effective in incentivising the populations to resettle in a more coordinated fashion, but this has proven to be more the exception than the rule. There are other government programs and policies that also aim to achieve or support decentralisation.

**Opportunities:** Off-grid electrification and renewable energy systems can circumvent the distance problem to a certain degree, by being self-contained. Because of this, distribution is relatively simple (via road transport) and it will support decentralisation without requiring localised [micro / inter-house] centralisation.



**Threats:** Distances, and especially isolation, still present a significant problem in terms of operation and maintenance, if skilled personnel are not located nearby, or if access to communication facilities is a problem.

#### 4.3.2 BULK ELECTRICAL CONNECTIONS

Three options are generally considered in rural electrification, namely 11kV or 22kV three phase overhead lines, or 19kV Single Wire Earth Return (SWER). SWER is generally considered adequate for small electrical loads over long distances. In all of these cases, however,

costs increase with distance, and since distances between settlements in Namibia are typically far, they do not lend themselves to this type of solution.

**Opportunities:** Renewable energy technologies generally have high capital costs per unit power produced, but they avoid the requirement for centralised infrastructure. Also, the need for centralised maintenance of such infrastructure is avoided.

**Threats:** Grid based electricity supply offer consistent revenue generation for the authorities employing them. This would be foregone in the case of “self generation” and consumption, thus opposing the need of local government to generate revenue streams.

#### 4.3.3 COORDINATION

Bulk electrical supply connections are constructed based on contracts signed between Regional Councils and NamPower. Historically, local government has generally experienced difficulties in applying for funding from central government for financing these supply connections (most often in the form of fixed monthly payments), due to the timing of certain electrification project activities.

**Opportunities:** Increased coordination could increase the effectiveness of the decision making at the regional level and would undoubtedly increase the impact of rural electrification for beneficiaries – who could more effectively exploit the new opportunities – as

well as on the environment – through more effective tackling of forestry management issues.

**Threats:** Lack of coordination does not necessarily preclude the successful implementation of energisation projects, though it does decrease overall efficiency.

#### 4.3.4 FUNDING

Funding allocation for rural electrification has, for the most part, been sufficient over the years to complete the electrification in a set numbers of towns in each region. Funding has shown a steady decline in the later years, though; contrary to what was envisaged in the REDMP.

**Opportunities:** Foreign concessionary loans could be exploited to “kick start” off-grid energisation projects, which could immediately put the supporting revolving fund(s) in a positive cash flow position and thus self-supporting from then on (if well managed).

**Threats:** The recent historic decline in funding for electrification projects does not bode well for any off-grid initiatives: if there is a lack of funding or a lack of willingness to fund electrification projects, then the same can be expected of off-grid projects, and more, since there is a generally higher cost per unit energy for the technologies involved.

### 4.4 GRID ELECTRIFICATION VERSUS OFF-GRID OPTIONS

It is feasible that the Namibian Government will continue to electrify rural areas where economically viable. It is likely though that a large number of rural households will not have access to grid electricity in the near future. The reasons for this lie with the high cost of electrifying and maintaining service in dispersed rural villages, coupled with the low consumption of electricity by rural households. Electricity does however provide benefits for rural households by improving quality of life. Electricity also provides important services to rural people where it is supplied to public facilities in the community.

For these reasons it is important and inevitable that off-grid, renewable energy products be provided and distributed. Transforming the tariff structure to become cost reflective will inevitably lead to their increase; this, in turn, is supporting market penetration of renewable energy technologies (RETs), which generally have high initial capital costs, vis-à-vis grid electricity. In the local context, the main drive with renewable energy and energy efficiency technologies consists of solar photovoltaic (PV) systems and associated accessories, as

well as solar cookers, efficient electrical appliances and efficient wood stoves.

The model currently employed by preferential-rate debt financing through a revolving fund has had good market acceptance, and has gained popularity. There have been shortcomings, though, in terms of the fund management and governmental support, which have decreased overall effectiveness. The current model in Namibia can only be successful in a Government-subsidisation context; given that the preferential financing rate is often considerably lower than inflation (CPI), leading to overall long term loss of monetary value. Nevertheless, at this same time, such undertakings can stimulate the economy and increase economic activity, leading to increased indirect income for Government. There are also social and health aspects which are positively affected by RETs; which can also be considered Government's function to provide and finance. An intangible benefit that can be expected of this model is that it creates a sense of ownership with beneficiaries, which manifests itself in a greater respect of the technology(ies) purchased, in turn leading to better maintenance. In addressing the needs of the poorest of the poor, though, extensive subsidisation (up to the point of donation) of such technologies would have to be considered in the Namibian context to ensure complete market penetration.

A basic summary of the differences between grid and off-grid electrification can be made by comparing the pros and cons of the two.

#### 4.4.1 GRID ELECTRICITY:

- a. Places all the capital expenditures of electricity provision in Government's hands.
- b. It generally requires little maintenance and is well established and robust.
- c. The capital costs, though, increase rapidly with increasing distances from the grid.
- d. Consumers are directly exposed to inflation in energy prices and can only control the impacts of such inflation, or generally high tariffs, by changing their usage patterns.

#### 4.4.2 OFF-GRID RENEWABLE ENERGY TECHNOLOGIES:

- a. Places capital costs, which are often very high, on a cost-per-unit-energy basis, in the hands of the consumer.
- b. They do, however, allow independence from grid supply and the associated operational costs.
- c. The maintenance of such technologies is left to the consumer – the costs of which can be considerable.

- d. Theft of especially photovoltaic systems is generally a significant problem in Namibia.
- e. RETs by nature also have lower environmental impacts and compare favourably in the context where the bulk of the grid supply is from coal fired power stations, as is the case in Southern African.

In the final analysis, given the comparatively low cost of energy and benefits of a Government managed model in a low-income setting, the grid electrification model appears the most sensible. The foregoing arguments of the low density of human settlement in Namibia and the fast-rising cost of electricity, however, pose insurmountable medium to long term challenges to grid-based electrification. These difficulties change the question of whether off-grid energy solutions should be considered, to when they should be implemented, and how their particular features can be addressed most cost-effectively.

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## INTERVIEW: SISEHO SIMASIKU, CEO, ELECTRICITY CONTROL BOARD



Simon Willkie

Board (ECB) have, as the regulator, been concerned more with electricity policy. As you know there are six objectives for the energy sector in the 1998 White Paper. I think in terms of electricity, they have been good policies. For instance, looking at [the White Paper objective of] sector governance, NamPower is one of the few [credit] rated companies in the region, the only other one being Eskom. NamPower has reached that level because it followed the regulator's guidance, and the regulator came about following the White Paper's instructions. In terms of [the objective of] security of supply, for instance, we have a situation where South Africa suffered from power cuts, but due to rationalising the use of electricity, as laid out in the White Paper, we in Namibia have not suffered serious power cuts. In addition to that, in the time of crisis, we talked to industry as well as to household consumers, to look at better ways of using electricity. That ensured, on the demand side, that security of supply was maintained. However, security of supply goes beyond that. It includes also the generation and transmission systems. We have been a little bit weak on the generation side. NamPower has not come out with any new generation facilities. It means we have depended too much on imports, whereas the [White Paper] policy says we should have a minimum of domestic supply.

