EXECUTIVE SUMMARY

The manufacturing sector in Namibia is small relative to the economy, but is expected to exhibit high growth rates in the future. Manufacturing is highly concentrated on food processing, especially fish processing. Manufacturing is also highly concentrated by region, with virtually all of it in Windhoek, Walvis Bay and the towns close to them. Future development of manufacturing seems likely to follow existing patterns. Within the sector rapid development is predicted for fish processing, as stocks recover, plus a degree of diversification into areas such as chemicals and metal working. Manufacturing growth is predicted to mainly be in the areas where manufacturing already exists, with a certain degree of growth in northern Namibia around Oshikango, Oshakati and Ondangwa.

The sources of raw materials for manufacturing were examined and there were found to be no serious sustainability problems. The wastes produced by manufacturing were examined. Generally manufacturing, both existing and developing, is light industry with few hazardous wastes generated. Those that are generated are diverse chemicals, sludges and oils. Some specific problem areas such as the processing of non metallic mineral products (e.g. cement) and tanneries were identified. In addition costing was done of reducing organic waste pollution in the fish processing industry. The diversity of the sector then led to an examination of municipal capacity to deal with solid, liquid and gaseous wastes. Solid waste disposal was costed and examined for Walvis Bay and Windhoek. Effluent disposal systems were also examined, particularly in the light of Windhoek’s Zero Emissions Research Initiative project. The general waste disposal capacity in Namibia is low, however in the key manufacturing towns it is quite good. Finally three indicators were suggested, one based on the positive developmental aspects of manufacturing, the other two on solid and liquid wastes.
STATE OF THE ENVIRONMENT REPORT ON NAMIBIA'S INDUSTRIALISATION ENVIRONMENT
Draft Final Report: 31 May 1999

INDICATOR B1: NON PRIMARY SHARE OF EXPORTS

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Non primary share of exports</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Proportion of exports that do not come from traditional sources such as agriculture, mines and fishing</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Expressed as %</td>
</tr>
</tbody>
</table>

SIGNIFICANCE OF INDICATOR

PURPOSE: This indicator measures the proportional contribution of manufacturing and services to the total economy and tracks the changes in the country’s reliance on primary production for economic production and the extent and rate at which the country is moving towards or away from being a mineral, agriculture and fish based economy.

RELEVANCE: This indicator tracks the country’s diversification away from traditional industries into higher value industries such as manufacturing and tourism. The present situation of Namibia’s linkage to the Rand means that for the present the exchange rates effects are not important, however the effects of commodity prices on employment and government revenue continue to be significant. The higher the proportion of exports that are not dependent on the weather and

LINKAGES TO OTHER INDICATORS:

UNDERLYING VARIABLES AND DEFINITIONS: The indicator compares exports in primary industries (mining, fishing, agriculture and forestry) to the rest of the economy.

MEASUREMENT OF INDICATOR: The Central Statistics Office publishes the annual contribution of each of the main sectors of the economy to exports in the ‘National Accounts’. Data is thus readily available.

LIMITATIONS OF THE INDICATOR:
**INDICATOR 32: EFFECTIVENESS OF WATER QUALITY POLICY**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Effectiveness of water quality policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Percentage of urban population who live in municipal areas which are in breach of water quality permits</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Expressed as %</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF INDICATOR**

**PURPOSE:** This indicator aims to show whether most people who are living in urban areas are potentially at risk from low quality water treatment.

**RELEVANCE:** This indicator relates to the capacity of municipalities to treat effluent from domestic and industrial sources so that it is not a health hazard to the residents of these areas. It inevitably measures pollution problems that are due to both domestic and industrial waste.

**LINKAGES TO OTHER INDICATORS:**

**UNDERLYING VARIABLES AND DEFINITIONS:**

**MEASUREMENT OF INDICATOR:** This indicator is measured as follows. Each town's urban population is taken from the 1991 census and multiplied by one if it is in breach of its permit conditions at the last inspection and zero if it is not. These figures are then divided into the total urban population in 1991. Statistics on breaches of water permit conditions are available from Division: Water Environment in the Department of Water Affairs. Urban populations are available from the 1991 census from CBS.

**LIMITATIONS OF THE INDICATOR:**

There are three major limitations. Firstly, the seriousness of the breach is not measured. Secondly, the root cause of the pollution is not measured, so there is no distinction between waste from manufacturing and other sources. Thirdly, it relies on constant enforcement levels by Water Environment.
INDICATOR 33: INDUSTRY IN REGIONS WITH HAZARDOUS WASTE DISPOSAL FACILITIES

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Industry in regions with hazardous waste disposal facilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Proportion of industry in regions which have some formal disposal system for hazardous waste</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Expressed as %</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF INDICATOR**

**PURPOSE:** To show the ability of municipalities in a region to access a facility in which they can dispose of hazardous waste.

