HELIO INTERNATIONAL

BOTSWANA

Sustainable Energy Watch
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Energy and Sustainable Development in Botswana

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Botswana's state of energy for sustainable development is within the 1990 global average for the eight indicators, except for localised SO_2 emissions, but significantly above the Sustainable Energy Watch (SEW) sustainability objectives.

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Summary

Botswana's per capita carbon emissions of 650.7 kg is less than the 1990 global average of 1,130 kg C/cap but almost double the sustainable objective of 339 kg C/cap. Therefore the calculated vector value of 0.39 is above the sustainability figure of 0, hence more needs to be done if this target is to be achieved. Between 1990 and 2000 the vector value increased by 86%, which means that the country is moving away from the sustainability objective.

The annual mean concentration of SO_2 in Selibe Phikwe (at the secondary school) was found to be way beyond both the WHO and Government guidelines of 60 and 80 ug/m^3 respectively. Between 1990 and 2000 there was a very small decrease (2%) in annual mean SO_2 concentration. As a result the vector value for 2000 is more than 1 (i.e. 1.79).

Between 1993 and 2001 there has been a significant increase (167%) in access to electricity although the current national level of 24% is still far below the ideal level of 100% access by households.

Investment in clean energy is low at 1.6% of the total investment in energy although between 1990 and 2000 there was an increase of 60%. The current level of investment in clean energy is way off the sustainability objective of 95%. Consequently the vector value of 0.99 is far from the sustainable value of 0.

Botswana is heavily dependent on energy imports, which makes her vulnerable to supply interruptions and price fluctuations. All petroleum products requirements are met through imports and more than 50% of electricity supply is imported. This is reflected in the vector value of 0.55, which is significantly higher than the sustainability value of 0.

Government investment in non-renewable energy as a percentage of GDP is low which means that the government is spending less on energy. This is the only indicator which is reasonably close to the sustainable value. However this does not mean that government is spending more on renewable energy or energy efficiency and it might be that the government is under-investing in the energy sector. The low access to electricity, particularly in rural areas, is reflective of the low investment in energy. Therefore this indicator must also be viewed together with the level of investment in energy efficiency and renewable energy, which happens to be low.

Energy consumption per GDP provides a useful measure of a nation's progress in terms of obtaining more economic activity per unit of energy consumed. This is often achieved through energy efficiency. In the case of Botswana, whether using conventional GDP or GDP in PPP the vector value of 1.35 or 0.55 is above the sustainability objective value.

Renewable energy share of total primary energy supply is 30% which is above the 1994 global average of 8.64% but less than the desired objective of 95%. As a result the vector value is 0.75, way above the sustainability objective of 0.

Summary of the eight indicators is provided next page.

Summary of indicators

	Eight Indicators of Energy Sustainability for Botswana					
	1990		**2000**		**% change**	
	Metric	**Vector**	**Metric**	**Vector**	**Metric**	**Vector**
1.Carbon emissions	506.21	0.21	650.7	0.39	29	86
2.SO_2 concentration	100	1.83	98	1.79	-2	-2
3.Households electrification	9%*	0.91*	24%	0.76	167	-14
4.Clean energy investment	0.010		0.016	0.99	60	
5.Resilience: Energy Trade	0.45	0.45	0.56	0.56	24	24
6.Government Investment			0.0012	0.012		
7.Energy Intensity			14.04(6.31)	1.35(0.55)		
8.Renewable energy			0.3	0.75		

( ) Calculations based on GDP(PPP)
*Data for 1993.

Introduction

This is the first Sustainable Energy Watch (SEW) Report for Botswana and was compiled by Buti Mogotsi of the Ministry of Minerals, Energy and Water Affairs (contact address: bomogotsi@gov.bw). Although the intention was to compare the 1990 indicators with current ones (2000), in some instances this was not possible because data needed to calculate the 1990 indicators are not readily available.

The reporter would like to acknowledge the assistance of Mrs. M. Kealotswe who was of assistance in compiling the report and Dr. P. Zhou for the support and advice during the preparation of the report.

General Discussion of Botswana

The Republic of Botswana is situated in Southern Africa, with a land area of 582 000 square kilometers. It is situated between the Republic of South Africa, Namibia, Zimbabwe and Zambia. The country's population was estimated at 1.611 million in 1999, with a growth rate of 2.8% and more than 50% of the population living in rural areas (MFDP 2000). Although the national population density is 2.8 persons per km^2, the population is concentrated in the southeastern part of the country where 80% of the population resides, creating a density of about 10 persons per km^2.

