SUSTAINABLE ENERGY FOR ALL

NAMIBIA:
Rapid Assessment and Gap Analysis

OBJECTIVE

The purpose of Rapid Assessment and Gap Analysis is to provide:

- A quick brief look of the energy situation in the country (Section 1) within the context of its economic and social development and poverty eradication.
- A good review of where the country is in terms of the three SE4ALL goals (Section 2), and
- A good estimate of the main challenges and opportunities vis-à-vis the three goals of SE4ALL where the major investments, policies and enabling environments will be required (Section 3)

EXECUTIVE SUMMARY

Energy policy and planning is guided by the **1998 Energy White Paper** chiefly aimed at achieving social development, economic efficiency and sustainability. Within the guidance of the 1998 White Paper, energy has also been integrated into the development plans particularly the Vision 2030 and Namibia's Development Plan (NDP) . The **strategic plan 2012/13 to 2016/17** of the Ministry of Mines and Energy, formally launched in June 2012, provides the strategic directions towards the implementation of activities which will contribute to the goals of the sustainable energy for all.

For all modern energy (petroleum products and electricity), Namibia is still highly depend on external supply. Namibia does not have any indigenous sources of oil, coal or natural gas although there are prospects for commercial exploitation of natural gas. There is no oil refinery and as a result, all refined petroleum products are imported. With regard to electricity, Namibia, to a large extent, relies on energy imports. The country imports most of its electricity supply from South Africa and Zimbabwe.

Although progress has been made to expand investment in domestic energy generation transmission and distribution, the situation will remain critical in the next 5 years as Namibia must import power from a region that has already insufficient power. As a result increase in the import prices of electricity is expected to continue given the prevailing electricity shortage in the region. This may impact negatively on electricity prices for all households and businesses.

In terms of investment (gross fixed capital formation), as expected mining and quarrying sector is the most important sector with 23.6 % of the total investment in 2010. Electricity and water sector accounts for only 5.2 % of the total investment. Despite the electricity act of 2007 which encourages private sector investment, the lack of a formal power market model, is a major constraint for the market participants and Independent Power Producers (IPP) developers who need to understand the Government's policy with respect to the market model in order for them to submit proposals consistent with the market rules.

The major challenge remains access to ***modern energy services for rural areas***. Although investments were devoted to local energy production and rural electrification, access to electricity and other modern energy services remain low in rural areas. In 2012, rural households still rely heavily on biomass for their basic energy needs and the rate of rural electrification does not exceed 25 %. With respect to off grid and rural electrification, the rural electricity distribution Master Plan and the off-grid energisation master plan are the key guiding documents. With respect to financial mechanisms, the solar revolving fund (subsidized loans for renewable energy technologies), still ongoing, could be a sound channel if sufficient funds are provided and there is

a good rate of loans recovery. According to the Off-Grid Energisation Master Plan (OGEMP), lack of access to credit prevents lower-income households and small firms to invest in RE and also prevents investors from financing RE projects which are characterized by high up front initial capital.

With regard to **renewable energy**, their relative share in the total primary energy supply (TPES) is particularly high, however traditional biomass contributed for 64 % to the TPES in 2009. The key challenge is therefore to ensure the sustainability of biomass resources to meet the household demand for the basic energy needs of cooking and space heating. Interventions to increase energy efficiency along the biomass supply chain and penetration of low carbon technologies will be major drivers to increase access to modern energy services and to preserve forest and other biomass resources. Hydropower is the other major source of RE currently exploited on a large scale. 98 % of the electricity generated in the country came from hydro power in 2011, however the bulk of the electricity consumed in the country is imported which may impact negatively on the energy security of the country. Such a trend could be reversed if the potential for solar and wind power production, on grid and off grid, for households and businesses, is exploited. However, the lack of national renewable energy targets and/or other measures to facilitate the introduction of carbon-neutral generation capacity is a major constraint to the deployment of RES.

With regard to **energy efficiency**, Namibia's energy intensity is attributable to:

- the dominant economic sectors such as mining and agriculture which are highly energy dependent on imported electricity and oil products
- the country's low population density coupled with the high domestic energy use in urban areas,
- the long transport routes to the country and between the few major centres within Namibia

These factors have led to the creation of the Renewable Energy and Energy Efficiency Institute (REEEI) and the Electricity Control Board (ECB) which has been promoting energy efficiency, and demand side management. Demand side management measures offer excellent opportunities to NamPower and the regional electricity distributors (REDs) to more effectively manage the supply and demand of electrical energy and at the same time limit the consumer's exposure to rapidly increasing regional electricity prices. Six demand side management measures have been identified and cost estimated (awareness campaign, electricity tariffs, dissemination of efficient lighting, dissemination of solar water heaters, expanding ripple control measures, energy audit in the commercial and industrial sector). These measures are cost-effective and provide opportunities to balance a limited and volatile supply with an increasing local demand.

The implementation of these programmes and reaching energy access for all is still constrained by **key barriers** mainly the inadequate financial and regulatory framework, limited financial technical and manufacturing capacities, lack of a comprehensive and updated database to provide information for potential local and foreign investors.

The key challenges faced by the country can be summarized as follows:

- It is likely that the majority of Namibia's rural population will continue to rely on traditional biomass for cooking and space heating in the foreseeable future. Considering the situation of deforestation in large parts of Namibia, there is a

need to improve this situation particularly with energy efficient technologies and the deployment of modern forms of energy.

- Reduction of electricity imports from South Africa Zimbabwe and development of a secure power supply with a relative independence from neighbouring countries
- Soaring prices for liquid and gas fuels;
- continuing increase in demand for mining products, and with that the electricity to process minerals;
- A regulatory and financial framework not sufficiently attractive to invest in RET which bear high initial capital cost
- The long gap time required in building new power plants particularly from renewable energy sources to meet the increasing demand.

Section I: Introduction

1.1 COUNTRY OVERVIEW

The macro energy picture of Namibia shows the high share of energy imports (electricity and oil products) compared with energy production and the high share of biomass within the total primary energy supply (TPES) due to the consumption of this form of energy in rural areas (tables 1 and 2)

1. Basic socio-economic data:

Key Indicators		Indicators per capita	
Population (million)	2.17	**TPES/Population** (toe/capita)	0.79
GDP (billion 2000 USD)	5.80	**TPES/GDP** (toe/thousand 2000 USD)	0.30
GDP (PPP) (billion 2000 USD)	18.80	**TPES/GDP (PPP)** (toe/thousand 2000 USD)	0.09

Source: International energy agency

1.2 ENERGY SITUATION

2. Energy supply (energy mix, export/import)

Key Indicators 2009		Indicators per capita 2009	
Energy Production (Mtoe)	0.33	**Electricity Consumption / Population** (kWh/capita)	1628
Net Imports (Mtoe)	1.39	**CO_2/TPES** (t CO_2/toe)	2.15
TPES (Mtoe)	1.71	**CO_2/Population** (t CO_2/capita)	1.70
Electricity Consumption* (TWh)	3.53	**CO_2/GDP** (kg CO_2/2000 USD)	0.64
CO_2 Emissions ** (Mt of CO_2)	3.69	**CO_2/GDP (PPP)** (kg CO_2/2000 USD)	0.20

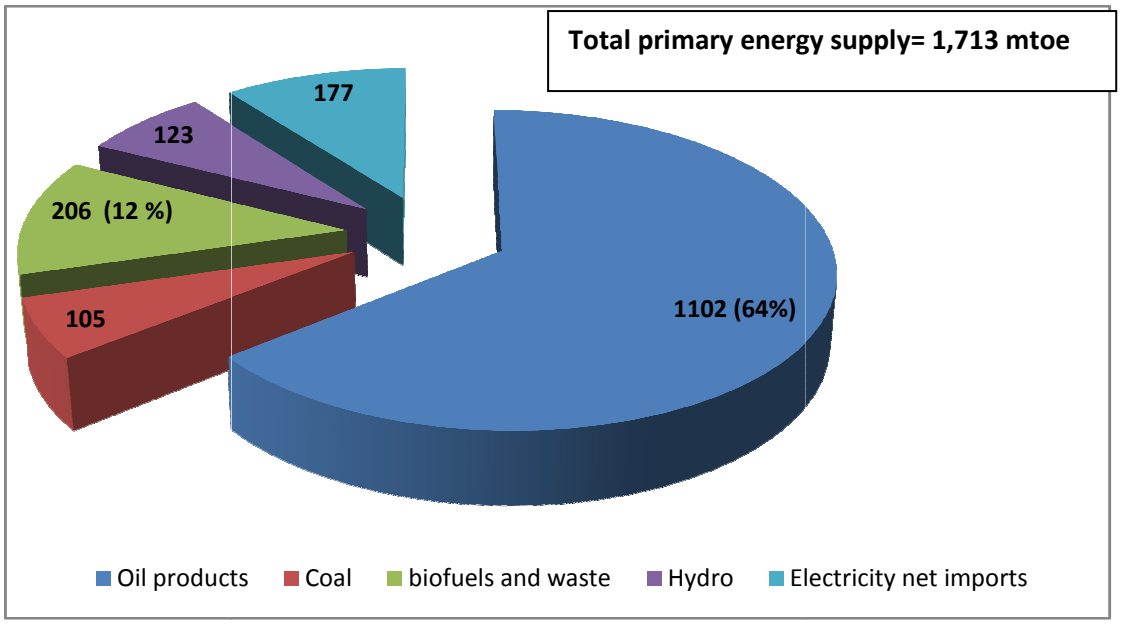


Figure 1 Total Primary Energy Supply in 2009 (1, 000 toe and %)

- **Power sector: key data**

Installed capacity

The total installed capacity in 2011 was 393 MW out of which 360 MW available and the peak demand reached 564 MW in 2010[1]. Hydro accounts for 63 % of the total installed capacity and coal for less than one third of the total installed capacity (figure 2). The remaining is provided by petroleum products (distillates).