**RELEVANCE:** Most industry is willing to dispose of waste legally as long as the costs are not too high and it is fairly simple to do so. Similarly most municipalities have the underlying wish to improve waste disposal, and are attempting to do so. Hazardous waste is a particular problem due to the cost of disposal. Hence it is suggested to monitor disposal systems.

**LINKAGES TO OTHER INDICATORS:**

**UNDERLYING VARIABLES AND DEFINITIONS:**

**MEASUREMENT OF INDICATOR:** Percentages of industry by region are taken from the table in the previous manufacturing census. Data is then collected from the Pollution and Waste Management programme of the DEA on whether each region has a waste disposal storage facility, or a place to store waste before its disposal in another region. If there is such a place then the proportion of industry in the region is multiplied by one, if not zero. Then the total of the regions are aggregated.

**LIMITATIONS OF THE INDICATOR:** Revision of estimates of the manufacturing by region could lead to large swings in this indicator.
C MINING INDICATORS

EXECUTIVE SUMMARY
INTRODUCTION TO KEY INDICATORS

The indicators selected for final recommended are divided into various categories as seen from the point of view of the basic requirements of sustainable development. In other words, resources should be used and the revenue therefrom must be applied in such a way that all in society can achieve a better quality of life. In achieving this, efficient administration of a country is one of the key factors otherwise inefficiencies lead to overexploitation and degradation of renewable resources and the environment. The result is unsustainable development. For an efficient administration, a knowledgeable and well-trained work force is essential. The indicators selected therefore fall into the following categories: income generation – 2 (Indicators C1, C2), diversification of the economy, particularly export of manufactured goods away from mining – 2 (C4, C8), small mining – 1, tests of the efficiency of the Ministry of Mines and Energy and the government approach to mining – 2 (C11, C18), tests of the efficiency of the Ministry of Home Affairs and coordination within government – 1 (C12), tests of the efficiency of the Geological Survey – 2 (C14, C15), social responsibility activities of the mining companies – 2 (C19, C20), tests of the efficiency of the Ministry of Environment and Tourism in relation to mining and the environment – 1 (C31). The selected indicators are given below.
Income generation

**INDICATOR C1: CONTRIBUTION OF MINING TO GDP**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Contribution of Mining to GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Annual GDP from mining as a proportion of total annual GDP</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>National Accounts, expressed as %</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF INDICATOR**

**PURPOSE:** This indicator measures the proportional contribution of mining to the total economy and tracks the changes in the country’s reliance on primary mineral production for economic production and the extent and rate at which the country is moving towards or away from being a mineral-based economy.

**RELEVANCE:** The indicator is most useful at a national level and tracks changes in the relative importance of the mining sector in the total Namibian economy over time. Mining is important for job creation (for every job in mining, almost 2 jobs are created in Namibian supplier industries), revenue generation (for every N$ 1 that mining contributes to GDP, supplier industries contribute N$ 0.44), foreign exchange earnings (range 36 to 57% from 1990 to 1998). Vulnerable to world commodity price fluctuations.

**LINKAGES TO OTHER INDICATORS:** Linked to the following Agenda 21 indicator: ‘Share of Natural Resource Intensive Industries in MVA’. Also linked to depletion of mineral resources, multiplier effects of mining, MVA from mining, training, health and safety indicators in the mining industry, environmental awareness/protection indicators in the mining industry. Direct links to Indicator C2 – Mining forex, C5 – Namibian sourced backward multiplier.

**UNDERLYING VARIABLES AND DEFINITIONS:** The indicator consists of five variables, namely, mine surplus + wages + depreciation + indirect taxes – intermediate inputs (intermediate inputs = expenditure).

**MEASUREMENT OF INDICATOR:** Data published in the Statistical Abstracts and National Accounts by the Central Bureau of Statistics. Data is thus readily available.

**LIMITATIONS OF THE INDICATOR:** There are two major shortcomings related to mine surplus and intermediate inputs. In years of high commodity prices, mine surplus is high but so is the repatriation of dividends to non-resident shareholders. Thus in good years, mining GDP over-emphasises the contribution of mining to the economy. Conversely, in bad years when the mine surplus is very low and dividends are low or passed, mining GDP under-emphasises the contribution of mining to the economy. Furthermore, intermediate inputs into the economy are often not much less in bad years than they are in good years because they are necessary to keep a mine running. This further under-emphasises the multiplier effects of mining and its contribution to the economy in bad years. In addition, in calculating GDP, only total intermediate inputs are calculated without consideration of import leakages. A very high proportion of intermediate inputs (44%) flows directly into the Namibian economy which is not obvious from the way that GDP is calculated.
Income generation

