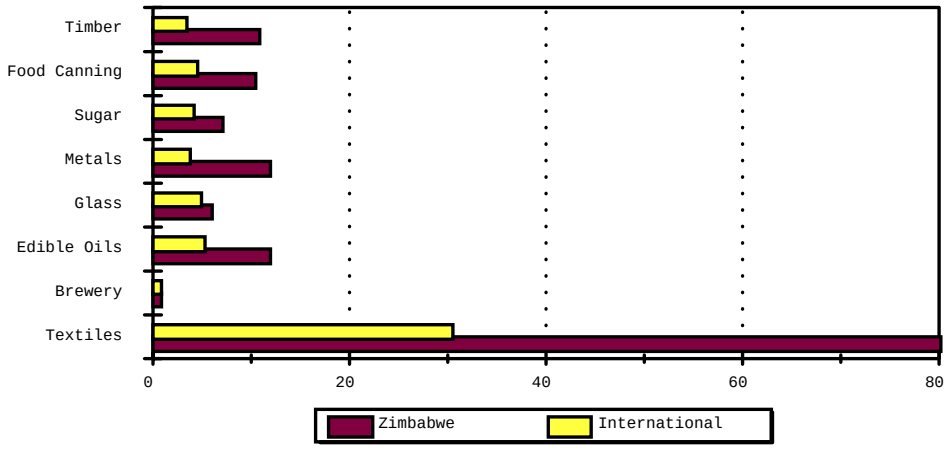
Technological sustainability

▸Indicator 7: Energy Intensity

Between 1990 and 1998, the economy of the country generally expanded and there was an associated increase in energy consumption by 41 PJ. The increase in the number of vehicles meant for private use has contributed to this increase. However since the vehicles are mostly imports from Japan, their efficiencies are fairly high. The development of infrastructure to accommodate public transport has seen more people using buses and minibuses for transportation. Recently, a train system was introduced to ferry workers from high-density areas and their workplaces in the capital Harare. The benefits of this initiative are yet to be analysed. The local industry has not been completely left out in the global technological trends. In fact, the local brewing industry is run more efficiently than in some industrialised countries. However on the grand scale, the country's industries are in dire need of a technological revolution to keep in line with global trends. Below is a graph that compares energy intensities per unit of production for the different sectors of the local industry to those of industries from developed countries. As can be realised, most industries in the country use more energy per unit of production compared to industries in developed countries.

Figure 4: Comparison of the country's industrial energy intensities to international trends in GJ/unit of production.



Source: Southern Centre for Energy and Environment: 2001, UNDP-GEF Energy Efficiency studies.

Calculation of the vector:

Information in 1,2 & 3 is from [IEA-OECD, CO2 emissions from Fuel Combustion 1971-1998, 2000]

1. Zimbabwe's total primary energy supply = in 1990 = 380 PJ
   = in 1998 = 421 PJ
2. Zimbabwe's total GDP (using exchange rates)
   in 1990 = 8.78 billion1990 US$
   in 1998 = 10.49 billion 1990 US$

3. Zimbabwe's total GDP (using PPP)
   in 1990 = 23.43 billion 1990 US$
   in 1998 = 27.97 billion 1990 US$

4. Energy intensity using exchange rates in 1990 = 43 MJ/$GDP
   in 1998 = 40.13 MJ/$GDP
5. Energy intensity using PPP in 1990 = 16.22 MJ/$GDP
   in 1998 = 15.05 MJ/$GDP

6. The 1990 Vector by exchange rate GDP = (43-1.06)/9.56 = 4.39
7. The 1998 Vector by exchange rate GDP = (40.13-1.06)/9.56 = 4.08
8. The 1990 vector using PPP = (16.22-1.06)/9.58 = 1.59
9. The 1998 vector using PPP = (15.05-1.06)/9.58 = 1.46

Discussion:

If we are to consider GDP obtained from considering exchange rates, Zimbabwe is 4 times more energy intensive than the world average. The contribution to GDP by the different sectors in the country is as shown in figure 5, below [CSO, 2002, CSO – Stats-Flash, March 2001].