Table 1: Population Indicators

Indicator	Year		
	1981	1991	1999
Population Size (000)	94.1	1,327	1,611
Population Density	1.6	2.3	2.8
% Urban	18.2	45.7	49.2
Population growth rate %	4.7	3.5	2.3

Source: MFDP 2000.

The discovery of large deposits of diamonds in the 1960s has enabled Botswana to achieve a remarkable economic and social transformation since Independence in 1966. GDP growth has averaged 6% per annum in real terms over the post-Independence period and per capita GDP has grown six fold. By 2000 GDP per capita had reached US$ 3,300 (World Bank 2001).

Revenue earned from the mineral sector has enabled the government to undertake major developments in terms of infrastructure and social services. Botswana is classified as upper middle-income country although some of her development indicators do not compare favourably with the average for the class, in particular those related to health (Table 2.b).

The 1999 UNAIDS Report indicates that over 30% of Botswana's population had HIV infection. This has negative impact on progress made so far in the health sector and overall economy. Government projections indicate that due to the impact of HIV and AIDS in 2021, the economy, measured in terms of GDP, would be 24-30% less than what it would be without HIV and AIDS.

Table 2: Development indicators

Indicator	Botswana	Sub-Saharan Africa	Upper middle income countries
Life expectancy at birth (years)	39	47	69
Infant mortality rate (per 1,000 live births)	58	92	28
Child nutrition (% of children under 5)	17	-	-
Access to improved water source (% population)	70	55	87
Illiteracy (% of population age 15+)	25	38	10
Gross primary enrolment (% school-age population)	108	78	107
GDP/capita (PPP)	7,190	1,560	9,170

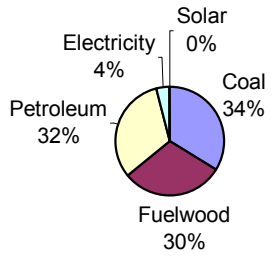
Source: World Bank, 2001 (www.worldbank.org/data), World Development Indicators Database, World Bank (2001).

At Independence in 1966, agriculture was the predominant sector of the economy contributing 40% to the GDP. The overwhelming rural population depended on agriculture for a livelihood and beef production was the mainstay of the economy in terms of output and export earnings (MFDP, 1997). However over the years the GDP share has declined reaching 2.5% in 2000 mainly due to the rapid development of the mining sector and slow growth of the agricultural sector (MFDP, 2002). Despite the decline of the sector it is still an important source of food, income and employment for the majority of people living in rural areas.

Botswana's climate is marginally suited for crop production except in areas where irrigation is possible. About 25% of the total land area is classified as state land mainly comprises of national parks, game reserves, wildlife management areas and forest reserves. Communal or tribal land and freehold farms form 70% and 5% of the total area respectively. Productivity in the arable sub-sector is very low, particularly in communal areas, and this is further worsened by poor rainfall.

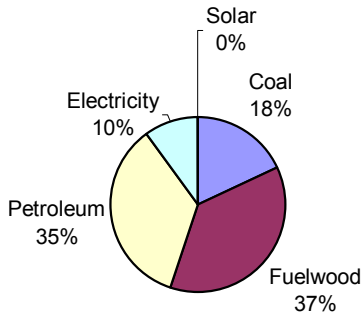
Coal, petroleum products and biomass dominate Botswana's primary energy supply. In 2000 coal accounted for 34% of the primary energy supply followed by petroleum product and fuelwood at 32% and 30% respectively (EAD 2000). Most of the coal is used for power generation.