**INDICATOR C2: CONTRIBUTION OF MINING TO TOTAL FOREIGN EXCHANGE EARNINGS**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Contribution of mining to total foreign exchange earnings</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Mining foreign exchange earnings as a percentage of total foreign exchange earnings</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Mining foreign exchange earnings as a percentage of total foreign exchange earnings</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF INDICATOR**

**PURPOSE:** Universal indicator providing an understanding of how important the sector is for earning foreign exchange.

**RELEVANCE:** The indicator is most useful at a national level and tracks changes in the relative importance of the mining sector in the total Namibian economy over time. Mining is important for job creation (for every job in mining, almost 2 jobs are created in Namibian supplier industries), revenue generation (for every N$ 1 that mining contributes to GDP, supplier industries contribute N$ 0.44), foreign exchange earnings (range 36 to 57% from 1990 to 1998). Vulnerable to world commodity price fluctuations.

**LINKAGE TO OTHER INDICATORS:** Linked to value adding within the industry and to processing within the country of initial products to higher-value semi-refined or refined final products. Liked to staffing, labour and educational indicators, including:

**UNDERLYING VARIABLES AND DEFINITIONS:** Availability of labour and technically skilled people, productivity, cost of supplies, services and infrastructure. Variable commodity prices. Consumer markets.

**MEASUREMENT OF THE INDICATOR:** Data available from Central Bureau of Statistics, National Accounts. Measured as mining foreign exchange earnings as a percentage of total foreign exchange earnings.

**LIMITATIONS OF THE INDICATOR:**
### Indicator C4: Other Manufacturing/Minning Foreign Exchange Earnings Ratio

<table>
<thead>
<tr>
<th>Indicator Name</th>
<th>Other manufacturing vs mining foreign exchange earnings ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Annual forex earnings of manufacturing other than fish and meat processing as a proportion of mining forex earnings</td>
</tr>
<tr>
<td>Measurement</td>
<td>National Accounts, expressed as %</td>
</tr>
</tbody>
</table>

#### Significance of Indicator

**Purpose:** To indicate the diversification of the economy, particularly manufacturing other than fish and meat processing, away from a reliance on mining for export earnings.

**Relevance:** Most useful at a national level. Allows an evaluation of whether the economy is successful in expanding export earnings from manufactured products, other than fish and meat processing, in order to supplement and eventually replace those from mining. A measure of diversification of export earnings.

**Linkage to Other Indicators:** To be read in conjunction with Indicator C3 – Other manufacturing GDP vs Mining GDP. Comparison of Tables C37 and C38 indicates that the diversification that is taking place is to serve local demand only and is not directed at exports. The sharp increase in 1998 may indicate a diversification towards increased export earnings from manufacturing but will need confirmation in the years ahead. Also linked to Indicator C8 – Mining capital investment vs total capital investment.

**Underlying Variables and Definitions:** Indicator consists of two annual variables, mining forex earnings and forex earnings by ‘other manufacturing’ sector in the National Accounts.

**Measurement of the Indicator:** Data published in the Statistical Abstracts and National Accounts by the Central Bureau of Statistics. Data is thus readily available.

**Limitations of the Indicator:** Namibia is far from large markets for capital goods and it may well be difficult to diversify the economy and thus export earnings into ‘other manufacturing’ and the country may have to rely largely on other sectors of the economy. The EPZs may significantly alter the situation however. If export earnings from mining decline, it will give a false signal of an increase in export earnings from ‘other manufacturing’; the reverse also applies.
**Diversification of the economy**

**INDICATOR C8: MINING CAPITAL INVESTMENT vs TOTAL CAPITAL INVESTMENT**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Mining capital investment vs total capital investment</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Annual capital investment by mining as a proportion of total capital investment</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>National Accounts, expressed as %</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF INDICATOR**

**PURPOSE**: Gives a measure of the level of capital investment by mining relative to capital investment by the rest of the economy.

**RELEVANCE**: Most useful at a national level. Allows an evaluation of whether the manufacturing, other than fish and meat processing, is expanding and investing in infrastructure in order to increase output. A measure of diversification of the economy. The indicator will demonstrate whether capital investment by other sectors of the economy is beginning to increase relative to mining and thus how successfully or otherwise diversification of the Namibian economy is progressing.

**LINKAGE TO OTHER INDICATORS**: Linked to indicators on the financial health of the economy or the mining sector. Linked to C1 – Contribution of mining to GDP, C2 – mining forex. C7 – mining capital investment vs mining GDP

**UNDERLYING VARIABLES AND DEFINITIONS**: Indicator consists of two annual variables, mining capital investment and total capital investment. Will include expenditure on infrastructure necessary to keep operations running normally as well as expenditure on new developments. Highest when new mines are opened. Will decrease for individual mines as they approach the end of their lives. Mining expenditure on infrastructure will fluctuate as commodity prices fluctuate.

**MEASUREMENT OF THE INDICATOR**: Data published in the Statistical Abstracts and National Accounts by the Central Bureau of Statistics. Data is thus readily available.