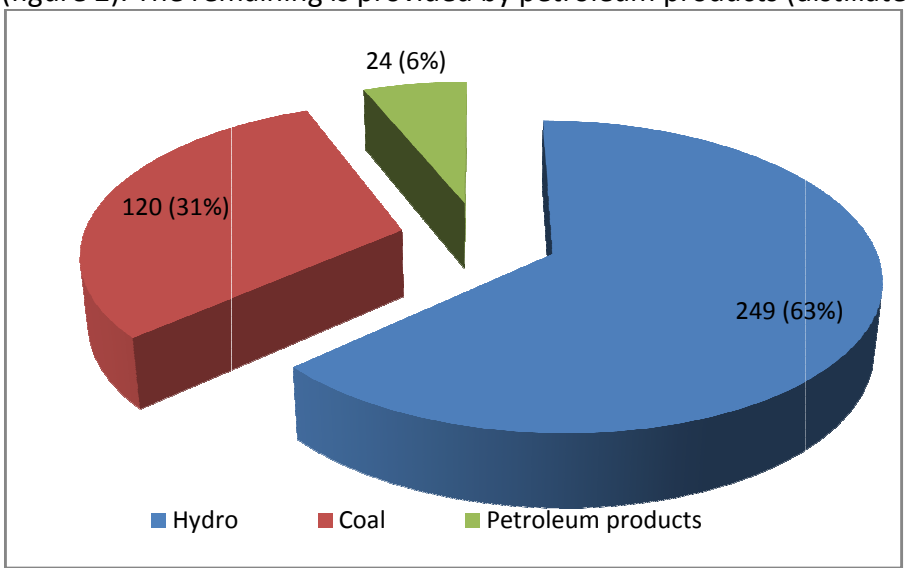


Figure 2 Structure of the installed capacity in 2011 (MW)

[1] The gap is met by the interconnector for imports. In fact in NamPower statistics such as the annual reports, the interconnector (600 MW) is included in the installed capacity.

Generation, losses, electricity trade and domestics supply

The installed capacity is however not sufficient to meet the demand and the country imports the bulk of its supply from neighbouring countries (energy balance below and figure 3).

Energy balance of the electricity sector in 2009 (adapted from IEA)

	Production	**Structure (%)**
Production from:	*Unit: GWh*	*%*
- coal and peat	304	17
- oil	9	1
- hydro*	1429	82
Total Production	**1742**	**100**
Imports	2202	
Exports	-144	
Domestic Supply	**3800**	
Losses	**266**	
Final consumption	**3534**	

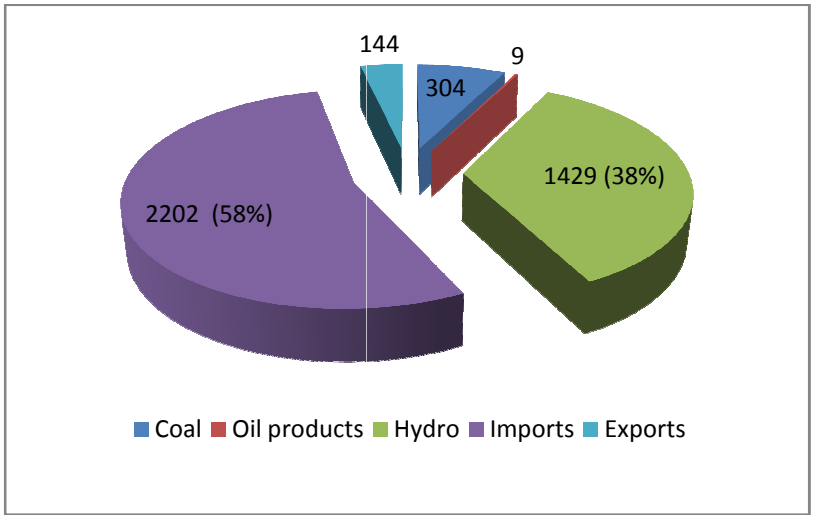
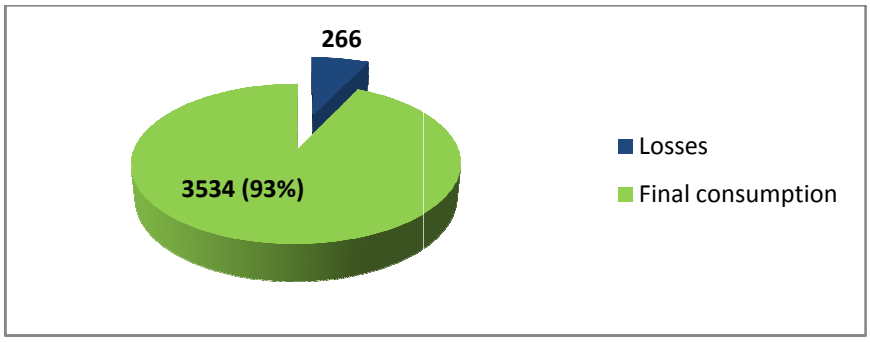


Figure 3 Breakdown of total electricity supply excluding losses in 2009 (GWH and %)

The breakdown of electricity supply shows the high share of imports (58%) and that of hydro. Although coal accounts for 31 % of the total installed capacity, its contribution to the supply is much lower due to the weight of imported electricity.

Losses and final consumption (GWh in 2009)
When losses are deducted (266 GWh), the total final consumption amounts to **3534 GWh in 2009.**



Out of a total supply of 3800 GWh mainly from imports (58 %) and hydro (38 %) in 2009, the total final consumption has reached 3534 GWh due to 266 GWh losses. Industry accounted for 639GWh in 2009 and the remaining was used by other sectors, mainly the residential sector.

3. Energy demand: overview of main consuming sectors, industry, residential, agriculture, transport

The total final consumption reached 1.61 Mtoe in 2009 of which industry, transport and residential sector accounted respectively for 65 % of the total final consumption (see also point 9 modern energy for productive uses).

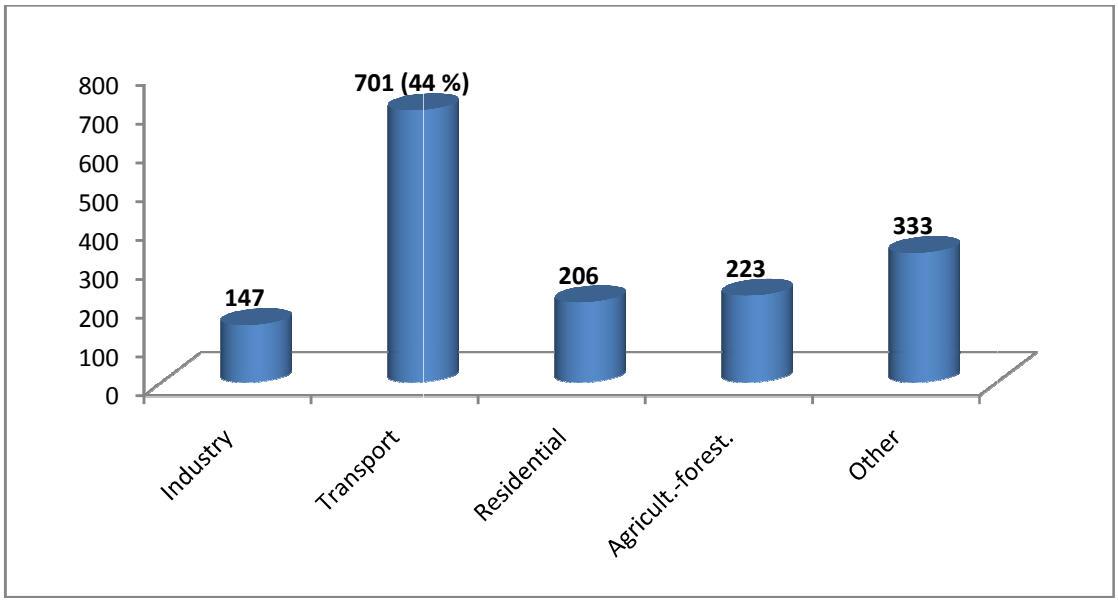


Figure 4 Breakdown of the final consumption per sector in 2009 (1,000 toe)

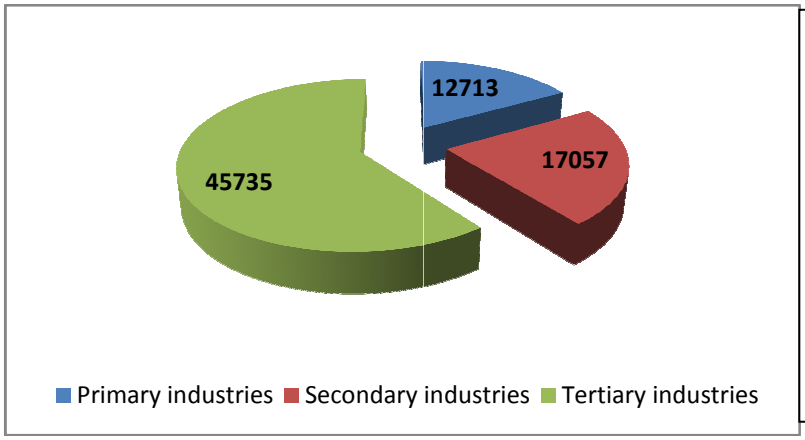
Petroleum products are mainly used in the transport sector which accounts for 44 % of the total final consumption.