[The policy objective of] social upliftment is an area which is a bit difficult because it could also include affordability of power, which many people do not have. But this is not because of the power itself, but because some people do not have employment or other economic support, and as a result they cannot afford electricity. Regarding the policy objectives of investment and growth, [we did not do so well] because of the period in which we are, and us running out of generation capacity. We have not been able to attract much investment on the electricity side, the reason being that there was no legal framework for those who have money to come and invest here. There is no real competition in the electricity sector at the moment, but now we have these regulations in place for the private sector to come in and invest. On the other hand, in terms of efficiency, we have been able to achieve improvements: we have reduced losses on transmission and distribution

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CONDUCTED 19 MAY 2009

**IPPR: From a regulatory point of view, would you say that the 1998 White Paper has lived up to expectations? If a new White Paper was to be drawn up, which areas should receive more attention?**

Simasiku: I think there will be a need to review the whole [energy] policy. We at the Electricity Control

lines. The protection and quality of supply have been increased.

**How has this been brought about? Is it due to NamPower introducing cost-saving measures?**

Simasiku: First of all, the costs of every operator are controlled by the regulator. When we were determining the new tariff methodology, we studied the cost structure of all those participating in the industry, who can't go beyond what the regulator has accepted in terms of tariffs. In addition to that, we have rules for quality of supply and service, and they can't be reckless and be losing a lot of power. For example non-technical losses, where people just connect illegally and steal electricity, have been almost eliminated. We have also introduced ways by which consumers, if they are not happy with the supplier, can report them to the regulator.

The policy objective of sustainability has got something to do with the introduction of renewable energies, which are not depleted. Water [as a fuel for hydropower] is also renewable, but it is sometimes affected by drought. We are ensuring that the supply mix is right, including those renewable energies. If we take Kenya as an example, their utilities have accepted that renewables must be seriously promoted, for example geo-thermal power plants. So in terms of electricity, I think the White Paper has worked very well overall.

In terms of the way forward, I think more emphasis should be on renewable energy sources, such as wind and solar. So far, there hasn't even been a pricing study on these sources. In South Africa they have a pricing system that is based on the conversion of the sources of power. We should also look into that. We also need to look at the targets of renewables as a share of our total supply. Sometimes we look at Europe – for example in Germany they have 10% renewables, but 10% in Germany is a lot more than our total electricity demand. Possibly renewables might become the best solution for this country [Namibia], who knows, so we should focus more on them. The other new focus should be on the use of nuclear materials. That is something the past White Paper did not do. A new policy should indicate what we want to do with that material. Nuclear energy is a serious option for the medium to long term, since we have uranium deposits. Even if we don't use uranium for large power generation projects, we may be able to use it for something else, and a nuclear policy should be developed. Government has already started looking at this.

**The ECB has approved to bring the electricity tariffs into a cost-reflective regime by 2011. Just last month, you approved a 15% tariff hike for NamPower. How much more will tariffs have to rise until cost-reflectivity is achieved?**

Simasiku: First of all, our tariffs have four points in which they rely on government: firstly, tariffs must be cost-reflective, in other words costs must be recouped through the tariff. We also look at the profit margin of the suppliers, which must also be taken into account. Secondly, we look at long-run marginal cost, so that in the long term the entire cost of the operation can be covered. Thirdly, the tariff must be economic, so you can't raise the tariff to a level where it kills off your economy. While it should be affordable to industry, it doesn't mean that everyone can afford electricity. Just like cars or some food cannot be afforded by everybody, it's the same with electricity at the present moment. Finally, the tariff should provide a level ground for the players on the demand side and in the supply industry. Those four points are very important.

Since we started increasing their tariffs, NamPower has not yet reached cost-reflectivity. It is understood that NamPower would many times [have to] go above their tariffs in order to ensure that Namibians have supply. In terms of the law, no company should raise tariffs above what is approved by the ECB. So if they incur losses at a given tariff, possibly due to increasing input cost, such as coal, they will try to recover these losses at the time of the next tariff negotiation. We change the tariff only once a year, and if they prove that loss, we find a way to include that in the future tariff. Otherwise, NamPower would have no money to buy coal and we'd face power cuts. The cost-reflectivity has now been postponed from the financial year 2010/11 to 2011/12 to allow for more time to reach that level.

**Coming back to the issue of affordability, does the ECB consider a regime of cross-subsidisation, for example of poor households in rural areas?**

Simasiku: In rural areas in particular, rural electrification is already a cross-subsidised activity that is paid for by government in terms of infrastructure. So all people have to pay for is their use of power. But poor people are not only in rural areas, but also in towns, in particular in peri-urban areas. Local authorities use certain systems, by which the richer [population] groups subsidise services for the poorer groups; that is already happening. These groups are paying different

tariffs. The regulator will grant a tariff for a supplier, like a town, and the supplier then develops different categories with different price ranges, and these categories allow for a differentiation between different customers, effectively cross-subsidising some of them. As for the electricity regulator, in line with the law, we only enforce that they don't go above the tariff we set.

As the regulator, we want to achieve the cost reflective path the government has put us on. So when we are working with general tariffs, we don't look at subsidisation until cost-reflectivity has been achieved. We are doing a study on pro-poor tariff systems in all of southern Africa at the moment. Once we've reached cost-reflectivity, it is very likely that pro-poor systems will be introduced.

**The establishment of Regional Electricity Distributors (RED) has been accompanied by some controversy. Many town councils claim that REDs have led to poorer service at higher cost. What would you say are the main benefits and problems of their introduction?**

Simasiku: To start with the problems, local authorities are complaining that they are not receiving assistance from government. We as the regulator have also exchanged ideas on this issue with government. And there is acceptance that local authorities [should raise some of their revenue] by themselves. The easiest way to make money for them is through the sale of electricity. They were putting a tax on top of the price of electricity, for instance in the case of towns like Grootfontein, that tax has been probably more than 40%. That tax would go towards things like maintaining the local road network or water supply in that area. That tax obviously makes electricity very expensive. What we have done in order to [support] the business of electricity, which is of course a commodity like many others, is to ring fence and cap that tax at its 2003/04 value. That in turn has put pressure on local authorities, who had been increasing that tax every year by inflation in order to meet their budgets. That became more of a political than an economic issue, because the local authorities now say that their source of income has been taken away, but government has agreed to look into this problem and to seek ways of helping them, so that the price of electricity is not taken to be the source of their lack of money.

The positive aspects of REDs are many. First of all, there are economies of scale. In the past, towns like Usakos, Katima Mulilo or Otavi did not have money to pay NamPower for many months. And NamPower needs that money from consumers to cover their

operating costs, so NamPower was threatening to take over the management of supply in these towns. Having economies of scale means that smaller and larger towns come together as a group; some towns have better human resources - trained and qualified staff - while others are in a better financial position. [By pooling their resources, everyone benefits.] That means that Usakos doesn't anymore say "We are not paying NamPower", because now the RED is the one responsible for the collection of customer payments. They have staff trained for such collections, which was not the case before, and immediately pay for supplies from NamPower. So ever since the REDs were established, there have not been any power cuts for entire local communities due to non-payment. And secondly, there are qualified people now, engineers, technical people and so on, who can immediately rectify a problem when it arises. The other thing is quality of supply: the ECB has given out regulations on how quality of supply and service should be maintained. In the case where customers experience a problem, they first contact the RED, and if the RED is not prepared to listen to them, they contact us and we work with the RED to ensure the mistake is corrected.