**LIMITATIONS OF THE INDICATOR**: Need to consider data for several years to reduce the effects of rather irregular capital investments by the mining industry and to smooth out the effects of those years when new mines are opened.

Good red flag indicator when there is no diversification and capital investments by other sectors of the economy are static or decrease.
**Small Miners**

**INDICATOR C6: MEMBERSHIP OF SMALL MINERS ASSOCIATION**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Membership of Small Miners Association</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Membership of Small Miners Association as a proportion of the total number of small miners</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Numbers supplied by the Small Miners Association (SMA)</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF INDICATOR**

**PURPOSE:** Gives a measure of the degree of organisation and control amongst the small miners as thus an improvement in the lot of more small miners.

**RELEVANCE:** Small miners are not well organised, largely chaotic and most small miners do not pay much heed to mining, safety and environmental laws. Marketing of most products is haphazard and opportunistic. Prices obtained are often well below international market price. SMA only markets a limited number of products on behalf of the small miners. Increasing values of the indicator should indicate better organisation of the small mining industry and possibly a consequent increase in revenue for the small miners.

**LINKAGE TO OTHER INDICATORS:** Linked to social, health and educational indicators in the Socio-economic SOER since most small miners are extremely poor.

**UNDERLYING VARIABLES AND DEFINITIONS:** Probably an erratic membership. Only 84 out of about 1,000 small miners were members of the SMA in 1998.

**MEASUREMENT OF THE INDICATOR:** Numbers supplied by the Small Miners Association (SMA)

**LIMITATIONS OF THE INDICATOR:** Very few small miners belong to the SMA or can afford the fees. No true indication of exactly how many small miners there are in total. SMA funded by donor funds and its future uncertain. Membership of SMA cannot sustain SMA on its own.
Efficiency of the Ministry of Mines and Energy: government approach to mining

**INDICATOR C11: PENDING MINERAL LICENCE APPLICATIONS**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Pending mineral licence applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Total number of unprocessed applications for mineral licences</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Total number of unprocessed applications for mineral licences at the end of each year</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF INDICATOR**

**PURPOSE:** Tests the efficiency of MME in processing applications for mineral licences, mainly exploration licences.

**RELEVANCE:** Important to encourage investment through quick and efficient management of applications. A test of the efficiency of one link in the chain of sustainable development, efficient administration of investment that specialises in mining. Persistantly high numbers of unprocessed application will deter investment. Red flag indicator of inefficiencies or staff shortages in MME.

**LINKAGE TO OTHER INDICATORS:** Relates to indicators measuring the success of Geological Survey and MME and government in attracting investment, and the international perception of Namibia as a destination for exploration; i.e. C14 – Geological mapping, C15 – Geophysical surveying, C16 – Conference attendance, C17 – Data sales, C18 – Positive/negative events in Namibian mining industry. Relates to numbers of applications for mineral licences; C9 and C10 – Exploration activity.

**UNDERLYING VARIABLES AND DEFINITIONS:** Number of applications will depend on commodity prices, interest of international exploration companies in exploring in Namibia, success of Geological Survey and Mme in enticing mining investment to Namibia, international competitiveness of Namibia’s mining law and tax regime. Ability of MME to process applications will depend on staff complement and their experience. High number of unprocessed applications is likely to be due to staff shortages which, in turn, is generally the result of uncompetitive salaries. Delays in processing can also be due to bad record keeping by MME, over pegging, disputes etc.

**MEASUREMENT OF THE INDICATOR:** Data readily available from Mining Commissioner. Shown as a total of unprocessed applications (Table C16).

**LIMITATIONS OF THE INDICATOR:** Will unfairly reflect on MME if there is suddenly a large increase in applications since each takes time to process.
Efficiency of the Ministry of Mines and Energy; government approach to mining

INDICATOR C18: NEGATIVE/POSITIVE EVENTS IN THE NAMIBIAN MINING INDUSTRY

INDICATOR NAME
Negative/positive events in the Namibian mining industry

DEFINITION
Ratio of number of negative to number of positive events each year

MEASUREMENT
Record the number of positive and negative events

SIGNIFICANCE OF INDICATOR

PURPOSE: To record and assess the number of events each year in mining in Namibia which will have an influence on international perception of mining in Namibia

RELEVANCE: Important that the international mining industry sees Namibia as a favourable destination for investment funds. Good indicator of negative sentiment towards the government's administration of mining in Namibia. Red flag - when the number of negative citations increase significantly in parallel with a fall in the number of positive citations.