4. Energy and economic development:

Namibia's economy consists primarily of mining and manufacturing and its economy is tied closely to South Africa's. Namibia is the fourth largest exporter of non-fuel minerals in Africa, and the world's fifth largest producer of uranium. Rich alluvial diamond deposits make Namibia a primary

source for gem-quality diamonds. Namibia also produces large quantities of lead, zinc, tin, silver, and tungsten[2].

The national accounts data show that two sectors (mining & quarrying and, to a much lesser extent, electricity & water) have a major contribution in the GDP. However it should be highlighted that these two sectors are not limited to energy although energy represents the highest contribution in the GDP for the two sectors. The mining industry is very important to the economy in terms of its contribution to GDP growth, export earnings, government revenue jobs creation and energy consumption. As far as primary industries are concerned, the mining sector accounts for 48 % of the GDP of this sub-sector. Electricity and water accounts for 12.4 % of the secondary industries sector (figure 5).



Secondary industries account for 23 % of the total GDP out of which **electricity and water** with 12.4 % of the GDP of this sub-sector.
Primary industries account for 17 % of the total GDP out of which other mining and quarrying **(mainly uranium)** accounts for one quarter of the primary industries GDP and the diamond mining accounts for 31 % of the primary industries GDP

Figure 5 GDP breakdown and energy sector contribution in 2010 (N$ million current prices)

In terms of investment (gross fixed capital formation), as expected mining and quarrying sector is the most important sector with 23.6 % of the total investment in 2010. Electricity and water sector accounts for only 5.2 % of the total investment (figure 6). To increase energy security of the country, substantial investment will be required. The creation of a conducive investment climate is among the objectives of the strategic plan for energy 2012/13- 2016/2017.

[2] Program for Basic Energy and Conservation in Southern Africa (PROBEC), Namibia country profile, http://www.probec.org/displaysection.php?czacc=&zSelectedSectionID=sec1194697671

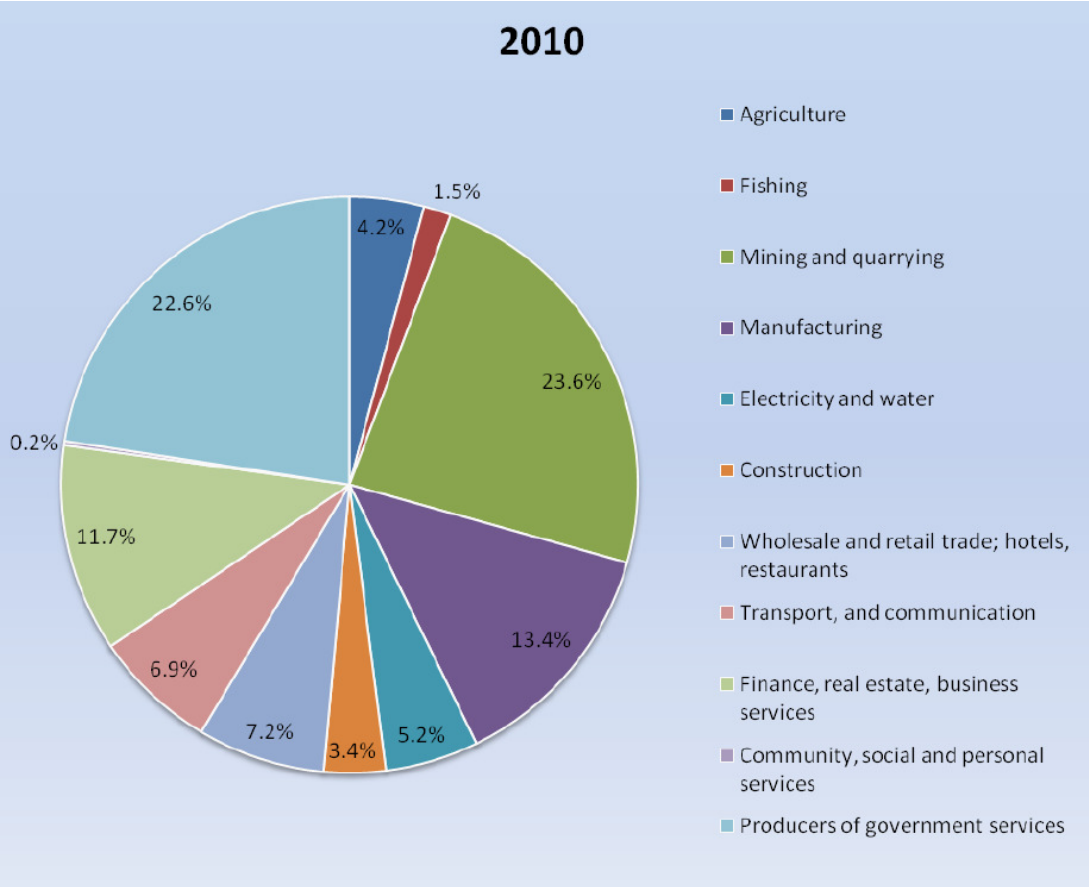


Figure 6 Breakdown of investment and share of electricity and water sector in 2010.

Energy strategy and relevant targets: access, capacity, generation, energy security/

Namibia remains highly dependent on *electricity imports*, coal and hydro to meet the growing electricity demand. This high import rate of electricity can be explained by the historical surplus capacity and generation in the RSA, which however is rapidly diminishing. Coupled with a transmission constraint between the North Eastern regions of the RSA (where most generation capacity is situated) and the Cape this has put the Cape (and Namibia) at risk in the event of Koeberg nuclear power station not being available. This has become reality in 2006 with damage occurring to one of Koeberg's generators and the other being due for refuelling. Eskom's supply to Namibia has been drastically reduced, forcing NamPower to run its own generators at the van Eck (coal) and Paratus (heavy fuel oil) power stations. This has led to significant losses for NamPower since these stations generate at a higher rate than NamPower's average selling rate. In the short-term, issues may be repeated and load shedding may become necessary.

In the medium to long-term, Namibia is faced with rising generation costs and hence retail prices are projected to increase in real terms by maybe as much as 50% above the levels currently being experienced. Stability of regional energy supply (generation, transmission and distribution) is being pursued in the context of the Southern Africa Power Pool (SAPP). Downstream energy supply processes are being consolidated through the encouragement of the emergence of Independent Power Producers (IPPs). Furthermore, NamPower is pursuing negotiations with various stakeholders for the development of a wind farm at the coast and has also implemented the 200 kW Tsumkwe-based hybrid mini-grid solar energy system and is considered similar schemes.

Section 2: Current situation with regard to SE4ALL goals

2.1 ENERGY ACCESS vis-à-vis GOAL OF SE4ALL

5. Overview and assessment

Namibia is characterized by sharp disparities in terms of energy access between urban and rural areas. Although access to modern energy services is not a key issue, imports of oil products and above electricity may put under pressure poor urban people with limited access to energy services due to the financial constraint. Lack of access to modern energy services (rural electrification only 25 %) remains a key issue for rural areas. This constraint is compounded by the financial barrier.

Modern energy for thermal applications (cooking, heating)

Namibia still relies heavily on traditional biomass for cooking and space heating. Despite being the driest country in Southern Africa, Namibia nonetheless produces considerable woody biomass on its total land area. According to the 2009 IEA energy balance, **biofuels and waste account for 13 % of the total final consumption**. However for the household sector, biofuels, particularly in rural areas, are the main source for cooking and space heating.

With respect to cooking and space heating, there is still a great disparity between urban and rural areas. In the latter, traditional biomass remains the main fuel for cooking and space heating. **90 % of rural households use firewood** for cooking, 34 % LPG, 9 % paraffin, 8% electricity[3]. However the share of LPG might be over-estimated in quantitative terms as 40 % of households use multiple fuels with biomass as a dominant fuel. Approximately 80% of firewood users in rural areas gather it themselves. In 63% of rural households women and children are responsible for the collection of firewood. Approximately 12, 000 tons of charcoal is produced annually in Namibia, much of which is exported. The use of charcoal and charcoal briquettes is almost totally limited to urban areas.

This trend has not fundamentally changed. According to a comprehensive survey of the Ministry of Energy carried out in 1997, firewood was used in 90 % of the households[4]. However the per capita consumption and prices vary a great deal between the capital and rural areas.