The other thing is that the local authorities are the owners of the REDs, along with the regional councils and NamPower, which owns [the relevant] assets across the country. The boards of the REDs are appointed by these shareholders, including the local authorities, so if something is wrong, they can dismiss them and bring in more active boards which can take care of the RED's operations. Those are some of the things that people [in the local authorities] sometimes turn a blind eye to and say they are losing money. They are not losing money, I can tell you that in the case of the tax that is put on top [of the electricity price], some of the local authorities never got it before the REDs came because they were not able to collect money [from their customers]. But now, following the instructions by the ECB, the first thing that the REDs will do is pay these levies to the local authorities, regional councils and NamPower. Whether they have got enough money or not, they should pay. That is money that comes to [the local authorities] without them doing anything.

**What is the status quo on the establishment of Central RED and Southern RED?**

Simasiku: In the case of Central RED, the feeling everybody had was that the City of Windhoek was not prepared to go into the RED system. There was one time

when they were talking of turning the Department of Electricity [at the city of Windhoek] into a company. That was not clear so we asked them to explain whether that meant they were not prepared to join the RED. They replied that that was not the case, but rather they were trying to commercialise that Department, after which it would become part of the RED. The other thing that has been disputed by the City of Windhoek was whether legally, the REDs could be established. We told them that in terms of the Local Authorities Act, joint ventures between local authorities and similar entities, like REDs or NamPower, could take place. Their interpretation was that the law did not state that. But we do not think that at the present moment there is a serious lack of understanding between the City of Windhoek and [those] who are promoting the Central RED. The Ministry of Regional and Local Government, which is dealing with some of the issues related to the REDs, is appointing a consultant to look at some of the related problems. After the consultant's findings have been released, there will be a meeting to [discuss them]. At the present moment, government has not come out with an alternative policy on distribution. We still only have one policy and that is that distribution should be undertaken by REDs.

Regarding the Southern RED, there are still some questions. There are many small towns and villages which are experiencing a lot of problems with the supply of electricity. That requires the [establishment of the Southern] RED as soon as possible. They are teaming up with their central brethren and I think we should wait for the results of the consultant's study there.



### **Would you dare a guess for when the Central and Southern REDs will become operational?**

Simasiku: The thinking is that by next year they will be [operational], but I can't say what time. Of course, if the consultant finds there is too much negativity in the REDs system, they may not [be established]. But I think it would be reasonable to leave those [REDs] which already exist, as there are a lot of benefits to them.

### **On the supply side, the Independent Power Producers (IPP) framework and the investment market guidelines were completed in December 2006, but still no IPPs have fed electricity into the grid. What is holding them back?**

Simasiku: It is true that the Framework was accepted by government in 2006, but it is not yet operational. Why is that? Because the Namibian electricity supply system does not have the people to implement these guidelines and the framework. We asked the USAID [United States Agency for International Development], represented by an agency called US Trade and Development Agency, who are funding the development of the IPP framework, to help with the capacity building for the industry to implement the framework. So NamPower, ECB, the REDs and the rest of the industry were trained on how to implement that; the training ended [in April 2009] and we have asked them to help with the actual implementation. The possibility exists that they could fund us to get this started.

The implementation will include the identification of two or three companies that could become real IPPs, and we will help them with everything they need to set up their power plants and so forth. At the present moment NamPower and a group called Aeolus Wind Energy Company are negotiating a power purchase agreement, which is at a very advanced stage. Since Namibia has never had a wind power plant it was difficult to define certain parts of this power purchase agreement, but I think the two groups are reaching some conclusion. Once that conclusion has been reached, in particular on the tariff, then we at ECB will analyse it. We will not only look at the risks, which cover only one part, either the generation side or NamPower [transmission] side, but also at the way in which the economy of the country is affected, and who is going to use the power. Then we'll combine all these things and come up with a tariff, but I must warn: the wind energy tariff at the present moment is very high. In South Africa they have come up with a price regime and said

that wind energy could cost N\$1.25 per unit. So it's still expensive, but the world is also going for wind energy, and we should seriously consider it. We are looking with a lot of excitement at the possibility that Namibia could become the first country in Southern Africa with a wind power plant of sizable magnitude [40MW], at Lüderitz. They had even planned for 100MW, but the transmission infrastructure from Lüderitz is too weak for that.

**NamPower has effectively still a monopoly on generation and transmission. Given the limited size of the Namibian market, what can be done to promote vibrant upstream competition?**

Simasiku: First of all, when government gave us the responsibility of restructuring the ESI [Electricity Supply Industry], they instructed that we work on the transformation of the market system. The first level is the so-called single-buyer model, which is based upon the introduction of competition at generation level. So it will not only be NamPower, but also other groups, such as IPPs, generating electricity. Then a single buyer is established to buy power, using certain approved rules, such as first buying the cheapest available power. Of course some people said that if NamPower is the single buyer, and also one of the generators, how can you be sure that they will trade in an impartial way? What happens in some areas, like Kenya and Uganda, is that instead of a single buyer being connected to a generator, it is a stand alone company, which is also the [network] system operator. So they have cut the single buyer from the generation business and handed them, as an independent operator, the power over the transmission lines. But in Namibia, generation and the transmission lines still fall under one roof, NamPower. That has created the problem that NamPower may not allow competition. But the single-buyer model is undergoing changes worldwide. The new single-buyer model that we are looking at is that NamPower is the single-buyer, but IPPs have the authority to look outside Namibia for customers, for example in Zambia. They can then use NamPower's transmission lines and the tariffs to be charged for that transmission are regulated by us. The tariffs are regulated under a cost-reflective methodology called "cost-plus". There are, however, conditions that the IPP cannot sell power outside unless it is concluded that that power is not needed in Namibia.

**The problem remains then that NamPower operates as a transmission monopolist but operates in a**

**competitive market in generation. What prevents them from using their transmission monopoly power to keep competition out of the generation business?**

Simasiku: First of all, they cannot use the transmission lines to block the flow of electricity from third parties. All users have access to power lines unless there are capacity constraints or technical problems. If NamPower has a problem with a line they have to inform the regulator. Therefore we cannot see them stopping anybody from using the lines. Competition will be allowed to take place at generation level. At the distribution level, competition is still not there because the REDs do not compete with each other now. But in the future we will move to a wholesale multi-seller, multi-buyer model, by which the distribution groups can buy from any generator including IPPs. Once we have completed the single-buyer market structure, we will move to that system. Even now, despite that [single-buyer] model we are developing, there is already some wholesale activity among some of the larger users. For example the Skorpion zinc mine is supplied directly by Eskom, and NamPower only transports the power.

Finally, the retail model will allow even the end-user to choose the cheapest generator to buy from them directly. If, for example, they see that CENORED is cheaper than Erongo RED, they will be able to switch their supplier. At the moment there is no choice, but that will change.

**Where do you see the Namibian electricity sector in 10 years time in terms of supply mix and competition?**

Simasiku: I'm very optimistic that competition will come within the next ten years. NamPower by itself cannot put up large power plants which cost billions of dollars. Government also does not have the money to give NamPower billions to come up with power plants. NamPower therefore will have to team up with the private sector to build these plants. Plants that come out of such a joint-venture process are not NamPower's power stations, even if NamPower holds 50% or even more of the shares. They will be IPPs, and that means that the management of the plants will not be purely NamPower-controlled. They will compete with the 100-percent NamPower generators. That could introduce some form of competition.