LINKAGE TO OTHER INDICATORS: Relates to indicators measuring the success of Geological Survey and MME and government in attracting investment, and the international perception of Namibia as a destination for exploration; i.e. C14 - Geological mapping, C15 - Geophysical surveying, C16 - Conference attendance, C17 - Data sales, C18 - Positive/negative events in Namibian mining industry. Relates to numbers of applications for mineral licences; C9 and C10 - Exploration activity

UNDERLYING VARIABLES AND DEFINITIONS: Variables are all the events happening in mining in Namibia including changes in the tax regime

MEASUREMENT OF THE INDICATOR: It was suggested that citations in the Mining Journal be recorded for this purpose. Unfortunately, the Mining Journal merely reports events, it does not pass comment on how it sees an event. It also missed increases and decreases in mining taxation in the annual budget. Better to have Geological Survey record events and, in conjunction with the Chamber of Mines, decide whether the event is positive or negative for the industry. No data recorded as yet but citations in the Mining Journal would serve as a guide - 24 in total for 1998.

LIMITATIONS OF THE INDICATOR: Recording of whether an event was positive or negative can be very subjective and can be diametrically opposite from the viewpoints of the investor and the worker. Needs to be evaluated from the investor point of view.
**INDICATOR C12: PROCESSING OF WORK PERMITS**

**INDICATOR NAME**  
Processing of work permits

**DEFINITION**  
Annual mining industry work permits processed against number of work permits pending

**MEASUREMENT**  
Obtain statistics from the mining companies via the Chamber of Mines

**SIGNIFICANCE OF INDICATOR**

**PURPOSE:** To highlight slow bureaucratic processing of work permits and the fact that efforts by some ministries to attract investment are thwarted by counterproductive bureaucracy and lack of interministerial coordination in others. Provides a measure of how readily government allows investors to get on with their business unhindered in a highly specialised industry that needs high levels of expertise and knowledge.

**RELEVANCE:** Mining is a highly specialised industry that needs high levels of expertise and knowledge which is often not available in Namibia in sufficient numbers. Slow processing of or refusal of work permits is hindering the activities of investors and deterring investment. Highlights a shortcoming that need attention.

**LINKAGE TO OTHER INDICATORS:** Relates to indicators measuring the success of Geological Survey and MME and government in attracting investment, and the international perception of Namibia as a destination for exploration; i.e., C14 – Geological mapping, C15 – Geophysical surveying, C16 – Conference attendance, C17 – Data sales, C18 – Positive/negative events in Namibian mining industry. Relates to numbers of applications for mineral licences; C9 and C10 – Exploration activity.

**UNDERLYING VARIABLES AND DEFINITIONS:** Types of skills needed will vary with the type of job being carried out. Available skills in Namibia will vary. As more and more Namibians qualify in the required fields, so the number of applications for work permits will decrease automatically. Red flag indicator if ratio is high since it is a deterrent to investment.

**MEASUREMENT OF THE INDICATOR:**  
Obtain statistics on number of applications approved and pending from the mining companies via the Chamber of Mines. No data at present. Ratio of number of work permits granted to number of pending work permits.

**LIMITATIONS OF THE INDICATOR:**  
Companies and the industry may be reluctant to supply this information.
Effectiveness of the Geological Survey

**INDICATOR C14: GEOLOGICAL MAPPING**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Geological mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Total number of 1:50 000 geological sheets mapped each year vs total 1:50 000 sheets covering mappable geology</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Count number of 1:50 000 geological sheets mapped each year</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF INDICATOR**

**PURPOSE:** To test whether the Geological Survey has adequate staff and budget to carry out one of its prime line functions – mapping and providing the investor with data.

**RELEVANCE:** Gives a measure of the relative amount of a specific type of new geological data being made available to the investor and whether the Geological Survey is successfully carrying out one of its prime line functions essential for the promotion of investment in mining. Exploration is high risk with no guarantee of success. Geological and geophysical data are the only guide the explorationist/investor has when exploring for mineral deposits. This data is therefore critical to success in mineral exploration. The more data that is available, the greater will be the interest and investment from the international mining community. New/additional geological maps should be published on a regular basis to encourage investment.

**LINKAGE TO OTHER INDICATORS:** Relates to indicators measuring the success of Geological Survey and MME and government in attracting investment, and the international perception of Namibia as a destination for exploration; i.e. C11 – Pending mineral licence applications, C18 – Negative/positive events in the Namibian mining industry, C12 – Processing of work permits, C15 – Geophysical surveying, C16 – Conference attendance, C17 – Data sales, C18 – Positive/negative events in Namibian mining industry. Relates to numbers of applications for mineral licences; C9 and C10 – Exploration activity.

**UNDERLYING VARIABLES AND DEFINITIONS:** Dependant on adequate budget and staff with the right qualifications and experience (highly technical). As long as maps continue to be published, the ratio for this indicator should increase. A static ratio will be a cause for concern needing investigation and remedying – normally uncompetitive salaries and shortages of professional and technical staff. With adequate staff at least 10 or more sheets should be mapped each year depending on the complexity of the geology. If staff numbers adequate but simply do not map, ratio will also be low. Good achievement indicator – red flag if ratio low which it is at present.