Total Consumption (Including Own Collections) in Windhoek, Ovambo and all towns,

Town / City	Type of User	Population	Consumption kg/capita/day	Annual consumption (tons	Price N $/ton	Total value N$1,000
Windhoek I	Occasional	67000	0.19	4646	630	2,927
Windhoek II	Main	78000	0.9	25623	480	12,299
Windhoek II	Occasional	47000	0.46	7891	480	3,788
Windhoek	Total	192000	0.54	38160	499	19,042
Ovambo	Occasional	40500	0.95	14043	390	5,477
Ovambo	Main	5500	0.56	1124	390	438
Ovambo	Total	46000	0.9	15111	390	5,893
Total all towns		**262000**	**0.69**	**65985**		**26,529**

[3] Program for Basic Energy and Conservation in Southern Africa (PROBEC), Namibia country profile, http://www.probec.org/displaysection.php?czacc=&zSelectedSectionID=sec1194697671

[4] FAO, Wood fuels and assessment, Namibia country report, http://www.fao.org/DOCREP/004/X6797E/X6797E02.htm

Namibia does not have much of a tradition for the extensive use of **charcoal** for domestic energy needs (FAO). The following figures from FAO provide a good summary

There were in 1997, 100 charcoal producers employing 2000 small entrepreneurs, earning an average of N$ 430.0 per month from burning charcoal.

-Producers earn a net profit of N$ 217.00 per ton
-Marketing agents earn profits of N$ 210.00 per ton
-The Industry was producing 12,000 tons of charcoal per year marketed as follows:
-5000 tons exported to Germany
-2500 tons exported to the UK
-3000 - 4000 tons exported to South Africa
-1000 tons consumed locally

The charcoal was retailed locally at N$ 1 500 per ton and sold wholesale in Europe at N$ 1 700 per ton.

Two stove manufacturing centres in Namibia produce the Tso-tso fuel-efficient stove which requires on average 50% less wood than does an open fire for an equivalent cooking task. About 2000 to 2500 stoves were sold [5]. Imported stoves like the Vesto stove are gaining popularity. The Tso-tso stove was sold for around N$150, while the Vesto stove was sold for about N$450. Solar Cookers (box-type) are also manufactured in Namibia. Although accurate and recent figures are not available, it is very likely that the rate of penetration of improved wood stoves is low and that of solar cookers marginal.

6. Access to electricity:

At the level of Africa, Namibia is among the countries with an electricity generation per capita above the average although there was a decrease between 2006 and 2009.

Net electricity generation (kWh/year/capita) and comparisons with selected African countries[6]

	2006	2007	2008	2009	Rank in Africa in 2009
Namibia	819	790	773	746	9
South Africa	4,658	4,886	4,935	5,019	1
Zimbabwe	760	714	701	668	11
Swaziland	367	383	399	416	14
Niger	12	11	9	8	53 (last)

Source: AfDB, Statistics Department, The Africa Infrastructure Development Index, Economic Brief Volume 1, Issue 1, 25 April, 2011

Namibia is still characterized by a great disparity between urban and rural areas. The electrification rate for urban households is estimated at 70%[7], whereas for rural households, it has reached 25 % in 2011[8].

[5] GTZ-PROBEC (Programme for Basic Energy and Conservation), PROBEC country profile, May 2002.
[6] Source: AfDB, Statistics Department, The Africa Infrastructure Development Index, Economic Brief Volume 1, Issue 1, 25 April, 2011
[7] REEGLE, Energy profile Namibia, /www.reegle.info/countries/namibia-energy-profile/NA
[8] Development Dialogue Forum, theme sustainable energy for all, Rural Electrification (Grid & Off-Grid) – Status and experiences in improving modern energy access in rural areas in Namibia communication by Joseph S. Iita, Permanent Secretary Ministry of Mines and Energy, 14 May 2012

Although the country depends heavily on imports from South Africa, new facilities in 2010 may contribute to improving reliability of energy supply and energy security. The N$ 3.2 billion Caprivi interconnector has been officially inaugurated in November 2010 and a new 22.5 MW peaking power station at Walvis Bay was completed during the first half of 2011. A fourth turbine is being built at Ruacana which will add 92 MW capacity of renewable energy.

Transmission in the sector continues to maintain high standards. NamPower grid did not experience any major system blackout during the year. NamPower successfully completed the first phase, of the 220kV West Coast developments and upgrades, initiated by the need to supply power to the new Trekkopje Uranium Mine.

However , Namibia will be facing critical supply situation in the next 2-5 years as regional power demand is set to put strain on regional power supply. NamPower will be required to import power from the region that already has insufficient power. In response, NamPower has initiated the Short Term Critical Supply (STCS) project which will focus on providing short to medium term suite of power supply and demand management solutions (NamPower annual report 30 June 2011).

As Namibia imports the bulk of its electricity, the costs depend to a large extent on trading partners. The increase in the import prices of electricity is expected to continue given the prevailing electricity shortage in the region (NamPower annual report 2011). This trend may impact on electricity for households and businesses to ensure the financial sustainability of the utility.
In order to increase access to basic commodities, a first round of zero-rating VAT was put in place in 2000 which included water, electricity. A recent report, published in 2010, on Poverty and Social Impact Analysis (PSIA) reveals that this measure (VAT Zero-Rating) did not adequately target and benefit the poor. The Report reveals that only thirteen percent of the poor households in the income group of N$ 0-1000 were able to buy electricity now, while78.6 percent of this group is still unable to buy electricity[9].

If imports of electricity are excluded, RES (hydro power) account for 63 % of the total installed capacity in 2011 (figure 7). However this share may slightly decrease in the very short term with the new fossil fuels generating facilities in Walvis Bay. In the longer term, there are good prospects given the renewable energy potential including hydro (additional 92 MW capacity at Ruacana) and more particularly solar, including concentrated solar power (CSP) to increase dramatically the share of RES in the total energy mix. Indeed Namibia has one of the best solar energy resources in the world in addition to considerable wind energy potential in coastal areas (source White Paper 1998)

Installed capacity and share of RES in 2011

[9] National Planning Commission, Quarterly Newsletter, April 2011.

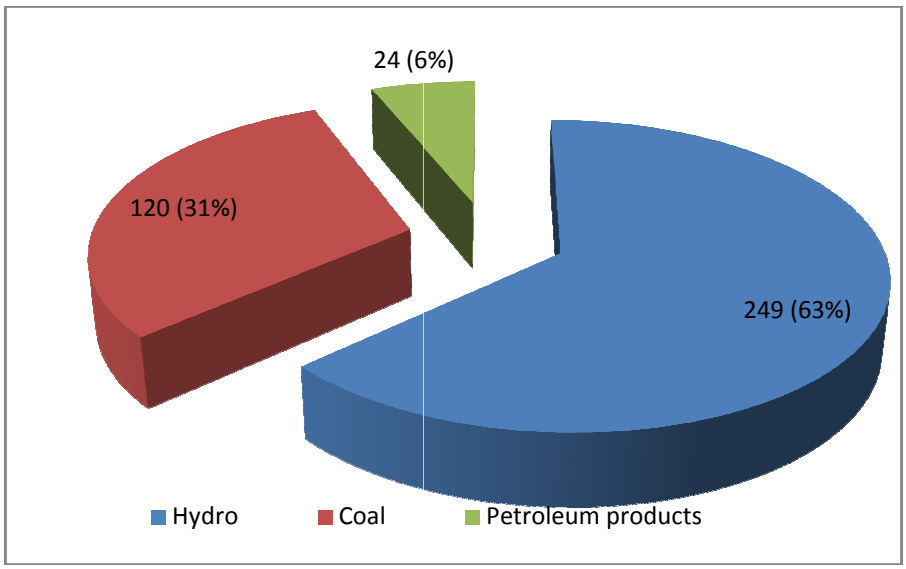


Figure 7 Installed capacity and share of RES in 2011 (MW and %)

7. Modern energy for productive uses:

Coal, petroleum products, electricity and marginally other renewable energy sources such as solar account for the bulk of modern energy sources. Modern energy for productive uses can be tracked through national energy balances and particularly through the total final energy consumption (TFC). However it should be highlighted that this indicator remains rather broad and does not provide a disaggregation within each sector. It remains however a useful tool as it encompasses all forms of energy

Coal is imported and used for electricity generation to supply the 120 MW Van Eck coal power plant which accounts for 31 % of the total installed capacity in 2010. Petroleum products account for 44 % of the total final consumption and are mainly devoted to the transport sector, industry, agriculture and, to a lesser extent, to the power sector and households. As far as electricity is concerned, apart from households and services, the mining sector is an important electricity consumer. For instance out of 3543 GWh sold in 2011, Skorpion Zinc Mine accounted for 690 GWh which is almost 20% of the electricity sold in the country.