Regarding the supply mix, at the moment NamPower has a hydropower plant as their largest station, and then there is [coal-fired] Van Eck and a diesel power station in Walvis Bay. There is the possibility of hydropower

from Baynes [on the Kunene river] and of course there is also Kudu, for which there is much interest from private investors. Then there are renewables, such as wind and solar. And finally, there is nuclear energy. So I think the Namibian energy mix of the future is very varied. That will help us if there is a drought. For example if there is not enough flow [on the Kunene] for hydro, other forms will help to compensate for that. Who knows, with wind energy we are talking 40MW next year, maybe in five years it could be more than 100MW. With nuclear energy, we could have a small 40MW plant in three years. People shouldn't just shout about anti-nuclear [sentiments]; we have uranium in Namibia and people outside the country are using it to generate power. I think we should accept that since we have uranium we should use it as well.

**There has been talk of creating a super-regulator for the entire energy industry. Do you see the role of the ECB changing in the near future?**

Simasiku: Yes, it is possible that the ECB could be converted from an electricity to an energy regulator. This is the trend in the world now. Regulators are being modelled to take on more responsibilities, and for a small country in terms of population and economy like Namibia, [this makes sense]. If you have a regulator for instance responsible for electricity, gas, petroleum products and maybe even water, the cost would be much lower than if we had separate regulators for all these industries. Nuclear energy has normally got a separate regulator. So that's one thing we are looking at, to reduce the cost of regulation. I can give you examples: just a few years ago, South Africa's and Malawi's electricity regulators were turned into energy regulators, Lesotho is trying to do that now, and in Tanzania it's energy and water [regulated] under one roof. Water is difficult in Namibia, but if government says it should be regulated by the energy regulator as well, why not? For the proposed energy regulation, the sub-sector industries have indicated that the ECB is the right organisation to run it, because experience in regulation is very limited in this country.

## 5. DEMAND SIDE MANAGEMENT

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### 5.1 INTRODUCTION

Demand Side Management (DSM) is an umbrella term that includes several different load shape efforts and objectives, including load management and end use energy efficiency that alter how much electricity customers use and when they use it. DSM originated from utilities who wanted to influence customer use of electricity in ways that would produce desired changes in the utility's load shape. The intentions of the power utilities, then, were to cut the "load peaks" and fill up the "load valleys" without necessarily reducing electricity consumption of well paying customers, since they were a source of profit for them. In that case, electricity saving was a side effect of DSM but never the objective.

Figure 5.1, illustrates four load shape objectives commonly associated with DSM. Peak clipping, valley filling and load shifting are classified as load management strategies, and result from utility

administered programmes. Energy efficiency involves a reduction in over-all energy use. Energy efficiency reduces the energy used by specific end-use devices and systems, typically without affecting the level of service and without loss of amenity. Energy savings and peak load reductions are achieved by behaviour changes and substituting technically more advanced equipment, processes, or operational strategies to produce the same or an improved level of end-use service with less electricity.

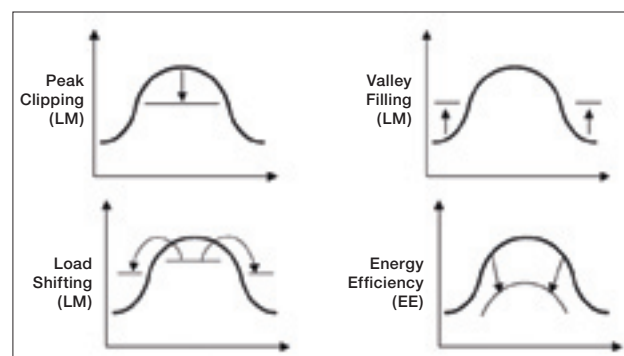


Figure 5.1: Load Shapes (Source: World Bank, 2005)

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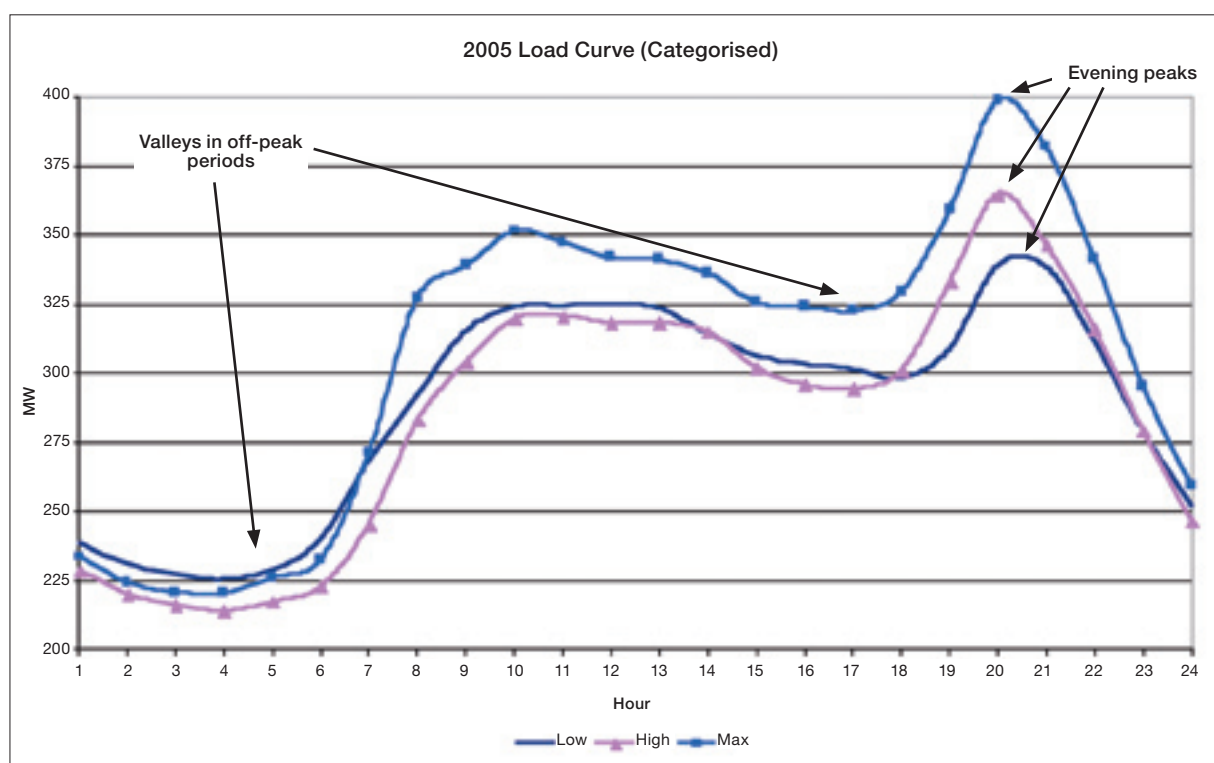


Figure 5.2: Typical Electricity Load Profile for Namibia (ECB, 2006)

Energy efficiency is effective on the demand side of the market by reducing load, peak demand, and energy consumption. Cost-effective energy efficiency load reductions result in lower costs of electric service for consumers who install energy efficiency measures, and lower total costs for all consumers on the grid. Load reductions from energy efficiency reduce market prices for everyone purchasing power in the market (wholesale and retail). Energy efficiency can also reduce the environmental impacts of electricity generation and transmission.

Energy efficiency programs provide meaningful choices and opportunities for customers of all sizes, including industrial, commercial, small business, and residential customers. In fact, energy efficiency provides what may be the most effective option for reducing the cost of energy service for many small, medium, and even large customers – by focusing on efficient energy use and reducing load, thereby reducing the size of the bill, not just focusing on the rate or price of generation service.