Fig. 1: Primary Energy Supply - 2000



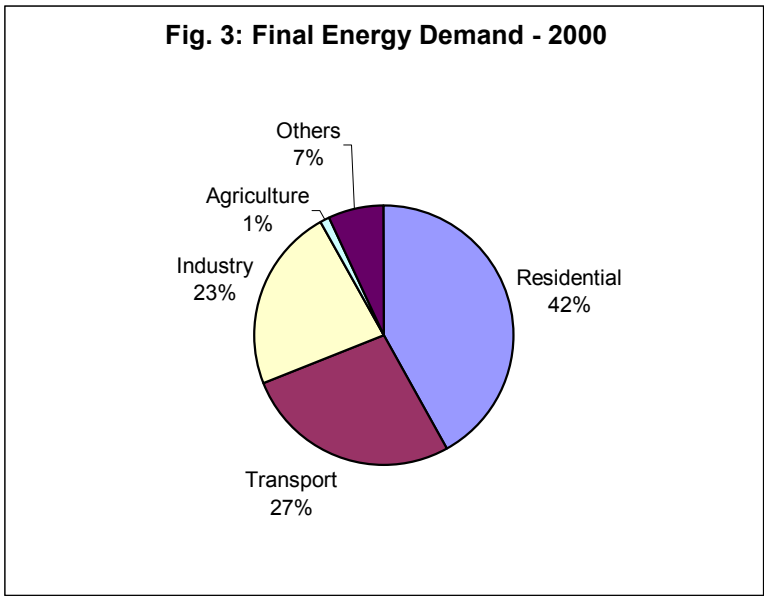
Source: Energy Affairs Division 2000

Fig. 2: Net Energy Supply - 2000



Source: Energy Affairs Division 2000

The major energy consumers are the residential (mainly fuelwood), transport, and industry at 42, 27 and 23% respectively.



Source: Energy Affairs Division 2000.

The main sources of emissions from the energy sector are power generation from coal, transport and industry.

The major environmental issues identified under the National Conservation Strategy are:

- Growing pressure on water resources
- Degradation of rangeland pastures resources
- Depletion of wood resources
- Over exploitation of some veld products
- Pollution of air, water, soil and vegetation resources (National Conservation Strategy Agency 1990)

The Eight Indicators

►Indicator 1: Per capita energy sector carbon emissions

According to the Initial National Communication to the United Nations Framework Convention on Climate Change Botswana is a net sink for $C0_2$ emissions as emissions resulting from burning of fossil fuels in 1994 were relatively small and balanced by large uptake of carbon by trees (Ministry of Works, Transport and Communication, 2001).

Table 3: Summary of $C0_2$ emissions and removals in 1994 (Gg/year)

GHG sources and sinks	CO_2	CH_4	NO_2
Energy	3,028	25	1
Industrial Processes			0.7
Agriculture			5
Land use charge and forestry	-38 734		
Waste		8	
Total (net national emission/removal)	-35734		7

Source: MWTC 2001.

Relative to the African continent, Botswana's GHGs emissions from energy use is equivalent to only 7% of the continent's total GHGs (MWTC 2001). Therefore the country is a minor contributor to the problem of global warming and climate change, though it will be significantly impacted by climate change.

Botswana's per capita energy sector $C0_2$ emissions are less than the global average of 0.87 kg/capita (Table 3b). The relatively low energy intensity is largely due to low level of industrial development. Most of the energy is consumed in the residential sector (42%).

Table 4: Comparative per capita $C0_2$ emissions

COUNTRY/REGION	CO_2 per capita (tonnes/cap)	$C0_2$/GDP (kg/1990 US$)
Botswana	1.86	0.6
South Africa	8.54	2.82
Africa	0.96	1.31
World	3.86	0.87

Sources: World Resources Institute 2000- 2001, EAD 2000, Spalding-Fecher 2001

The 1990 global average of carbon emissions from fossil fuels was 1,130 kg C/capita which has been assigned the value 1. To define a sustainable level, SEW selected a sustainability objective of a 70% reduction relative to 1990 emissions. This translates into 339 kg C/ capita or 3/10 of the world average in 1990. This level has been assigned a value of 0.

In 1990, Botswana's $C0_2$ emissions stood at 2 415 000 tonnes (World Resources, 2000-2001). With a population of 1 300 999 (CSO, 2001) this translates into 1 856.27 kg CO_2/capita or 506.21 kg C/capita. By 2000, CO_2 emissions from fossil fuels were about 3 940 138 tonnes or 650.69 kg C/capita (EAD 2000 & MWTC 2001). The estimates are based on fossil fuel consumption. The emission levels are comparable to the 1994 levels of 3 038 000 tonnes of CO_2 reported in the Initial National Communication.

Metric (actual data) for 1990: 506.21 kg C/capita and for 2000: 650.69 kg C/capita

Vector value for 1990 is 0.21 and for 2000 is 0.39

Discussion

The most recent official data on GHG emissions were compiled under the National Communication to the Framework on Climate Change and pertains to 1994. In the absence of recent official data, international organisations such as the World Bank, UNDP and World Resources Institute have been used as source of data. Existing data on consumption of fossil fuels was also used to estimate $C0_2$ emission levels.