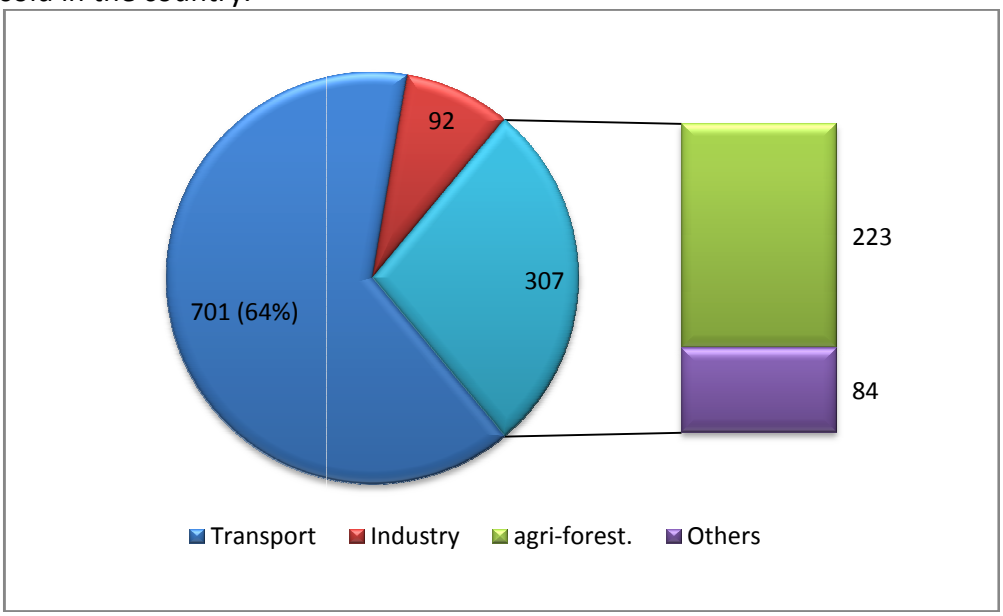


Figure 8 Modern energy services from petroleum products (2009) 1,000 toe

2.2 ENERGY EFFICIENCY vis-à-vis GOAL OF SE4ALL

8. Overview and Assessment

Energy efficiency is an area which is yet under developed for all sectors: residential and productive sectors. There is therefore an important potential of energy savings to be tapped through demand side management programmes and the penetration of more efficient technologies. The Renewable Energy and Energy Efficiency Institute should play a key role in setting up a data base and providing guidance for the implementation of best practices in the area of energy efficiency.

9. Energy intensity of national economy: current situation and trend

Energy efficiency is a component of demand side management. Energy intensity is a good indicator to measure the energy efficiency of a sector or the whole economy. The energy intensity in 2009 was as follows[10]:

- TPES/GDP (toe/thousand 2000 USD[11]): 0.30
- If the GDP is measured according to the purchasing power parity, the energy intensity is much lower. Although there is not sufficient data to measure the evolution of the energy intensity, it doesn't seem there was a decoupling between energy use and GDP. Namibia's energy intensity is attributable to:
  - the dominant economic sectors such as mining and agriculture which are highly energy dependent on imported electricity and petroleum products
  - the country's low population density coupled to high domestic energy use in urban areas,
  - the long transport routes to the country and between the few major centres within Namibia,

At the household level, the implementation of the Namibian Renewable Energy Programme (NAMREP) has led to some modest results at the national level However the approach can be scaled up to get significant results as the potential for energy savings is very important. The demand side management (DSM) strategy combines tariff policies and deployment of more efficient appliances, equipment and technologies. It is estimated that switching 60 % of incandescent lamps with compact fluorescent lamps (CFL) will reduce the energy consumption by 22 GWh/year and the demand by 20 MW[12].

2.3 RENEWABLE ENERGY vis-à-vis GOAL OF SE4ALL

10. Overview and Assessment

Despite some efforts during this last decade, renewable energy for electricity is limited to large hydro which accounts for the bulk of the electricity generated in the country. Rural areas rely on biomass for their basic needs for cooking and space heating. Such a pattern of consumption may call into question the sustainability of the resource if alternative and low carbon options are not developed. This includes energy efficiency within the supply biomass chain.

[10] International Energy Agency

[11] Indicators expressed in US$ at their value in 2000.

[12] ECB, , Demand side management study for Namibia, , implementation plans for six DSM, options report 2 november 2006.

Given the solar and wind potential and the recent off grid deployment of renewable technologies, there are good prospects for a significant penetration of RE if financial, regulatory and technical barriers are removed

11. On-grid and off-grid renewable energy

Currently the bulk of electricity is provided by a large on grid hydro power plant (Ruacana) with a capacity of 249 MW which contributed to 63% of the total installed capacity in 2011 and 98 % of the total electricity generation[13]. It is also worth mentioning that NamPower was able to obtain a grant from KfW of Germany to conduct a biomass feasibility study for the utilisation of large scale invader bush to fire a power station of between 10 to 20MW to be connected to the grid.
Contribution of off grid RES remains marginal despite the recent commissioning in 2011 of one of the biggest solar hybrid (diesel-soalr) off-grid systems in southern Africa. The Desert Research Foundation of Namibia (DRFN) launched the Tsumkwe Energy Project in March 2008 with funding from the European Commission's EU ACP Energy Facility, the NamibianPower Corporation (NamPower) and the Otjozondjupa Regional Council (OTRC).The power produced by the 200 kWp photovoltaic field is directly fed into two mini-grids of the village Tsumkwe. The hybrid solar plant in Tsumkwe supplies approximately 100 households, the sewage plant, a school, the police station, a hostel and the water supply system with 24h electricity.

The implementation of the Namibian Renewable Energy Program (NAMREP) offers also opportunities for rural electrification. NAMREP was launched in 2004 to address the key barriers experienced in the dissemination of RETs in Namibia. Under NAMREP there were achievements for solar water heaters, solar cookers and solar PV for pumping (see next section). However one of the most important programme is the Off grid Energisation Master Plan (OGEMP) which aims at providing energy access from renewable energy and energy efficient appliances to those who do not have access to energy services from the grid over a period of 20 years A two pronged approach is adopted:

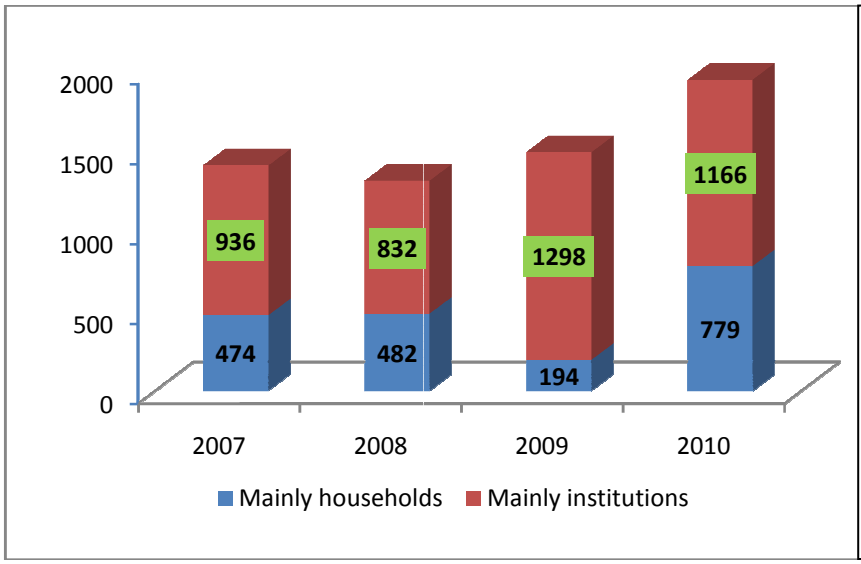
- energy shop approach: commercialisation of renewable energy technologies and efficient appliances
- Access to credit through a revolving fund.

Given the solar and wind potential and the declining world prices, there are good prospects for a significant penetration of on grid and off grid RES.

12. Use of renewable energy sources (RES) for thermal applications: cooking/heating

Currently the use of off grid RES for cooking and heating is rather marginal if we exclude traditional biomass in rural areas. In fact, this source of energy should be considered as renewable if it extracted from sustainable biomass resources.
The implementation of the NAMREP has led to significant number of solar water heater (SWH) sold during the phase II period 2007-2010. During this phase 6161, solar water heaters were installed for household and institutions such as hotels, clinics. The capacity and the costs of the latter are much higher to meet the higher demand for heat water. The following figures give the evolution of SWH according to the main category of beneficiaries

[13] Source NamPower Annual report, 30 June 2011

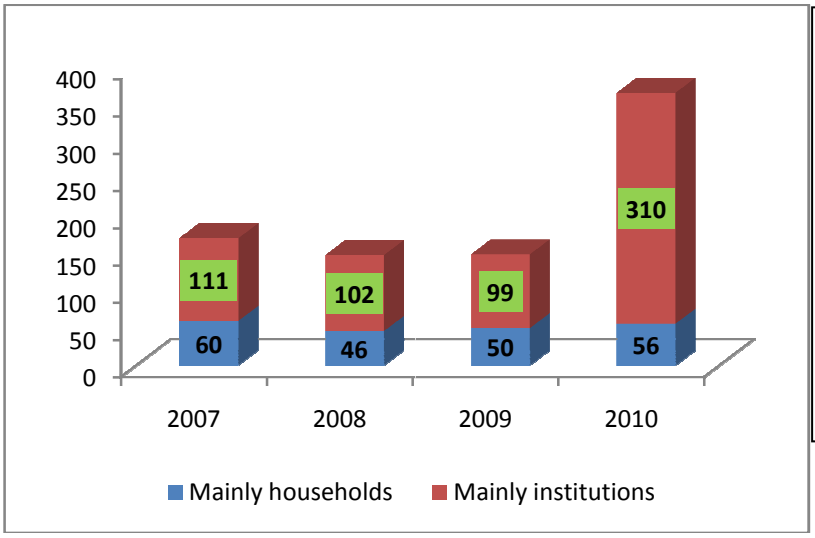


The capacity of SWH for households vary between 100 and 160l. The average price was between US$ 1,677 and 2,543 depending on the house. In 2010 the selling prices have decreased and are between US$1,073-1918. With regard to institutions, the capacity varies between 200 and 1,500 l. The prices in 2007 according to the size were between US$ 2,582 and 9,323. In the 2010 the prices decreased to US$ 1,922- 5,964.
For both categories (households and institutions) this is substantial price reduction over a short period of time

Figure 9 Commercialisation of SWH for households and institutions (units)

The energy savings potential from a substitution of domestic electric water heaters by SWH is tremendous. It has been estimated that 97,000 domestic electric water heaters were in use in Namibia in 2006 which may contribute to 106MW to the peak load assuming that some 50% of all electric water heaters are switched on during the winter evening peak. Reducing the electric water heater load can therefore bring about a substantial overall load reduction, both nationally and in urban distribution networks.