## 5.2 ACHIEVING DSM

DSM measures are achieved by voluntary and compulsory means, and they are best achieved if coordinated through an institutional framework that ensures that voluntary and regulatory measures complement each other.

### 5.2.1 VOLUNTARY MEANS:

The customer arranges with the utility to implement measures such as Demand Market Participation for mutual benefits, e.g. load shifting, energy efficiency and voluntary load shedding.

### 5.2.2 COMPULSORY MEANS:

The customer has no choice and the utility/regulator or any other authorities are empowered by regulation or other legal means to force the customer to implement DSM measures. A measure that is already in use in parts of Namibia is ripple control for geysers. Other measures include: standards specifications, load shedding (for power system security), including economic measures such as time of use tariffs.



### 5.3 DSM IN THE NAMIBIAN CONTEXT

The White Paper on Energy Policy (WPEP) of 1998 identifies Namibia as being energy intensive<sup>14</sup>, largely due to the nature of the industries (high energy consuming) against the economic value of the goods produced by those industries. Figure 5.3, illustrates the distribution of electricity consumption by type of customer in Namibia in 2007. Regional electricity distributors (REDs) consumed 28% of electricity supplied in that year. The domestic sector, accounted for approximately half of that.

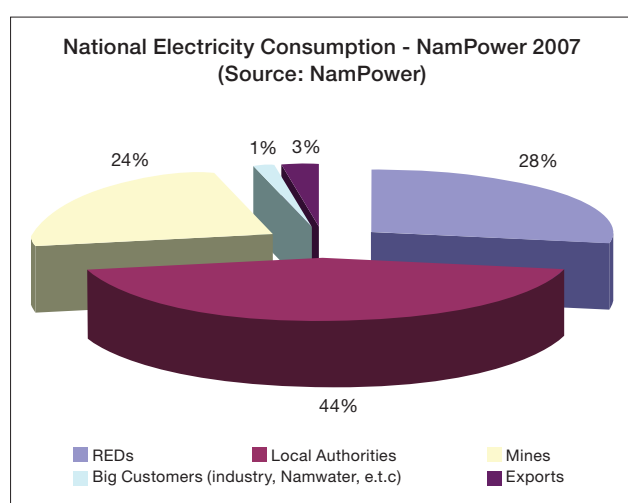


Figure 5.3: National Electricity Consumption (Derived from NamPower, 2007)

The WPEP of 1998 states that the “Government will investigate the nature of energy end use patterns in all sectors and use the data captured to monitor and assess energy efficiency in these sectors”. The information generated would be used to determine what kind of intervention would be required. The first comprehensive DSM investigation was commissioned by the Electricity Control Board (ECB) in 2005, and the study was completed in 2006 (DSM study, ECB 2006). The following seven DSM measures were adopted by all DSM stakeholders including MME, ECB, NamPower, all the REDs, the Manufacturers Association of Namibia and others:

1. Compact Fluorescent Lights
2. Solar Waters Heaters
3. Time of use tariffs
4. Demand Market Participation
5. Ripple Control of Geysers
6. Energy Audits
7. Energy Saving Awareness Campaigns

### 5.4 THE DSM MEASURES AND THEIR PROGRESS

DSM measures introduced by MME, NamPower, ECB, and other stakeholders appear to have already begun to bear fruits in the first year of their implementation. NamPower has reported a peak demand reduction of 20MW in 2008, from an all high of 449MW in 2007 (*from discussion with ECB*). A further reduction in peak demand is expected in 2009 as DSM measures take more effect and sadly due to the general economic decline especially in the mining sector. Given the economic downturn, one has to be cautious when claiming DSM to have “caused” a reduction in electricity demand, as this effect is difficult to isolate from other developments.

#### 5.4.1 COMPACT FLUORESCENT LIGHTS

CFLs are considered energy efficient devices because they consume up to 85% less electricity compared to incandescent lights. The Ministry of Mines and Energy teamed up with the Electricity Control Board and NamPower in early 2008 to distribute over 900 000 energy saving bulbs to households across the entire country for free, at a cost of almost N\$14.2 million. The DSM study (DSM study, ECB 2006) had estimated a potential saving of 20MW of peak capacity from CFLs alone.

#### 5.4.2 SOLAR WATER HEATERS

Solar waters heaters (SWH) are considered as both renewable energy devices, because they use solar energy as heating source, and as energy efficient technologies because they reduce the amount of electricity used. SWH also defer the investment in peaking plants by the utility. In 2007, the Government, through the Cabinet issued a directive that all public buildings including state owned enterprises must meet all their warm water needs through solar water heating. The capacity of solar water heating more than doubled from 2MW in 2006 to 4.3MW in 2007 (REEEI 2007 solar energy market survey). The DSM study by ECB estimates solar water heating to amount to 54MW in ten years time. Solar

<sup>14</sup> Energy intensity is a measure of the amount of energy required to produce a unit of GDP, and is observed to increase during the first stage of industrialization in developing countries before decreasing as observed in maturing economies. In 2005 Namibia’s energy intensity was 5045 Btu per 2000US\$ (1 Btu = 1.055 kJ) against 4117 Btu per 2000US\$ for Botswana.

water heaters are included in solar energy technologies funded under the government's Solar Revolving Fund and by other financial institutions as well. Since about 50% of electricity demand is in the domestic sector and that sector uses electricity for lighting, cooking and water heating then the domestic solar water heating market segment has the potential to save over 30% of electricity demand in a typical household.

### 5.4.3 TIME OF USE (TOU) TARIFFS

As part of their 2002 tariff study, SAD-ELEC recommended that Namibia should implement ToU tariffs as a way to keep electricity generation costs down and promote the efficient use of electricity. ToU tariffs benefit both suppliers and customers. Suppliers benefit from electricity tariffs that reflect the cost of supply, and customers save costs by managing their consumption. The tariffs are categorised as winter and summer, and they will vary during the course of the day from peak, standard to off-peak. In 2007, the ECB published the introduction of ToUs and NamPower implemented them to bulk transmission customers such as the mines in July 2008. NamPower also ran dummy invoices during that period to test the implementability of the project. ToUs will be implemented to other transmission customers such as the REDs and municipalities with effect from July 2009 who, consequently are expected to push the effect down to their customers as well. There are both opportunities and risks associated with introduction of ToU tariffs.

#### Opportunities

- A customer / distributor can reduce its energy purchase costs by reducing purchases in the peak hours (**peak clipping**).
- A customer / distributor can reduce its average purchase price by reducing peak consumption and by increasing off-peak consumption (**load shifting**).
- A customer / distributor can reduce its average purchase price by increasing off-peak consumption (**valley filling**).
- Overall reduction in cost of electricity generation and/or imports.

#### Risks

- Total electricity purchase cost can increase and the average purchase price may rise if load profile is not properly managed.
- There is considerable tariff risk with huge financial implications for the distributor if it buys on ToU and sells on non-ToU tariffs.

- This mismatch can result in windfall gains or losses especially if the actual load profile differs from the assumed profile.
- There is an initial cash flow risk with the introduction of ToU tariffs.
- There is a considerable risk, unless well regulated and monitored, that utilities and distributors use the ToU regime to generate additional profits at the expense of end consumers.

The implementation of ToUs still faces challenges with the compatibility of prepaid and normal credit meters. These meters need to be converted or upgraded to be compatible with ToU tariffs. All customers must be involved and made aware of the reasons of the implementation of the programme and the benefits and risks associated with the programme.