For the 1990 vector calculation, data was obtained from the World Resource Report (2000-2001) whereas for the current year (2000), the emission levels were estimated based on the national energy consumption data and emission coefficient that were used for the national communication for 1994. Due to time constraint, it was possible to reconcile the method used in the World Resource Report with that was used for estimating the 2000 emissions. However the CO_2 emissions levels for the two years were compared with the one reported during the 1994 National Communication to see if they are reasonable or consistent. It should be noted that the only available official statistics on CO_2 emissions for 1994 are reported in the National Communications.

Based on the calculations, the vector values have increased by 86% from 1990 to 2000, largely because of the annual increase in energy consumption. This trend is likely to continue as currently the government is seriously considering expanding the current power generation capacity from coal. This means that the consumption of coal will increase together with the associated emissions. The government is also promoting the use of coal as a substitute for fuelwood in the residential sector and small industries. However the latter is not likely have much impact in terms of emissions although the trend should be monitored.

Notes to SEW for next year's Observer- Reporter

The only official statistics available from the National Communication is for 1994 and there is no indication as to when it will be updated. Hence the other option is to estimate CO_2 based on the energy statistics. The energy statistics is available from the Energy Affairs Division Office. For the next year, the Observer should in consultation with HELIO International establish the best or mutually acceptable method to estimate CO_2 emissions from yearly energy balances.

References:

The following provided useful reference material:

i. CSO (Central Statistics Office) 2001. Statistical Bulletin. Government Printer. Gaborone.
ii. MWTC (Ministry of Works, Transport and Communication) 2001. Initial National Communications to the UN Framework on Climate Change. Printing and Publishing Company. Gaborone.
iii. World Resources Institute 2000-2001, Emissions from Fossil Fuel Burning and Cement Manufacturing. www.wri.org.
iv. R. Spalding-Fecher 2002.Sustainable Energy Watch Report for South Africa. www.helio-international.org

►Indicator 2: Most Significant Energy - Related Local Pollutant

The Atmospheric Pollution Act prescribes the maximum permissible emissions levels that each industrial process may release into the atmosphere. Under this provision the Department of Mines has set emissions levels and monitors levels for CO, NO_2, O_3 and SO_2.

Botswana does not have many industries and according to the 2000 Air Pollution Control Annual Report (DOM 2000) the major sources of air pollution are:

- BCL copper nickel smelter in Selibe Phikwe
- Botswana Power Corporation power station at Morupule
- Soda ash plant at Sua–Pan

Monitoring of major sources of air pollution in 2000 showed that industrial processes emissions were within acceptable levels except for the copper nickel smelter in Selibe Phikwe. Measurements recorded at Selibe Phikwe Secondary Schools showed mean concentrations of SO_2 of 98 ug/m3 compared to the recommended government guideline of 80 ug/m3.

Table 5: SO_2 concentration levels measured at different sites in 2000.

	Selibe Phikwe	Madinare	Tonota	Palapye	Francistown
$SO_2(ug/m^3)$	**98**	26	1	16	9

Source: DOM 2000.

However it is evident from Table 3c that in general SO_2 emissions in the country are within acceptable level.

The high SO_2 levels have the potential to negatively impact on the health of the students (e.g. respiratory problems) and for this reason the SO_2 concentration in the school premises have been used as a key indicator. The smelter uses coal.

For this indicator, the value for 1 on the vector is the World Health Organisation guidelines (60ug/m3) and value for 0 on the vector is 20% of the WHO guidelines or 12 ug/m3.

According to the Air Pollution Annual Reports (1991 and 2001) mean $S0_2$ concentration at the school were 100 and 98 ug/m^3 for 1990 and 2000 respectively.

Metric (actual data) for 1990: 100 g/m3 and 2000: 98 ug/m3

Vector value for 1990 is 1.83 and for 2000 is 1.79

From the vector calculations it can be concluded that the SO_2 concentration level at the school in Selibe Phikwe is unsustainably high and between 1990 and 2000 the levels have remained more less constant.

Discussion

The Air Pollution Control Division of the Department of Mines has fairly detailed information of average annual SO_2 concentration for many years in Selibe Phikwe. However data recorded by the mine and the Department of Mines is not the same for the same sites. For this report, data from the Department of Mines have been used as they are considered to be official. However this discrepancy needs to be investigated.

Since the 1990 and 2000 SO_2 concentrations in Selibe Phikwe are way above the WHO guidelines, the vector values are high indicating low sustainability. The vector values

have remained fairly constant over the past decade i.e. very little change has occurred (2%).