**MEASUREMENT OF THE INDICATOR:** Count number of 1:50 000 geological sheets mapped each year by Geological Survey. Calculated as a percentage.

**LIMITATIONS OF THE INDICATOR:** Cause of a low ratio not obvious from the indicator ratio. Cause needs to be determined and remedied, staff shortages, uncompetitive salaries, staff not prepared to do field mapping, inadequate budget.
**Effectiveness of the Geological Survey**

**INDICATOR C15: HIGH-RESOLUTION AEROMAGNETIC SURVEYS**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>High-resolution aeromagnetic surveys</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Gives total area covered by annual high-resolution aeromagnetic survey as percentage of the total area to be covered</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Measure area covered and plot as a percentage of the total area of Namibia</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF INDICATOR**

**PURPOSE:**
To test whether the Geological Survey has adequate staff and budget to carry out another of its prime line functions – geophysical mapping and providing the investor with data.

**RELEVANCE:**
Gives a measure of the relative amount of a specific type of new geophysical data being made available to the investor and whether the Geological Survey is successfully carrying out one of its prime line functions essential for the promotion of investment in mining. Exploration is high risk with no guarantee of success. Geological and geophysical data are the only guide the explorationist/investor has when exploring for mineral deposits. This data is therefore critical to success in mineral exploration. The more data that is available, the greater will be the interest and investment from the international mining community. High-resolution aeromagnetic data is an extremely powerful exploration tool and thus a very powerful enticement for investment. New/additional geophysical data and maps should be published on a regular basis to encourage investment.

**LINKAGE TO OTHER INDICATORS:**
Relates to indicators measuring the success of Geological Survey and MME and government in attracting investment, and the international perception of Namibia as a destination for exploration; i.e. C11 – Pending mineral licence applications, C18 – Negative/positive events in the Namibian mining industry, C12 – Processing of work permits, C14 – Geological mapping, C16 – Conference attendance, C17 – Data sales, C18 – Positive/negative events in Namibian mining industry. Relates to numbers of applications for mineral licences; C9 and C10 – Exploration activity.

**UNDERLYING VARIABLES AND DEFINITIONS:**
Dependant on adequate budget and staff with the right qualifications and experience (highly technical). As long as surveys continue and the resulting maps be published, the ratio for this indicator should at least remain steady. It should preferably increase as it is very low at present because of very limited funds. A static ratio will be a cause for concern needing investigation and remedying – normally uncompetitive salaries, shortages of professional and an adequate budget. Good achievement indicator – red flag if ratio low which it is at present.

**MEASUREMENT OF THE INDICATOR:**
Measure area covered and plot as a percentage of the total area of Namibia which is the area the should be covered in the long run.

**LIMITATIONS OF THE INDICATOR:**
Highly specialised subject requiring rare, highly trained and experienced geophysicists in the Geological Survey. Needs an adequate budget because survey carried out by contractors with purpose-built aircraft. However, large areas covered so unit costs acceptable.
### INDICATOR C19: EDUCATIONAL SUPPORT

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Educational Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>The total number of mining company employees and other Namibians attending in-house courses and receiving mining company sponsorship for further training of any type</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Sum of all mining company employees and other Namibians attending in-house courses and receiving sponsorship for further training of any type</td>
</tr>
</tbody>
</table>

#### SIGNIFICANCE OF INDICATOR

**PURPOSE:** Gives an indication of the number of staff and other Namibians receiving training any field in order to ensure a better educated and more capable work force and thus more efficient work performance both within and outside the mining industry.

**RELEVANCE:** A key component of sustainable development which needs an efficient, knowledgeable work force and administration. Gives a measure of the commitment to develop human potential.

**LINKAGE TO OTHER INDICATORS:** Linked to educational indicators of the Socio-economic SOER, health indicators, financial health of the mining industry, other mining indicators such as C20 – Number of Peer Educators, C21 – total number of employees, C22 – size of social responsibility budget, C1 – Mining GDP, C2 – Mining foreign exchange earnings, C5 – Namibian sourced backward multiplier.

**UNDERLYING VARIABLES AND DEFINITIONS:** Needs of the industry for a great variety of skills, level of existing training of staff, availability of tutors, adequate funds, commodity prices, profits, quality, levels of and subjects taken during pre-employment training, health of trainees (AIDS and other diseases that prevent people from working for long periods, loss of trainees to other employers, lay-offs.

**MEASUREMENT OF THE INDICATOR:** The total number of mining company employees and other Namibians attending in-house courses and receiving mining company sponsorship for further training of any type.