With respect to cooking under the same program, 834 solar cookers were sold during the same period for households and institutions (figure 10).



The number of solar cookers for **households** is marginal and has even decreased between 2007 and 2010 although this trend might be reversed if barriers to dissemination are addressed. With respect to this technology, a better strategy should be to focus on institutions. Indeed, there was a substantial increase during the period of the units sold to **institutions** although the cumulative sales remain still relatively low.

Figure 10 Commercialisation of solar cookers for households and institutions (units)

13. Use of RES for productive activities

If on grid renewable (hydro), and biomass are excluded, the contribution of renewable to productive activities is not significant. The main contribution was made under the NAMREP with the implementation of solar PV for water pumping targeting farmers and institutions Under the NAMREP, phase II, 4618 PV water pumps were installed however only 151 (3.3 %) have a capacity above 0.5 kW (figure 11). The relatively small size of the majority of PV pumps installed may limit their use for significant productive activities.

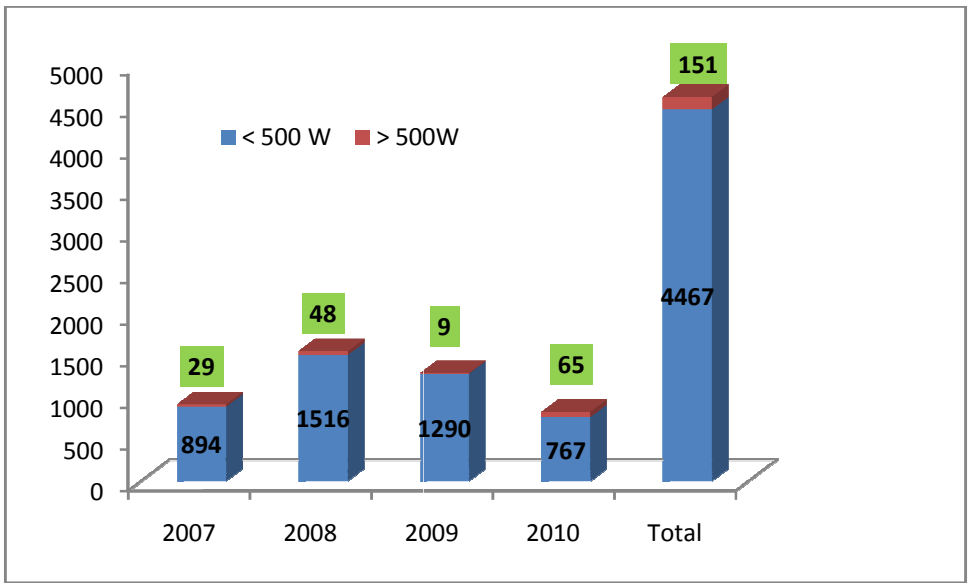


Figure 11 Commercialisation of PV water pumps 2007-2010 by size (units)

14. Consolidated Summary: problem statements with regard to energy access, energy efficiency and renewable energy

Energy Access

Namibia is still characterized by a sharp discrepancy in terms of access to modern forms of energy between rural and urban areas. With regard to fuels for cooking, rural areas still rely, to a great extent, on traditional biomass and inefficient stoves which may negatively impact on biomass resources as well as on health.

The rate of rural electrification in 2012 is estimated at just 25 % however the prospects for increasing dramatically this rate imply a significant increase in investments. Furthermore electricity in rural areas is limited to basic energy services for households and social services (education and health).

Namibia is heavily dependent on electricity imports mainly from South Africa and Zimbabwe to meet the internal demand. This situation may impact negatively on energy security and the balance of trade as the electricity trading partners are facing problems to meet their own demand. Furthermore, prices of imported electricity are increasing due to the imbalance between supply and the demand in importing countries.

Namibia will be facing critical supply situation in the next 2-5 years as regional power demand is set to put strain on regional power supply. NamPower will be required to import power from the region that already has insufficient power.

Energy efficiency and energy intensity:

Energy efficiency can be achieved by reducing losses in processes (production, transport and consumption), the deployment of efficient renewable energy technologies and shifting from fossil fuels to renewable energy.

High consumption is mainly due to the dominant sectors such as mining and agriculture which depends heavily on imported energy formed by oil products and electricity . In these sectors achievements in energy efficiency by reducing the energy intensity will have an important positive impact on the final consumption. Furthermore considerable carbon mitigation potential exist in the energy sector particularly with the deployment of additional hydro power capacity and, in the mid long term, of decentralised and centralised solar and wind energy units.

Renewable energy:

The share of renewable energy seems particularly high with 71 % of the total primary energy supply (TPES) in 2009 and 98 % of the electricity generated in the country. However traditional biomass accounts for 64 % of the TPES. The key challenge is to ensure the sustainability of the supply to meet the current and future consumption. With respect to electricity, the growth of the demand will increase electricity imports and as a result put much pressure on energy security.

Solar and wind potential remain largely untapped and should increase the share of on grid and off grid renewable energy particularly to increase access of rural populations to modern energy services.

2.4 SE4ALL GOALS

15. Goals

- Energy access
- Energy efficiency
- Renewable energy

Energy access:

- By 2017, all rural public institutions will have access to modern energy services.
- By 2030, almost 100 % of rural households will have access to modern energy services with at least 50 % of rural households will have access to reliable services from electricity by 2020 and almost 100 % by 2030 either from off grid or non grid.
- Energy services from non sustainable biomass, particularly for cooking and space heating will be decreasing dramatically during the next couple of decades (at least 30 % by 2020 and 60 % by 2030). The increase of energy efficiency will be achieved by a combination of efficient technologies (such as improved cooking stoves) fuel switching and behavioural change.

Energy efficiency:

- By 2015, efficient lighting (at least 5 times more efficient than incandescent lamps) will be used by 50 % of the households, 80 % by 2018 and almost 100 % by 2030.
- For high energy consumer sectors (mining, power sector, agriculture) efficient energy technologies will be progressively introduced as well as other demand side management measures such as peak load management when possible. Compared with the current level, energy efficiency will increase by at least 20 % by 2020 and 50% by 2030.
- By 2017, energy audits will be compulsory for all high energy consumer sectors, public and para-statal buildings.

Renewable energy

- By 2020, sustainable management practices for biomass will be generalised.
- As a result, by2030, all biomass energy will be derived from sustainable resources.
- By 2020, there will be an increase of 100 % of electricity capacity from renewable energy (mainly hydro, solar and wind) compared with the 2012 capacity. This target will be achieved by a combination of off grid mainly for rural areas and on grid options
- Solar water heaters (SWH) will be progressively introduced for households and institutions with a target of 40 % and 60 % respectively of urban households and institutions (hotels, social facilities etc.) equipped with SWH by 2020. By 2030, at least 60 %of households and 80 % of institutions will be equipped with SWH.
- By 2020, apart from hydro, wind farms and solar technologies (on grid such as concentrated solar power) will be deployed with a combined capacity of at least 100 MW. This capacity will reach 250 MW by 2030.

Section 3: Challenges and opportunities for achieving SE4ALL goals

3.1 INSTITUTIONAL AND POLICY FRAMEWORK

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16. Energy and development:

- Energy policy and planning is guided by the 1998 **Energy White Paper**. It is aimed at achieving security of supply, social upliftment, effective governance, investment and growth, economic efficiency and sustainability. Although this comprehensive guidance document is still relevant, it is being updated by the Ministry of Energy of Mines.
- Within the guidance of the 1998 White Paper, energy has also been integrated into the development plans particularly Namibia's Development Plan (NDP) and the **Vision 2030. The NDP, seeks to meet development challenges through improved access to renewable energy sources particularly in rural electrification, solar housing and water heating.**
- The Vision 2030 aims at the transformation of Namibia into an industrialized nation with a viable natural resources based export sector. This implies growth of the energy sector, particularly the electricity sector and ability to deliver reliable supply to businesses and households.
- The **5 year Energy Strategic Plan** 2012/13 to 2016/17 was formally launched by **Ministry of Energy and Mines** in June 2012. The key strategic themes include socio-economic development, sustainability, policy and regulations. Under the strategic theme socio-economic development, it is stated that Namibia's mineral energy and geological resources will contribute to the socio-economic development of the country. The strategic theme on sustainable utilization of minerals, energy and geo-environment is focused on the optimal utilization and their sustainability that will ensure the protection of human life and the environment. The policy and regulation theme is focused on improved and harmonized regulatory frameworks and policies thereby creating a conducive environment that will ensure that the energy sector prospers.
- Energy is also considered as key sector in the **macro economic framework**[14]. As a result strategic interventions in these sectors will spur economic growth and employment need to be implemented in different sectors (macro economic framework,). As far as poverty reduction and energy are concerned, at *macro level,* the zero rating of the VAT system has helped increase access of poor people to electricity although the improvement remains modest for the poor. According to the 2010 report on Poverty and Social Impact Analysis (PSIA), the rich households having benefited most while the VAT zero rating was unable to accurately target poor households.