### 5.4.4 DEMAND MARKET PARTICIPATION (DMP)

DMP is an initiative of NamPower in dealing with large load centres such as mines and NamWater. The load centres are requested to shift loads upon request by the power utility. Demand Market Participation is set to continue as long as the power utility faces supply constraints. However, the introduction of time of use tariffs, as mentioned above, will result in voluntary load shifting by the big users to take advantage of the incentives and penalties associated with the time of use tariffs.

### 5.4.5 RIPPLE CONTROL OF GEYSERS

The ripple control system is used by utilities to control switchable loads from the utility's or distributor's control centre. The transmitter is at the control centre and the receiver is at the consumer end. Ripple Control of geysers is currently only implemented by the City of Windhoek and Erongo RED. The City of Windhoek started the implementation of ripple control of geysers in 2006 and currently has control over 22 000 customers. The benefit for the City is reduced maximum demand charges. In Erongo RED, ripple control started with Walvis Bay Municipality in 2006 before the Municipality was incorporated into Erongo RED. Roll out of the programme to other REDs and municipalities is being considered by the MME and ECB.

### 5.4.6 ENERGY AUDITS

An energy audit establishes energy use patterns, the potential for energy and cost savings, and may include recommendations for actions for improving energy efficiency. It seeks to assess and answer the "how", "when" and "why" questions. This audit may be

carried out internally if sufficient expertise is available in-house, but very often is carried out by independent, expert energy consultants. A typical, comprehensive energy audit may cost in the region of 1% of the total site energy bill but would, in many cases, identify cost savings opportunities greatly in excess of that and up to 20% (Capehart, et al., 2005)

The energy audits measure was never intended to be centrally coordinated by the DSM Committee. However different surveys and information received from the Manufacturers Association of Namibia and the mines indicate that these organisations have already implemented sufficient energy efficiency measures which are benchmarked to international standards (DSM study, ECB 2006). However, energy audits are still required for large buildings including government offices. Figure 5-2 indicates a typical daily load profile for Namibia, and the “low” graph is representative of the summer period. It is evident that the period 08:00hrs to 17:00hrs has higher demand than the “high” period. This may be attributed to air-conditioning of office rooms during working hours. Office lighting also contributes significantly to the electrical load. The Renewable Energy and Energy Efficiency Institute (REEEI) conducted an energy audit training course in 2008 for public servants to raise awareness and enable them to identify energy saving opportunities within their organisations. The Energy Efficiency Strategic Action (REEECAP, 2008) recommended the establishment of an energy efficiency accord and mandatory energy audits for all public buildings.

#### 5.4.7 ENERGY SAVING AWARENESS CAMPAIGNS

Energy Saving Awareness Campaigns is an overarching DSM measure which was coordinated by the ECB. The campaigns were run over different media platforms. NamPower was responsible for the roll out of CFLs and the related awareness campaigns. The ECB ran several campaigns through its quarterly magazine-SPARK, and through public radio. Other stakeholders like MME, NAMREP, Desert Research Foundation and REEEI exhibited energy efficiency technologies and measures using energy trailers. The Renewable Energy and Energy Efficiency Capacity Building Programme (REEECAP) run by REEEI between 2006 and 2008 provided valuable information through research studies conducted by various experts in the field. The Institute also ran a competition on Energy Efficiency in the Tourism Sector, and held public exhibits and presentations on energy efficiency throughout the duration of REEECAP.

## 5.5 DSM CHALLENGES

DSM has its own challenges, especially if not properly administered, and if there is no buy-in from the end users. DSM comes at a cost in terms of capital equipment, coordination and human expertise. In the DSM study, the financial resources for the installation of geyser ripple control systems country wide was estimated at N\$60million, whilst that of installing of solar water heaters was estimated at N\$160million over a 10 year period.

Organizing the electricity industry into autonomous units of production, transmission, and distribution is an obstacle to integrated resource planning. In most cases, DSM leaves the distributor with all of the costs associated with DSM programmes, including revenue losses, but without any real avoided costs on the supply side. There is, however, a potential upside for distributors from being able to delay investments in infrastructure upgrades and new acquisitions. This may go some way to mitigate the perception that with DSM, reduced consumption lowers revenues for distributors and that the introduction of tariff caps by the regulator motivates the distributor to encourage demand growth as a way to enhance profits. The question then is how one motivates DSM programmes to power distributors. One solution lies with the tariff levels which must be set at levels high enough to warrant the effectiveness of DSM.

## 5.6 POWER CONSERVATION PROGRAMME

After realising the severe power deficit that SADC was facing in December 2007 and January 2008, the SADC Energy Ministerial Task Force (EMTF) met in Gaborone in February 2008 and recommended DSM and Power Conservation Programme (PCP) as short term measures to address the deficit. South Africa was tasked with developing the PCP on behalf of the region by July 2008 and other countries were to adapt the programme to suit their local environment. PCP has five elements: **Quota Allocations** of electricity to customers, **Penalties and Cut-offs** to those who exceed their allocated quota, **Incentives** for small consumers who exceed their saving targets, **Trading** of unused quotas by large consumers, and **Built in Flexibility** in line with changing future needs. The programme is expected to bring immediate benefits such as

- improved reserve margin,
- reduced or total avoidance of load shedding,

- provide relief to the utilities to perform maintenance of the generation assets,
- improvement of energy efficiency viability,
- a positive impact on climate change due to reduced energy consumption,
- productivity gains in the economy through elimination of wasteful energy usage, and
- behavioural change which could become permanent.

PCP prescribes extreme measures to provide electricity grid stability and it may be applied in Namibia if the supply constraints are not addressed immediately.

## 5.7 RECOMMENDATIONS

- There is a need to establish an Energy Efficiency Accord and binding targets with industry so as to set measurable action plans.
- The government must establish a National Energy Efficiency Agency (NEEA) to coordinate energy efficiency programmes and projects. The DSM Committee could act as a steering committee with a fulltime secretariat.
- The DSM committee must focus on corporate senior leadership for training on energy efficiency in order to establish energy management standards.
- There must be forums to share best practices across firms in the industrial sector, this could be through the National Energy Efficiency Agency.
- Support is required for the establishment of energy service companies (ESCOs) for all sectors.
- Government through NEEA should explore and promote clean development mechanisms (CDM) opportunities through energy efficiency.
- Government through NEEA should establish energy efficient agents in key ministries who will act as focal points for energy audits and energy conservation campaigns.
- Government should include energy efficiency in budgeting and policy drafting within line ministries and local authorities.
- Government should ensure there is measurement, verification and monitoring of energy efficiency activities.
- General lobby in government and civic society for energy efficiency regulations and laws.

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## 6. POLICY AND PLANNING: RECOMMENDATIONS ON THE WAY AHEAD



These recommendations have been compiled by IPPR and are based on input from the authors of the above chapters.

If the right steps are to be taken for the Namibian electricity sector to move forward in terms of the goals stipulated in the 1998 White Paper, it is helpful to have a medium-term vision for a feasible and desirable scenario of the sector in, say, ten years time. This should inform the drawing up of a national electricity policy framework. The vision should include the possible supply mix, taking into account security of supply, as well as economic and environmental concerns. There should be a level of competition both at generation and distribution level, and the ECB must ensure that NamPower doesn't use its single buyer function, generation or transmission businesses to prevent competition from entering the up- or downstream sectors. Besides new internal generation projects,

one cannot ignore regional developments and their impact on electricity trading. One also needs to look at the demand side and which measures should be implemented in order to optimise it. It is also necessary to sketch out the roles that the various institutions of the sector should play, including the establishment of new bodies, as well as changes in regulation and electricity pricing. This chapter first outlines what the sector could look like in ten year time, and then sketches a number of steps that should be taken in order to achieve that scenario.