**LIMITATIONS OF THE INDICATOR:** very broad-based and does not distinguish between levels of training or between short on- or two-day courses and full time study at a tertiary institution.
### Social Responsibility

**INDICATOR C20: PROPORTION OF PEER EDUCATORS**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Proportion of peer educators</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Number of peer educators in the mining industry per 1 000 employees</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Number of peer educators in the mining industry per 1 000 employees</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF INDICATOR**

**PURPOSE:** To indicate the size of effort that is being made to help create awareness of AIDS and other diseases and the assist the work force on health matters.

**RELEVANCE:** Useful at regional level because workers from all regions and peer educators assist the government in its fight against AIDS. The responsibility of fighting AIDS belongs to all, not just the government, and efforts at educating and assisting the work forces and the population are essential to limit the waste due to illness or death of trained and educated able-bodied workers, breadwinners etc.

**LINKAGE TO OTHER INDICATORS:** Linked to indicators on levels of education of the work force, health of the nation. Also C21 - total number of employees.

**UNDERLYING VARIABLES AND DEFINITIONS:** Levels of education of work force and their level of self discipline. Peer educators leaving the mining industry.

**MEASUREMENT OF THE INDICATOR:** Data from mining companies. Number of peer educators in the mining industry per 1 000 employees

**LIMITATIONS OF THE INDICATOR:** It takes time to train peer educators. It is essentially a voluntary function that is carried out mostly after hours. Trained peer educators leave the system and others have to be trained up. Unknown what the ideal number per 1 000 employees would be. Indicator does not convey the effectiveness of the peer educators.
**INDICATOR C31: ENVIRONMENTAL CONTRACT COMPLIANCE**

<table>
<thead>
<tr>
<th><strong>INDICATOR NAME</strong></th>
<th>Environmental contract compliance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>DEFINITION</strong></td>
<td>Proportion of lapsed Exclusive Prospecting Licences (EPLs) that have complied with their environmental contracts relative to the total number of lapsed EPLs</td>
</tr>
<tr>
<td><strong>MEASUREMENT</strong></td>
<td>Proportion of lapsed Exclusive Prospecting Licences (EPLs) that have complied with their environmental contracts relative to the total number of lapsed EPLs, %</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF INDICATOR**

**PURPOSE:** To test the compliance of the exploration companies with their environmental contracts and the ability of the Ministry of Environment and Tourism (MET) to verify in the field that environmental contracts have been complied with.

**RELEVANCE:** Useful at national level. If there are going to be environmental contracts, they must be complied with and they must be seen to be complied with. MET needs adequate staff to be able to carry out field inspections on a regular basis and police compliance.

**LINKAGE TO OTHER INDICATORS:** Linked to training and environmental awareness indicators. Also: C24 – Proportion of mines with EMPs, C25 – Proportion of mines with environmental staff, C26 – Proportion of mines with rehabilitation plans, C27 – Proportion of mines that conducted EIAs, C28 – Proportion of mines contributing to some form of rehabilitation fund, C29 – regularity of environmental auditing, C30 – Proportion of EPLs with environmental contracts, C32 – annual expenditure on environmental management.

**UNDERLYING VARIABLES AND DEFINITIONS:** Variable levels of environmental awareness of mining company staff and various levels of willingness to limit and rehabilitate environmental damage. Lack of understanding of how to limit environmental damage or even that environmental damage is being caused. Staff shortages in companies and government.

**MEASUREMENT OF THE INDICATOR:** Proportion of lapsed Exclusive Prospecting Licences (EPLs) that have complied with their environmental contracts relative to the total number of lapsed EPLs, %

**LIMITATIONS OF THE INDICATOR:** Assessment of compliance is subjective, apparently severe damage may recover naturally in a relatively short space of time and not easy to assess this, may be difficult to inspect all lapsed EPLs because of limited staff, time and funds, EPLs can cover large areas and unrepaired damage may not be found during an inspection.
EXECUTIVE SUMMARY

Namibia’s energy consumption is being dominated by the transport sector which accounts for about 75% of total commercial energy consumption at present. The trend since Independence suggests that the transport sector’s share is bound to increase further, which indicates the significance of the service industry in Namibia.

Electricity consumption is increasing gradually. The slow growth is due to a decline in the mining industry, a steady rise in local authorities’ consumption and a moderate increase in rural consumption. Electricity consumption for industrial processes is almost negligible at this stage.

Non-commercial energy consumption figures are not readily available if at all. The White Paper on Energy Policy suggests that biomass consumption could be as high as 14% of the country’s total energy consumption, while the use of solar energy is estimated at 1% of total consumption.

Household energy consumption patterns, particularly in rural areas, are not well researched and would have to be studied in detail if consideration is to be given to alleviating dependence on biomass fuels. In urban areas electrical load peaks (which are normally due to simultaneous household consumption in the evenings) may be avoided by demand side management measures and the replacement of energy intensive electrical appliances with other energy sources (eg. solar water heaters and cooking appliances using gas).