According to the Air Pollution Report (2000), the problem of high SO_2 concentrations in Selibe Phikwe is being addressed by putting hoods over converters and ducting fumes to the 153m chimneys. While this will not reduce the pollutants it will allow them to be discharged at high altitude with the possibility of dilution of concentrations to acceptable levels before reaching the ground.

References:

The following documents were used to calculate this indicator:

i. DoM (Department of Mines) 2000 &1990, Air Pollution Control Annual Report. Government Printer. Gaborone.

ii. Ricardo Cunha da Costa 2001. Generic Formula for calculation of energy sustainability indicators. HELIO International.

►Indicator 3: Households with access to electricity

Like most of the developing countries, Botswana has low access to electricity by households. In 2001, the rate of national access to electrification was 24% while for urban and rural areas access was 43% and 18% respectively (Energy Affairs Division, 2001). Over the years access to electricity has been increasing substantially due to government efforts to accelerate rural electrification although this is far from the ideal of 100% access to electricity.

Table 6: Access to electricity in Botswana

Year	Urban	Rural	National
1993	28	3	9
1999	37	8	16
2001	43	18	24

Source: Matshameko, T. 2002.

The value for 1 on the vector is 0% access to electricity while value for 0 is 100% access.

Metric (actual data) for 1993: 9% and 2001: 24%.

Vector value for 1993 is 0.91 and 2001 is 0.76

Discussion

As of the end of 2001, 186 out of a total of 395 villages were electrified. Since 1993 on average the government has been electrifying 14 villages per year. However during the period 1999-2001 government embarked on an accelerated rural electrification programme whereby 72 villages were connected to the grid. After 2002/2003, the government will revert back to electrification of 14 villages per year. To increase connections in electrified villages, government introduced a financing scheme for rural connections in 1990. Initially individuals wishing to connect to electricity paid 40% down-payment and the balance was paid over a period of 10 years. In 1995 the down-payment was reduced to 10%.

The large increase in access to electricity in rural areas from 8% in 1993 to 18% in 2001 can be attributed to the increase in the number of villages connected to the grid and to the existence of the financing mechanism for rural connections.. With the large investment in the 72 villages, government should ensure that these assets are utilised through marketing and making it easier and affordable for rural communities to connect eg. by an extension of the network in the villages.

Notes to SEW for next year's Observer Report.

Data from the government (Energy Affairs Division) should be checked against those of the utility, Botswana Power Corporation, to validate them. In the context of this study, access was used to mean the number of households who have actually connected electricity. In a lot of the rural villages very few households have connected electricity despite its availability.

Reference :

i. Matshameko, T. Energy Affairs Division. Personal Communication, March 2002.

►Indicator 4: Clean Energy Investment (a proxy for employment)

Research has shown that investment in clean energy creates more jobs and faster economic growth than comparable investment in conventional energy sources. Typically conventional energy technologies are capital intensive and are less labour intensive compared to clean energy technologies. Therefore, all other things being equal one would expect nations to invest more in energy efficiency and clean energy technologies.

In Botswana the only significant renewable energy resource is solar energy, there is no hydro potential and wind potential is very limited due to low wind-speeds (average 3 m/s).

The major players in the energy sector are the government, power utility, and oil companies. Data on investment in energy are not readily available except from the government and the utility.

Outside government there is very little, if any, investment in renewable energy and energy efficiency. Therefore data used is primarily based on government's and other related institutions. Most of government investment has been geared towards extending the national grid to rural areas. Some of the investment is renewable energy equipment. In 1990, total investment in energy by government and utility stood at US$ 1.25 million of which US$ 0.01 million was on renewable energy (MFDP 1991, BPC Annual Report 1990). There was no investment in energy efficiency. In 2000, total energy expenditure was US$ 21.8 million of which US$ 0.34 million was spent on renewable energy (MFDP, 2001, BPC Annual Report, 2000). There is still no investment in energy efficiency.

Metric (actual data) for 1990 = 0.010 and 2000 = 0.016.
Vector value for 2000 = 0.99.

Discussion
Attempts to get data from private sector were not successful. There is substantial investment by the oil companies particularly on the distribution network and this has not been captured.

The vector value for this indicator is far from the sustainability value. Inclusion of investment by the private sector would further decrease the level of sustainability as most of their investment is in "non-clean" energy sources.