- With regard to institutions, the Ministry of Mines and Energy is responsible for ensuring adequate and affordable energy supply taking advantage of Namibia's natural resources in support of the socio economic development of the country. The Ministry of Trade and Industry (MTI) is aimed at ensuring a continually responsive investor friendly climate. The MTI introduced a number of incentives for manufacturers and exporters such the provision of 50 % tax abatement for the manufacturing industry. These incentives could increase the attractiveness of RE for Namibian private investors.

[14] Ministry of Finance, macro economic framework for the 2011/12 – 2013/14 medium term expenditure framework, March 2011.

At the level of research institutions, the Renewable Energy & Energy Efficiency Insitute (REEEI) of the Polytechnic of Namibia is dedicated to serve as a national information resource base for RE, sustainable energy use and management.

17. Thermal energy for households:

With regard to households it is important to distinguish between urban and rural households. In the White Paper, it is specified that "government will initiate national studies on urban energy-use patterns, and possible mechanisms to improve energy services". The Ministry will also work closely with energy suppliers and financial institutions exploring mechanisms to improve household access to appliances and to energy sources other than electricity and wood.
With respect to thermal application the dissemination on a large scale of solar water heaters will have a positive impact on electricity demand but will also contribute to limiting greenhouse gas emissions as well as creating jobs if a solar industry is developed in the country. The NAMREP implementation shows a positive trend regarding the uptake of SWH.

It is **recommended** that domestic, commercial and institutional electric water heaters be selectively exchanged for solar water heaters. As installing solar water heaters is cost-effective for consumers, such an exchange programme is to be consumer financed. To enhance its effectiveness, this process is to be actively supported by an education and awareness campaign.
Hybrid systems may also contribute to increasing the rate of rural electrification. NamPower continues to provide technical advice to a PV/Diese hybrid mini-grid installation in Tsumkwe. Such projects should be seen as interim solutions to accelerate rural electrification. Once demand is recorded and grid connection is commercially viable, the hybrid system can be relocated to another remote location (NamPower annual report 2011).

Nevertheless, the major challenge remains access to ***modern energy services for rural areas***. With respect to off grid and rural electrification, the rural electricity distribution Master Plan and the off-grid energization master plan are the key guiding documents. With respect to financial mechanisms, the solar revolving fund (subsidized loans for renewable energy technologies) could be a sound channel if sufficient funds are provided and there is a good rate of loans recovery. Other sources of funding are the budget allocated by the Central Government to rural electrification, the Nampower Performance Agreement (NP) implemented by NamPower in coordination with the Ministry of Mines and Energy and external sources of funding mainly the European Investment Bank and SIDA .

18. Power sector:

The key challenge for the power sector remains to meet the increasing electricity demand with limited installed capacity in the country coupled with difficulties in the power sector in importing countries mainly South Africa. As a result, the cost of electricity increased by 32.% from N$765 million (representing 42.39% of revenue) to N$1 billion (representing 43.73% of revenue) during the financial year ended June 2011. The regulator (Electricity Control Board:ECB) granted NamPower a tariff increase of an average of 18% for the financial year 2010/11 (source NamPower, Annual report).

The current strategy from NamPower is to increase the supply from fossil fuels (coal, petroleum products and gas) and renewable (hydro and wind). NamPower is currently negotiating *Power Purchase Agreements* (PPA) with two prospective wind energy developers, one in the Lüderitz and one in the Walvis Bay area. **Distribution** is devoted the Regional Electricity Distributors (REDs) tasked with supplying electricity in a specific region. The MME recommended to divide Namibia in 5 areas and to establish a single electricity distributor for each area. REDs are established through private companies with all initial shareholding by Government owned or public entities.

With respect to regulation, there is a regulator through the **Electricity Control Board (ECB**) with a mandate to exercise control over the electricity supply industry with the main responsibility of regulating electricity generation, transmission, distribution, supply, import and export through setting tariffs and issuance of licenses. In November 2007, the Government of Namibia passed the Electricity Act 2007, which permits and encourages private sector investment in the country's power sector. The Electricity Control Board (ECB), the regulator in Namibia has been given the responsibility under the Act to implement the Independent Power Producer (IPP) regime in Namibia in accordance with the provisions of the Act and its own regulatory procedures approved by the ECB Board. ECB has developed a detailed procedure for the documentation and evaluation of the IPP applications. As a result a number of applications has been received for licenses for generation of power.

19. Modern energy for productive sectors:

NamPower is currently the only supplier of ***electricity*** from national sources and from imports. Apart from new capacity from increasing supply from national resources, NamPower has been strengthening its links through supply power agreement with trading foreign partners in South Africa (Eskom) , Zimbabwe (ZEDTC) and Zambia(ZESCO). NamPower receives a supply of 150MW from ZETDC. The NamPower-ZESCO Power supply agreement came into effect on January 2010. NamPower is also receiving 50MW through the recently completed Caprivi Link Interconnector.

With regard to ***petroleum products***, Namibia has no refinery capacity and therefore imports all its refined products from South Africa through the Walvis Bay harbour and rails in lubricants as well from South African refineries. Imports are monitored by the Ministry of Mines and Energy while the Ministry of Trade and Industry issues the necessary import permits. A process towards de-regulation of the downstream petroleum sector has already started with, the amendment of the Petroleum Products and Energy Act, the drafting of the downstream petroleum regulations .

The National Oil Company, NAMCOR, controls the exploration activities for oil and gas upstream by way of a bidding process while the international oil companies do the actual exploration. The Namibian government through the Ministry of Mines and Energy facilitates a privately run downstream oil business. At the moment there are five oil companies involved in the marketing of petroleum products in Namibia.

20. National monitoring framework for SE4ALL:

INDICATORS		
Energy access	**Energy efficiency**	**Renewable energy**
• National electrification rate (%) • Rural electrification rate (%) • National electricity consumption kWh/y/capita • Rural electricity consumption kWh/y/capita • % of households equipped with modern energy for cooking in rural areas	• TPES/GDP • TPES/GDP (PPP) • Losses in the power sector (transmission and distribution) • Efficiency of power sector (fuel consumption in toe per MWh) : breakdown per technology • Energy efficiency per sector (industry, mining, transport)	• **Capacity installed for electricity** • Hydro, solar, wind, other • **Number of PV** systems disseminated for HH, institutions, businesses etc • Number of SWH installed for households

For most of these indicators and particularly for energy access and energy efficiency, there are gaps regarding the information to measure the achievements. For the renewable energy sector, data is available and collected on a regular basis for the on grid renewable energy which is large hydro. There is therefore a need for the development of a database for the three areas. This task should involve the key players (NamPower, Renewable Energy and Energy Efficiency institute etc) but the coordination could be devoted to the MME.

3.2 PROGRAMS AND FINANCING

21. Thermal energy:

With respect to thermal energy, the main programs are under the Namibian Renewable Energy Programme (NAMREP) started in 2004 and was implemented in 2 phases with a focus on solar water heater and solar cookers. The assessment of the NAMREP shows that the most promising results were obtained from solar water heaters with almost 7,000 units installed till end 2010. The number of solar cookers installed remains rather marginal. The whole programme was funded f by the Global Environmental Facility (GEF) with USD 2.6 million for each phase.

Energy efficiency remains an area which is still under exploited. A study carried by ECB[15] has identified and estimated the costs for 6 demand side management options summarized in the following table

[15] ECB, Demand side management study for Namibia, , implementation plans for six DSM, options report 2 november 2006

	Estimated cost $N	Estimated MW saved	Estimated GWh saved	Estimated N$ saved	Initiated by and possible funding
Consumer awareness	**700 000**	**n.a**	**n.a**	**n.a**	**Utilities**
Tariffs	**4 500 000**	**n.a**	**n.a**	**n.a**	**NamPower**
CFL dissemination	**13 000 000**	**19.91**	**22**	**652 804**	**NamPower**
SWH dissemination	**88 000 000**	**52**	**115**	**1 692 308**	**MME/donors**
Ripple control expansion	**45 000 000**	**26.70**	**-**	**1 685 573**	**REDs**
Energy audits	**6 750 000**	**16**	**58**	**n/a**	**Beneficiaries**

22. Power sector:

In order to improve access, particularly from on grid, NamPower has focused its policy on increasing the supply from fossil fuels (22.5 MW additional capacity in 2010 based on heavy fuel oil) and renewable energy as well securing imports from trading partners in South Africa, Zambia and Zimbabwe. With respect to RES, a fourth turbine at Ruacana hydro power plant is being completed and will add 92 MW to the current 293 MW hydro already installed at the same site. Additonal RES from hydro are being considered. The environmental and hydrology studies of Phase 1 for the development of small scale hydro power plants along the lower Orange River is nearing completion. The lower Orange River holds the potential for an additional generation of up to 120MW. Grant funding was obtained from Developmental Financial Institutions (DFI) Power Purchase Agreements are being negotiated with potential partners for wind development (NamPower annual report 2011).