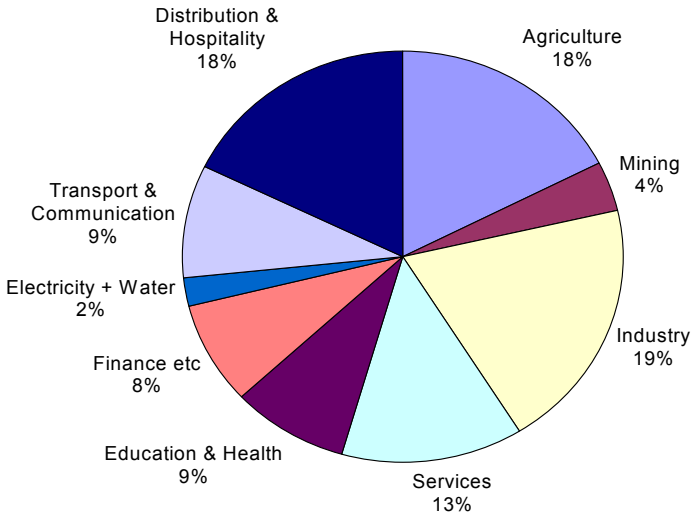


Figure 5: Sectorial contribution to GDP in Zimbabwe

Contribution to Zimbabwe GDP is based on agriculture, mining, industry, distribution and hospitality and transport. The first three sectors make use of heavy machinery and in the case of Zimbabwe the machinery is outdated and inefficient energy-wise. Recent studies have shown that energy efficiency in these sectors will result in energy consumption in these sectors being reduced by close to 40% [SCEE, UNDP-GEF : 2001, Energy Efficiency studies in Zimbabwe]. Energy in the country has been very cheap for some years and even subsidised in some cases. This has resulted in most of the sectors not factoring in the energy cost component in their production costs. Recent increases in the cost of energy have however forced many sectors to review their energy use patterns. Simple housekeeping measures and technological upgrades have so far resulted in success stories. Despite of these achievements, the need for a culture of energy efficiency remains critical to the country.

▸Indicator 8: Renewable Energy Deployment

Although the potential of renewable energy resources in the country is just unlimited, the deployment of these renewable energy technologies remains rudimentary. Below is a table comparing renewable energy potential in the country to what is being used in the country.

Table 6: Renewable energy situation in Zimbabwe

Technology	Current Situation	Technical Potential
Solar PV (SHS)	• Annual insolation of over 2200 kWh/m^2 • 3117 sunshine hours p.a. • 1.2 MWp installed & 10000 systems	• >>300 MW over 2 million houses can be electrified
PV water pumping	• 35 systems installed since 1980	• unlimited potential • horticulture & gardens
Solar Water heaters & cookers	• 50-1000 litres units available • cost US$1000 • 10 000 units installed	• 1 million systems can be installed. • 500 solar cookers in use
Mini Hydro	• 8 schemes in place producing 1.2 MW • 7 stand alone & 1 connected to the grid	• 13 MW potential. • 5 MW from existing irrigation dams • 8 MW from other bigger sites and dams
Biogas	• 5.5 million farm animals • dung with energy content of 100PJ is produced annually but is scattered. • Only 250 small scale units of the Chinese, Indian & Carmatec types	• 10 000 units potential • large farms • agricultural produce processors
Wind	• average wind speed of 3m/s countrywide • specific locations have great potential	• 4-7m/s @ 20m • 3 MW measured potential at specific sites
Bagasse based cogeneration	• 45 MW generated seasonally • 1.5 million tonnes of bagasse produced annually. • bagasse burnt inefficiently as a disposal measure.	• Current production is 30 % of the total potential. • >130 MW could be easily produced.
Power generation from sawmill waste	• 139 000 ha of commercial forests • 750 000 tonnes of sawmill dust produced p.a. • 70 tonnes used for drying • 6.5 MWe under consideration	• current project can achieve 25 Mwe • 100MWe could be eventually produced.
Methane production at Municipal sewerage works	• 400 000 cubic metres of raw sewage treated daily. • 75 000 cubic metres of methane produced daily some of the gas used to preheat digesters but most is vented	• 3 MW can be produced continuously • 5MW could be produced intermittently.

[Mhlanga A, 2002, State of Renewable Energy in Zimbabwe].

As can be noted, a lot can be realised by the exploitation of these resources in Zimbabwe. The deployment of RETs to date has been promoted for two reasons. Firstly, the government viewed the deployment of RETs in rural areas as a way around its rural electrification drive, which was critically hampered by lack of resources. Resultantly, most efforts to promote RETs were directed at rural areas with the aim of economically develop such areas. Secondly the deployment of these technologies was promoted by the

business involved. Equipment selling and servicing of these technologies provided business to a number firms in the country.

Calculation of the vector:
(information here is from the 1990 and 1998 Zimbabwe energy balances from DoE)

1. Total renewable energy consumption in 1990 = 136 PJ
   in 1998 = 147 PJ

5. Total primary energy supply in 1990 = 380 PJ
   in 1998 = 421 PJ

6. Renewable energy fraction in 1990 = 136/380 = 35.79%
   In 1998 = 147/421 = 34.92%

7. 1990 vector = (0.95-0.3579)/0.8636 = 0.686
8. 1998 vector = (0.95-0.3492)/0.8636 = 0.696

Discussion:

Between 1990 and 1998 both the country's renewable energy consumption and total energy consumption have increased. In 1990, renewable energy was mainly accounted for by woodfuel in residential areas mostly in rural areas and hydroelectricity generated from Kariba power plant. In 1998, we considered all renewables that are in place like solar home systems, bagasse-based cogeneration, micro-hydro systems, etc. that are however about 5% of the total renewable energy consumed. While more renewable energy technologies are now in use, compared to the total energy consumption in the country, their energy production is still insignificant compared to the national total supply. As more technologies are being deployed in the country especially for mini-hydro systems, cogeneration, solar PV, it is envisaged that the contribution of renewables to the national energy mix will increase.

Comparing the vector for the years 1990 and 1998, it can be observed that it has changed for the worse, despite of the fact that more renewable energy technologies are in use in the country. This is due to the increased fossil-fuel based energy consumption in the country from petroleum products and electricity generated from coal fired power plants.