Reference:
Data was obtained from government and the utility and the following are the reference material:

i. BPC (Botswana Power Corporation) Annual Report, 1990 & 2000. Gaborone.
ii. MFDP (Ministry of Finance and Development Planning) 1991 &2000. Project Review. Government Printer. Gaborone.

►Indicator 5: Resilience to External Imports: (Energy Trade)

Many countries are dependent on imports of energy and as a result are susceptible to price changes especially those of oil. Heavy dependence on energy imports also places burden on the economy. In Africa, oil importing countries typically expend 20-40% of export earnings on oil imports (Zhou, P. 1997).

Botswana is heavily independent on energy imports, all petroleum products requirement are met through imports, more than 50% of electricity is imported, mostly from South Africa. Therefore the country is vulnerable to distributions disruptions and changes in international prices of energy particularly petroleum. There are no exports of energy.

In 1990, non-renewable energy imports were 14,183 TJ whereas total non-renewable primary energy supply was 31,500 TJ (excluding biomass and renewable energy). In 2000 imports of non-renewable energy were 29,350 TJ (excludes 41 TJ for renewable energy based electricity) and total non-renewable primary energy supply was 52,143 TJ. Total primary energy supply was 74,885 TJ in 2000 (EAD 1990 & 2000).

There are imports of electricity from South Africa, Zambia and Zimbabwe. The bulk of the imports, which come from South Africa (98.6%) are assumed to be from non-renewable energy.

Table 7: Electricity imports in 1999 and 2000 (TJ)

Country	**1990**	**2000**	**Source**
South Africa		2,871	Non-renewable
Zambia and Zimbabwe		41	Renewable
Total		**2912**	

Source: EAD 2000, CSO 2001.

Imports from the other two countries are presumed to be renewable energy based.

Metric (actual data) for 1990 is 0.45 and for 2000 is 0.56.
Vector value for 1990 is 0.45 and for 2000 is 0.56.

Discussion

Since 1990, imports of non-renewable energy have increased by more than 100%. Substantial amounts of electricity are imported principally from South Africa, Zimbabwe and Zambia.

References:

i. EAD (Energy Affairs Division) 1990 & 2000. Energy Statistics. Government Printer. Gaborone.

ii. Zhou, P. 1997. Development of an Efficient Transport Sector in East and Southern Africa-Opportunities and Policy Implications under the UNFCC. Gaborone.

►Indicator 6: Burden of Energy Investment

This indicator assesses the level of government investment in non-renewable energy as a fraction of GDP. High level of investment in non-renewable energy as a proportion of GDP means that less resources are available to the nation for other productive uses and social services e.g. education, health etc.

Government investment on non-renewable energy in 2000 was P35.6 million or US$ 5.6 million. The GDP in 2000 was P28.88 billion or US$ 5.392billion (CSO 2001).

Metric (actual data) for 2000 = 0.0012.
Vector value for 2000 = 0.012

Discussion
Government investment is mainly for grid network expansion either to connect new villages to the grid or expand distribution network in electrified villages. Investment in non-renewable energy as a percentage of GDP is low which means that the government is spending less on energy. This is the only indicator which is reasonably close to sustainable value. However this does not mean that government is spending more on renewable energy or energy efficiency and it might be that the government is under-investing in the energy sector. The low access to electricity, particularly in rural areas, is reflective of the low investment in energy. Therefore this indicator must also be viewed together with the level of investment on energy efficiency and renewable energy.

Reference :

i. EAD (Energy Affairs Division) 1990&2000. Energy Statistics. Government Printer. Gaborone
ii. CSO (Central Statistics Office) 2001. Statistical Bulletin. Government Printer. Gaborone

►Indicator 7: Energy Intensity

This indicator provides a yardstick of the country's progress in terms of obtaining more economic output per unit of energy consumed. Reduction of energy input without compromising economic output will entail improving energy use. Besides direct economic loss due to inefficient energy use the following argument can be put forward in support of adopting energy efficient practices:

- Energy supply infrastructure is costly and inefficient use of energy will lead to investment in energy supply facilities in excess of what is actually required. This leads to sub-optimal allocation of scarce resources.

- Efficient energy use can assist in reducing environmental problems associated with burning of fuels to generate more energy.

- Excessive energy consumption increases costs of goods and services and this reduces the country's competitiveness in the global market.