Off-Grid Energisation Master Plan (OGEMP) is an important plan spanning a 20 year period with a cumulative funding of N$ 136.7 millions over the period[16]. With respect to financing rural electrification, according to OGEMP lack of access to credit prevents lower-income households and small firms to invest in RE and also prevents investors from financing low return RE investment projects. Access to credit is therefore an important component of the OGEMP

23. Modern energy for productive use:

When energy is available, which is the case in urban areas and for the more dynamic sectors of the country (mining, agriculture, energy sector) the key challenge is the efficient use of energy and the penetration of renewable energy into the energy mix. Although no in-depth studies were carried out on the overall efficiency of the productive sectors, empirical evidence suggest that significant improvement could be made to reach better energy efficiency and ultimately a better use of the energy without compromising the cost performance of the productive sectors. On the contrary, their competitiveness might increase as energy efficiency investments very often have a short payback period and therefore a very good return on investment.

The Renewable Energy and Energy Efficiency Institute is an institution which is an a position to provide guidance regarding the audits and implementation of energy efficiency programmes aimed at the productive sectors

3.3 PRIVATE INVESTMENT AND ENABLING BUSINESS ENVIRONMENT

[16] OFF-GRID Energisation Master Plan for Namibia, Final report, January 2007

24. Thermal energy for households:

Financial, technological and attractive regulatory framework are key barriers to the deployment on a large scale of renewable Energy Technologies (RETs) and energy efficiency programmes. However there are channels within the private sector which can facilitate the involvement of local businesses. The Namibia Manufacturers Association (NMA) has developed a strategic plan to help building a sustainable, and competitive manufacturing industry for its stakeholders. NMA has been representing 61 manufacturers, and offering them and others, services to help improving their businesses and opportunities for renewable and energy efficiency projects at a relatively large scale.

For off-grid energy solutions the private sector operating in the RETs business in Namibia has extended the industry not only technically but also with a wide range of product and sizes. The private sector has also enabled the insertion of new players in the field. Unfortunately, lack of access to financing, the small size of many enterprises are deterrent factors (NAMREP report end phase II).

25. Power sector

There are a number of critical gaps and barriers mainly financial, industrial (manufacturing capabilities) institutional and technical which limit the deployment of off grid and on grid power generation. The key gaps and barriers are as follows:

- Although costs are decreasing, RET are still expensive. However, if externalities (environmental costs) are accounted for, some RET might be cost effective
- Because of the low density of rural areas, rural electrification projects are expensive and the capital cost per capita is high and the purchasing power of rural communities low.
- The lack of adequately qualified electrical contracting companies locally presents a major problem
- Lack of PV installers for certain regions in the country [17]

26. Modern energy for productive sectors:

Financing remains a key barrier to a wider deployment of renewable energy on a large scale particularly from wind and solar. Financial mechanisms such as feed in tariffs and purchase power agreement (PPA) may contribute to overcome these barriers. This implies a regulatory framework with guaranteed long term incentives for private investors. NamPower is currently negotiating PPA for the development of wind power by private investors.

3.4 GAPS AND BARRIERS

27. Thermal energy for households:

Prohibitive taxes and tariffs, inadequate regulatory standards, poor coordination between grid and off-grid electrification and the overall acceptance of RE & EE strategies into national electrification strategies should be addressed further[18]. With the current trend and institutional set up, the penetration of thermal energy from RES (mainly SWH) may remain low despite some achievements under the NAMREP.

[17] Development Dialogue Forum, theme sustainable energy for all, Rural Electrification (Grid & Off-Grid) – Status and experiences in improving modern energy access in rural areas in Namibia communication by Joseph S. Iita, Permanent Secretary Ministry of Mines and Energy, 14 May 2012

[18] NAMREP

28. Power sector:

With respect to off grid, RE electrification initiatives, usually under the overall goal of "poverty alleviation" and/or providing low income households with "access" to electricity, have not yet reached a convincing impact. The non-cost-reflective tariffs and inadequate revenue collection are one of the biggest challenge which was experienced by the large hybrid solar power plant implemented in Tsumkwe.

NamPower remains the only producer and supplier of electricity which is a limit to the development of additional capacity, particularly from RES.
The lack of national renewable energy targets and/or other measures to incentivize the introduction of carbon-neutral generation capacity is a major constraint to the deployment of RES
Although there is a regulator (ECB), The Government of Namibia needs to adopt a formal power market model, as the market participants and IPP developers must understand the Government's policy with respect to the market model in order for them to submit proposals consistent with the market rules. In addition, as Namibia is a trader in the Southern African Power Pool, an established market model will be help strengthen Namibia's role as a power trading partner in the region[19].

29. Modern energy for productive sectors:

Modern energy from electricity has been extensively addressed under section 30 power sector. The main challenge regarding electricity is to ensure that rural electrification is not limited to providing only basic services for households. Most rural electrification programmes including in Namibia because of the high costs involved are targeting only marginally productive end uses although reaching households is considered as a major achievement.
With respect to oil gas, it is important to split between upstream and downstream activities. With respect to *upstream* activities, the Ministry of Mines and Energy's White Paper on Energy Policy states that security of energy supply and attracting investment and growth are primary goals in the policy framework. The key focus is on creating a policy and legislative framework, which attracts initial investment into the sector, while maintaining options for competition in the future and the fair distribution of economic rents. The National Petroleum Corporation of Namibia's (NAMCOR's) main tasks up to 1998 have been the acquisition of data and the promotion of Namibia's petroleum potential. Confirmed reserves in the Kudu gas field have led to the license holders to commission a feasibility study for a gas-fired power station onshore Namibia and to pursue discussions on large-scale gas exports to South Africa (source Ministry of energy,
Downstream The Namibian government through the Ministry of Mines and Energy facilitates a privately run downstream oil business. At the moment there are five oil companies involved in the marketing of petroleum products in Namibia: BP Namibia, Caltex Oil (Namibia),, Engen Namibia, Shell Namibia and Total Namibia.

[19] Electricity Control Board, Namibia IPP and Investment Framework Technical Assistance Technical Assistance – Final Report For the Electricity Control Board, Windhoek, Namibia, March 2009.

Summary: key gaps, barriers and additional requirements

- The key challenge for the power sector remains to meet the increasing electricity demand with limited installed capacity in the country coupled with difficulties in the power sector in importing countries mainly South Africa. As a result, the cost of electricity increased.
- Despite the electricity act of 2007 which encourages private sector investment, the lack of a formal power market model, is a major constraint for the market participants and IPP developers who need to understand the Government's policy with respect to the market model in order for them to submit proposals consistent with the market rules.
- Local investors (manufacturers, mines, development banks) often lack the technical and financial resources and expertise to develop and adopt renewable energy technologies.
- Local financiers and developers often cannot design and or implement appropriate financing packages adapted to RET.
- High taxes and tariffs, inadequate regulatory standards, poor coordination between grid and off-grid electrification and the overall acceptance of RE and energy efficiency strategies into national electrification strategies should be addressed.
- The non-cost-reflective tariffs and inadequate revenue collection might be a big challenge in the context of rural electrification.
- Namibia's technology and engineering skills base is small and generally underdeveloped. For most large-scale technology projects the country remains highly dependent on foreign expertise.
- The lack of national renewable energy targets and/or other measures to incentivize the introduction of carbon-neutral generation capacity is a major constraint to the deployment of renewable energy sources.

Annex 1 –Matrix of existing programs and required financing for achievement of SE4ALL goals

1.1 On-going initiatives by the Government and development partners

Title	Lead Agency	Possible Financier	SE4ALL Goals	Brief description and time frame	Esitmated cost, N$
CFL dissemination	NamPower,	NamPower/donors	Energy efficiency	Dissemination of efficient lighting (less than 5 years)	13 000 000
SWH dissemination	NamPower	MME/donors	Energy efficiency	Substitution of electric heaters with SWH for households and institutions (less than 5 years)	88 000 000
Tariffs	NamPower	NamPower	Energy efficiency	Time of use incentives and electricity tariffs (less than 5 years)	4 500 000
Ripple control expansion	REDs	REDs	Energy efficiency	Remote switching off or on using ripple relays off of electric heaters. (less than 5 years)	45 000 000
Energy audits	MME	Beneficiaries (eg industries)	Energy efficiency	Energy audits in the commercial and industrial sector. (less than 5 years)	6 750 000
Consumer awareness	Utilities		Energy efficiency	Sensitization of consumers to energy efficiency. (less than 5 years)	700 000
Small hydro	Possibly NamPower	Possibly NamPower and other donors	Renewable energy energy access	10 MW of small hydro in 2 sites in the South and 1 in the North (probably more than 5 years)	US$ 20 to 30 millions
Solar PV for net metering	Possibly ECB	Beneficiaries	Renewable energy Energy access	2 MW	Approximately US$ 7 millions
Wind farms	NamPower and IPP	IPPs and donors	Renewable energy	2 wind farms under consideration	At least US$ 100 million for a 50 MW wind farm
Electricity from biomass	NamPower	Donors	Renewable energy	Biomass from invader bushes for electricity generation. Capacity 10 to 30 MW (more than 5 years)	Investment for 20 MWe mechanized production around 5.4 million euros[20]
Concentrated solar power (CSP)	investigation led by MME with support from GEF and UNDP	Donors	Renewable energy	A 5 MW demonstration unit	At least US$ 25 million when capacity building is included,
Off grid Energisation Master Plan	MME	Government of Namibia and donors	Energy access Renewable energy	Provide appropriate energy technologies to off grid people and institutions	Average funding: N$ 6.8 millions Total over 20 years: N$ 136.7 millions

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