### 6.1 THE NAMIBIAN ELECTRICITY SECTOR IN TEN YEARS TIME

In the chosen timeframe of ten years, all supply options mentioned in chapter 2 could be realised. With

respect to the expiration of the supply contract for 150MW firm power from Zimbabwe in 2012, NamPower has made plans for alternate power supplies beyond that year. These plans, as mentioned before, include a fourth turbine unit of 95MW at Ruacana to come on stream in 2011/12, 260MW from Walvis Bay gas or coal power station by 2015, up to 100MW from wind and other renewable energy sources by 2016, and at least 200MW for Namibia at Baynes Hydro 2017<sup>15</sup>. The van Eck coal power station, which is very old, inefficient and expensive to run, may be decommissioned by 2012. Based on these projects, the generation capacity of Namibia is conservatively estimated to reach 900 to 1000MW by 2020, and needs to be attuned to the changing local and regional demand and supply situation. All the immediate and mid-term generation plans of NamPower do not provide for or feature any new renewable energy generation options, despite the abundance of these resources in the country.

It is paramount to establish a balanced mix of supply options with solid and reliable base-load capabilities (i.e. develop Baynes, establish a CCGT plant to benefit from Kudu, establish a small gas or coal-fired plant, negotiate diverse cross-border supply arrangements with several regional suppliers) and a number of smaller decentralised renewable energy options, such as bush-to-electricity, solar thermal and off-grid photovoltaics for rural electrification. It is political will and not technological, financial or social barriers that prevents Namibia from establishing new supply options.

However, one must be objective about the benefits of new internal generation capacity; perhaps increased imports are the preferred solution from an economic point of view. In the same vein, Namibia cannot afford to become a beacon of renewable energy while the region may remain dependent on currently cheap, but dirty, coal-fired power. Ideology and conviction must be ring-fenced by the economic realities of a developing country. Ultimately, the focus should be on those supply options that yield the greatest cumulative benefit in terms of economic, social and environmental criteria.

In terms of policy changes, in ten years an Energy Regulatory Framework and Energy Act should be in place, providing a more integrated long-term view of all sector plans and initiatives. MME will have established national electricity supply targets, including targets for renewable-based electricity generation, energy efficiency, and access to sustainable energy technologies in off-grid areas. NamPower and the REDs will also

have aggressive targets for renewable energy and energy efficiency.

Under a strengthened ECB, that has been upgraded to a fully-fledged energy regulator, 100% cost reflectivity of electricity has been achieved. This would incentivise local generation capacity development as well as energy efficiency; and could even stimulate a vibrant small scale Independent Power Producers market. It would also have created a fair basis of comparison for competing technologies and may also attract international investment.

Ideally, there would be vibrant upstream competition, with a number of IPPs feeding electricity from a variety of sources, not least renewable ones, into the grid. To that end, a renewable feed-in tariff for IPPs will have been established and fully implemented. In addition to several IPPs, there will be active cross-border trading throughout SAPP countries, improving overall cost effectiveness as well as economic efficiency.

On the distribution-side, there would also be competition between the – by then – five operational REDs, between which consumers can switch. Moreover, the multi-seller multi-buyer framework will have been implemented, allowing distributors to buy from any generator, both internally and from abroad.

The REDs would be driving regional programmes for energy efficiency. Some type of incentive (or disincentive) or policy would be established to make it more in their interest to promote energy efficiency rather than increased electricity consumption. MME and ECB will have to prevent a scenario whereby REDs attempt to curtail the distribution of off-grid energy technologies, which negatively affects their revenues.

Demand side management will have been strengthened significantly, with energy-saving technologies being widely used and affordable. Net metering programmes will be operating in Windhoek and other municipalities, whereby households and businesses can install PV panels and other types of small-scale electricity generation technologies to provide for their own electricity needs, and feed any excess electricity into the grid for credit.

The Renewable Energy and Energy Efficiency Institute (REEEI) would be significantly larger and more active in a variety of programmes. They would be responsible for driving the Off-grid Energisation Master Plan as well as a national appliance labelling programme. They would also be responsible for implementing pilot-scale technology projects.

Rural electrification will have become widely spread even to remote areas, following MME's aggressive roll out its off-grid electrification programme and promotion

15 Seeing that the Baynes hydropower station is a joint project between Namibia and Angola, it is assumed that Namibia's share of its expected generation capacity of 400MW will be approximately 200MW.

of off-grid over grid options. A permanent source of funding will have been established through a small renewable electricity levy, a carbon tax or other means, to fund the rapid and geographically extensive roll-out of the Off-grid Energisation Master Plan, as well as practical programmes, pilot technologies and research on renewable energy and energy efficiency.

## 6.2 TOWARDS A NEW ELECTRICITY POLICY AND PLANNING FRAMEWORK

With the intention of achieving this medium-term scenario, a number of regulatory steps need to be taken. Namibia has just begun the exercise of developing a new Energy Regulatory Framework, which is anticipated to address various concerns of different energy sectors such as gas, electricity, petroleum, nuclear, renewable energy and energy efficiency. To facilitate the coordination of the necessary developments in the sector, including national electricity supply targets, this must be accompanied by the establishment of a comprehensive Energy Act.

Awerbuch & Yang (2004) argue that “traditional energy planning in Europe and the United States focuses on finding the least-cost generating alternative. This approach worked sufficiently well in a technological era, marked by relative cost certainty, low rates of technological progress, and technologically homogenous generating alternatives and stable energy prices. However, today’s electricity planner faces a broadly diverse range of resource options and a dynamic, complex, and uncertain future.” In order to achieve an appropriate generation mix for energy security, based on a balance of economically efficient and sustainable sources, the Government must create an enabling environment.

### 6.2.1 ENCOURAGING SECTORAL INVESTMENT

One of the major risks on the supply side consist of insufficient investments in both base-load and peak production capacity, and relatively low electricity tariffs. Even at regional, SAPP, level these risks have translated into low prices at the Short-Term Energy Market (STEM) due to imperfect competition. To date, the restructuring of the electricity supply industry which saw the creation of the Electricity Control Board (ECB) and the latter issuing conditional generation licenses under the IPP framework, has not resulted in the desired outcome of any meaningful investment in the industry.

Electricity sector investments should be incentivised by way of special taxes, tax incentives, investment incentives and tax breaks. These interventions should be geared to aggressively focus on the development of Namibia’s comparative advantages, such as its abundant and diverse renewable energy resources, and possibly also the vast uranium deposits. The suitability of various generation options should be assessed by considering economic, social and environmental criteria.

Among the social criteria, the new policy framework needs to emphasise local job creation before, during and after construction, for example by designing tax incentives for the use of labour-intensive technologies. Investment should be shored up by promoting the use of local resources, which would also mitigate foreign exchange risks for local companies. From an efficiency point of view, unserved electricity must be minimised to reduce economic losses.

The persisting barriers to the development of renewable electricity and the low level of competition in the electricity market imply that there is a need for policy intervention. The purpose of the policy is to govern the approach of renewable energy and energy efficiency market development in Namibia by facilitating fair market access, return on investment, quality of supply, standards, market support structures and incentives and legal issues. It is envisaged that the critical mass created by an enabling environment through the incorporation of provisions of renewable energy and energy efficiency in the new policy will eventually lead to a self sustaining clean energy market.