In line with the guidelines for observer-reporter both the conventional GDP output at current prices and purchase power parity have been used to calculate the indicators. GDP was US$ 5.3 billion in 2000 (World Bank, 2001). From the same report GDP (PPP) was US$ 11.87 billion. Total primary energy supply was 74,885 TJ.

Metric (actual data) for 2000 = 14.04 MJ/US$ of GDP or 6.31 MJ/US$ of GDP (PPP).
Vector value for 2000 = 1.35 or 0.55

Discussion
Botswana's current energy intensity of 6.31 MJ/US$ GDP (PPP) is below the 1990 global average of 10.64 MJ/US$ GDP, but 6 times the SEW sustainability objective of 1.06 MJ/US$. Consequently the vector value of 0.55 is above the sustainability value of 0.

The country's energy intensity is projected to increase as the country continues its efforts of economic development and, in the absence of effective energy efficiency initiatives, it is unlikely that the current vector value will move away from the sustainability value.

References:

i) EAD (Energy Affairs Division) 2000. Energy Statistics. Government Printer. Gaborone.
ii) World Bank 2001. World Development Indicators Database. www.worldbank.org/data.

►Indicator 8: Renewable Energy Deployment

It is widely considered that technologies based on renewable energy sources provide options for GHG mitigation in the energy sector. Globally the use of renewable energy sources is increasing faster than conventional energy sources although in absolute terms their contribution is still low, averaging 2% in 1998 (HELIO International 2000). Increasingly many countries have initiated programmes to promote the use of renewable energy.

Total primary energy supply in 2000 in Botswana was 74,885 TJ and renewable energy supply (primary energy supply including biomass) was 22,743 TJ. Therefore 30% of the energy was derived from renewable energy.

Metric (actual data) for 2000 = 0.30

Vector value for 2000 = 0.75

Discussion

About 30% of the total primary energy supply is derived from renewable energy, the bulk of which is biomass (99.9%). However data on biomass consumption is based on estimates as collection of data is not readily captured in data collection system. Contribution of the renewable energy sources such as solar energy is small (0.1%). Most of the renewable energy is consumed in the residential sector.

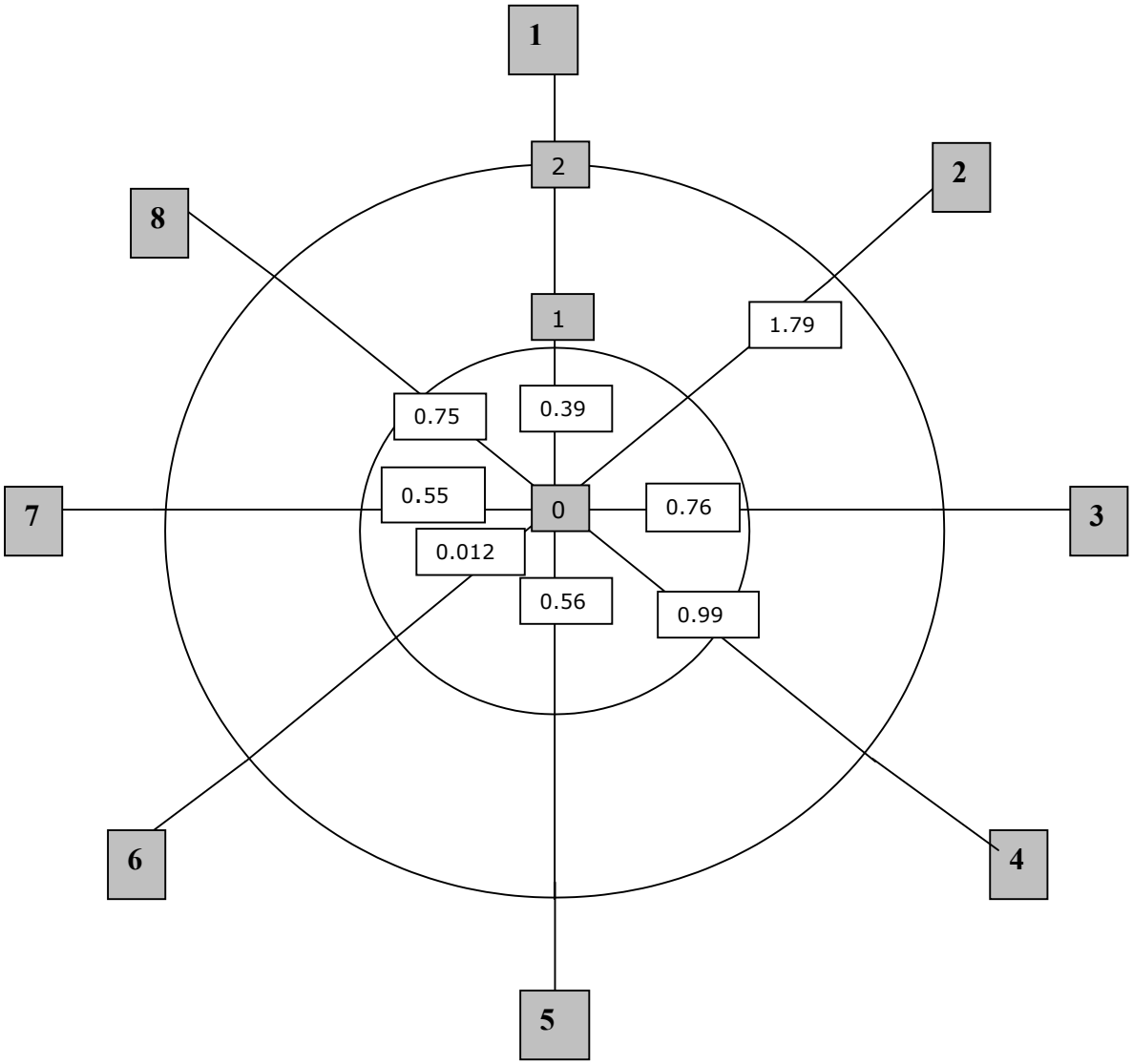
Although biomass has been considered to be renewable there are indications that in some parts of the country it is harvested in an unsustainable manner. Therefore the classification of biomass as renewable may reflect a misleading indication of sustainability

References :

i) EAD (Energy Affairs Division) 2000. Energy Statistics. Government Printer. Gaborone.
ii) HELIO International 2000. Guidelines for Observer-Reporter. www.HELIO.international.org/anglias/reports/reports2000.html

Botswana Star

2000



Conclusion

All the indicators, except for SO_2 concentrations, are within the 1990 global averages (1) but still significantly far from the sustainability goal (0). In the case of SO_2 the vector value is more than 1, which means that for the indicator Botswana is more unsustainable than the global average. However this condition is localized in one area and is not representative of the whole country. Notwithstanding this, the impact of the high SO_2 at the school is of great concern. Over the past 10 years the indicator has not significantly changed as the concentrations have remained more or less the same. This unsustainable level of SO_2 concentrations results from the operations of the Copper Nickel smelter in Selibe Phikwe and considering the global average there is room for reduction of the concentrations.

The vector closest to the sustainability value is the one on the burden of public investment in energy. This provides an indication of the level of government investment in clean energy as a fraction of GDP. The low level of investment in clean energy has led to low access to modern energy fuels particularly in rural areas. This is particularly true for electricity as provision of power to rural areas, where the majority of people reside, is capital intensive and uneconomic for the private sector to venture into.

Recommendation to the SEW

Official data on GHGs emissions is not available except for the year for which the National Communication was prepared i.e. 1994. The only option available is to calculate or estimate emission levels from data of fossil fuel consumption. It is recommended that SEW should adopt a common approach to calculation of emissions that can be used by all reporters for consistency.

For a developing country like Botswana the indicator on clean energy investment may present a wrong picture. The country still needs to develop its conventional energy resources e.g. coal in a clean manner and spending less on this area means it could remain underdeveloped. For example Botswana has abundant unexploited coal resources which can be exploited to generate power for economic development. However this does not mean that the country should pursue the development of non-clean energy sources at the expense of the environment.

The classification of biomass as a renewable energy distorts the actual sustainable level of energy as in most developing countries this resource is exploited unsustainably. For example in the case of Botswana, if one includes biomass as a renewable energy, the percentage of renewable energy contribution is 30% and when it is excluded the percentage falls to less than one percent.

Biomass should therefore be treated as a "conditionally" renewable energy source and therefore classified as a renewable energy where there is evidence that it is used in a sustainable manner.

Notes for Future Observer-Reporter

Official statistics on GHG emissions are not available except for 1994. Data on energy consumption can be used to estimate the emissions. This data can be obtained from the Energy Affairs Division. A method for calculating the emissions (e.g. coefficients) should be agreed with HELIO International.

Effort should be made to get data on energy investment from the private sector especially oil companies and the colliery. This could be obtained from their annual report or directly from their offices.

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