It must be understood however, that this will require subsidies, in the form of higher feed-in tariffs or otherwise. This cost will have to be weighed against the environmental benefits in an objective way. The long-term survival of the nascent renewable energy industry hinges also on global developments as well as those in the region, which impact on export market conditions as well as domestic electricity prices. Moreover, the economic benefits of the industry in terms of job creation and value-added is currently limited by the fact that most of the hardware is manufactured abroad. Whether this limitation can be addressed in a cost-effective way largely depends on the size of the regional market and whether economies of scale can be achieved.

The restructuring of the electricity supply and distribution industry in Namibia commenced with the passing of the Electricity Act of 2000 which was followed by the establishment of the ECB as the independent regulator of the industry and the statutory requirement to have a licence to participate in the

electricity supply industry. These efforts should be followed up by exploring the option of turning the ECB into an energy regulator and establishing the Energy Act.

The New Energy Regulatory Framework being pursued by the Ministry of Mines and Energy (MME) must provide a guiding framework to address the challenges and take advantage of various opportunities coming up in the different energy sectors of the country. The Namibia Energy Regulatory Framework Steering Committee (NERSC), drawn from the gas, petroleum, electricity, renewable, regulator and government, must provide a coordinated approach to the development of a national energy regulatory policy framework for Namibia, taking into consideration the specific needs of each energy sector in order to ensure an efficient and harmonised energy regulatory environment. Such a comprehensive approach will ensure that no sector will be omitted, and that there is optimisation in the best options to be pursued. To ensure citizen engagement, information should be solicited from the public through debates and focus group meetings and studies. Consumer awareness will make for behaviour changes that save on electrical energy – underpinned by awareness and availability of technologies.



The restructuring of the industry poses the risk of fragmented investment and development of electricity generation projects in a liberalized economy. Namibia requires a national integrated resource plan for new generation stations to mitigate the risk of over-investment while ensuring sufficient supply to meet demand. Key policy decisions need to be included in the resource plan regarding how much generation must be sourced from local resources and what proportion must come from renewable energy resources, which generation options should be developed further, responsibilities for implementation and method/s for procurement. The Ministry of Mines and Energy should play a leading role in coordinating the drafting of national integrated resource plan and ensure its implementation.

### 6.2.2 REGIONAL ELECTRICITY TRADING

Electricity imports are to remain a part of the overall supply mix, which needs to be balanced with own generation. They play a crucial role in providing base-load power, and contribute to the diversity and therefore robustness of Namibia's future electricity supply mix. The national transmission backbone is currently being strengthened, and can be used for more diversified imports and exports.

The Southern African Power Pool is expected to play an increasingly influential role in electricity trading in the region. The northern countries of SADC, namely the Democratic Republic of Congo (DRC), Zambia and Mozambique in the east have generally and traditionally enjoyed a surplus of electricity, whilst the south has been experiencing a power deficit. The soon to be implemented Day Ahead Market (DAM) platform, which is replacing the Short Term Energy Market, will increase the competitiveness and interdependency of the electricity market of SADC. This will be complimented by an expansive transmission network in the region. Namibia will play a significant role in the wheeling of power from north of SADC to South Africa, mainly.

The Zimbabwe-Zambia-Botswana-Namibia, named "ZIZABONA" transmission project, will reduce congestion along the central corridor via Zimbabwe and Botswana as the network will be connected to the Trans Caprivi Link (Katima-Gerus 350kV HVDC Interconnector). This transmission line will be capable of carrying up to 400MW. Through this Interconnector, Namibia will be able to access power from Mozambique and DRC, which have excess hydro power. As mentioned before, this means that any new internal generation project will have to compete on price with these regional plants.



### 6.2.3 COMPETITION

In the electricity sector a modified single buyer market model is expected to be adopted. This model differs from the usual regulated monopoly in that there is division of the generation sphere into several financially independent power generation companies (PGC or IPPs) that begin to compete with one another for electricity supply to the common purchasing agency. In the modified single buyer model, the spheres of common purchasing agency and electricity transmission are envisaged to remain with NamPower, while distribution and retail sales will be through regional electricity distributors (REDs). Naturally, the activities of this purchasing agency, and in particular the setting of the prices of electricity bought from producers and sold to consumers, should be regulated by the ECB, which in turn reports to the Ministry of Mines and Energy. The single buyer will also be responsible for uninterrupted supply of electricity to consumers.

NamPower's role and leverage as single buyer and main Electricity Supply Industry (ESI) actor makes the entry and bargaining position of new entrants difficult. In order to stimulate competition, the IPP framework needs to be revisited to identify bottlenecks that are keeping potential entrants out of the market. The setting of targets, taxes and tariffs that will incentivise investments in generation should complement the current framework. At the same time, the tariff policy and its application needs to be transparent. Once the single-buyer framework is operational, the next step to a multi-seller multi-buyer market for electricity can be phased in.

### 6.2.4 INSTITUTIONAL DEVELOPMENTS

The ECB looks set to expand its role and mandate to cover electricity, gas and renewables. The development of this regulator into a broader energy regulating entity must be preceded by a better understanding of the costs and benefits involved. Moreover, there needs to be an awareness of the risk of political interference in such a body, and its independence must be ensured and further strengthened.

Energy efficiency is an overarching theme which will remain under the direct ambit of MME, possibly with an Energy Efficiency Agency coordinating the sector. The ECB is to set transparent supply industry rules, and enforce them. The Board should develop and promote multi-stakeholder rules for the ESI, which incentivise new entrants and guard against monopoly power abuse. Before the envisaged move to a multi-seller multi-buyer market can be undertaken, transparent and enforceable rules for the single-buyer function need to

be defined. The ECB must become an active regulatory agent for this key function in the country's electricity supply sector.

The Ministry of Mines and Energy is, by default, the driving force of developments at the policy level. In the coming years, it is to revise and adapt the new White Paper. MME shall also draft an Energy Act, which establishes national supply targets and sets a framework for the long-term development of the entire energy sector. For progress on electricity distribution, we deem it important for the Ministry to take a position on the REDs, especially the Central and Southern RED, as well as on the future of the local authority surcharge. MME should further provide clarity on the longer-term independence of the country's single buyer entity. On Kudu, the Ministry should take a position on its utilisation for the country's development. Presently, it has been pointed out, Kudu's main stakeholder Tullow appears to determine the pace of development.

NamPower should realign its focus on the company's established generation and transmission functions. The separation of business units along the value chain – namely generation and transmission – must be transparent and enforceable by the ECB. The utility should give up its single-buyer function in favour of a more independent and transparent national single buyer. NamPower needs to strengthen the REDs to allow them to eventually take over all distribution functions. In a concerted effort with the Ministry, NamPower needs to provide funding for the country's continued rural electrification.

The REDs must focus on cost-effective and sustainable provision of electricity to customers, whilst driving efficiency and transparency in what they do. They should remain politically neutral. The REDs should also be encouraged to make rural electrification contributions and to venture into small-scale decentralised generation. Finally, local authorities need to be assisted in finding other revenue sources, to compensate for the loss of electricity revenues. If the establishment of the REDs have led to efficiency gains, then economic theory is quite clear that with adequate redistribution of the revenues, everyone can be made better off. Such an arrangement would shore up support among local politicians for the existing as well as the two to-be-established REDs.

## ABOUT THE IPPR

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 Namibia Political Party Prospects Leading to the 2009 Elections  
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## NOTES

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