Commercial energy is still relatively cheap in comparison with other countries, due to subsidisation by government to promote certain policy goals. This is a barrier to the promotion of renewable energy technologies like wind farms, solar home systems and solar water heaters.
To be expanded
# Indicator D1: National Commercial Energy Consumption

<table>
<thead>
<tr>
<th>Indicator Name</th>
<th>National Commercial Energy Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Definition</td>
<td>Commercial energy consumption level and trend expressed by energy carrier</td>
</tr>
<tr>
<td>Measurement</td>
<td>Measured in Tonnes of Oil Equivalent (TOE), per capita, per unit GDP, as % change from the previous year, as average % change since 1990, and as contribution of energy carriers to total consumption</td>
</tr>
</tbody>
</table>

## Significance of the Indicator

**Purpose:**
This indicator provides an indication of the level and trend of the total annual amount of commercial energy consumed in the country. It should be endeavoured to include non-commercial energy sources to complete the country's total energy balance, and to break energy consumption down by sector, by region, and for urban and rural areas, to be able to identify strategies for energy policy implementation.

**Relevance:**
This indicator provides a broad overview of the energy situation in Namibia, and makes it possible to compare with other countries. It is a measure of Namibia's energy intensity (consumption per capita and consumption per unit GDP), and can provide warning signals on inefficient and unsustainable utilisation of resources and environmental impact.

**Linkages to Other Indicators:**
The indicator is linked to the more specific electricity (D2), petroleum fuels (D3) and biomass fuels consumption (D4) indicators.

## Underlying Variables and Definitions:
The indicator measures the contribution of each commercial energy carrier towards the total national consumption.

This indicator is disaggregated by energy carrier (liquid fuels, electricity, and coal).

## Limitations of the Indicator:
Currently not possible to disaggregate all data by sector, by region, and between urban and rural. To obtain a complete picture of Namibia's energy consumption it would be necessary to include non-commercial fuels (biomass and renewable energy). Information on biomass and renewable energy consumption is very sketchy, and household energy consumption patterns are not well researched. The implementation of effective strategies to promote specific policy goals may therefore be difficult.
D1.1 PAST PERFORMANCE

D1.1.1 Commercial Energy Consumption Trend by Energy Carrier

Total commercial energy consumption has been increasing since 1990 at an average rate of 5.4% per annum, mainly contributed to by the rising liquid fuels consumption. Electricity consumption has barely increased. Coal consumption had a peak in 1993 but this leveled off again to its pre-1993 level by 1996. The overall trend is ascribed to increasing transport fuel consumption.

![Graph showing Namibia's total commercial energy consumption trends from 1990 to 1998.](image)

Figure D1.1 Energy consumption trends by energy carrier (commercial energy only)

The contribution of the individual energy carriers to the total consumption is shown in Figure D1.2.

*Per capita*

The per capita commercial energy consumption trend has been leveling off until 1997 and shows a decreasing trend since then. This is due to the population growth rate being higher than the commercial energy consumption growth rate.
Figure D1.2  Contribution of energy carriers to total commercial consumption

Figure D1.3  Trend of commercial energy consumption per capita

Per unit GDP
Commercial energy consumption per unit of GDP has been decreasing steadily, indicating that GDP growth (which is higher than energy consumption growth) is mainly due to non-energy intensive production.
% change from previous year

Coal consumption is the most volatile of the commercial energy carriers. Being mainly consumed by NamPower’s Van Eck power station near Windhoek, it could be assumed that this is an indication of NamPower’s efforts to avoid costly imports from ESKOM in times of high demand.
D1.2ENERGY CONSUMPTION TREND BY SECTOR

There is at present insufficient information available to disaggregate energy consumption by sector. The sectors that should be considered are Transport, Mining, Local Authorities, Water Pumping, Industry, Government and Parastatals, and Households.

D1.2 INTERPRETATION

The large contribution of the transport sector to the country’s energy consumption is a clear indication of the present importance of the service industry. This sector should receive the greatest attention in terms of energy conservation and environmental impact mitigation.

D1.3 DATA REQUIREMENTS

All information should be available from the Ministry of Mines and Energy. However, it is not presently readily available in the required format. The source from which the information for this indicator has been compiled has been obtained from the following sources:

Liquid fuels information: Mr A Peens of Caltex South Africa who compiles Namibia’s oil and gas industry’s data for the Ministry of Mines and Energy.

Electricity information: NamPower (Mr John Kaimu, Marketing Manager)
Coal information: Ministry of Mines and Energy (Mr Mburumba Appolus and Mr Markus von Jeney) NamPower (Mr John Kaimu, Marketing Mananger)

GDP information: This is published in a booklet titled “National Accounts” published by the Central Bureau of Statistics in the National Planning Commission.

D1.4 CALCULATION AND FUTURE UPDATING OF THE INDICATOR

An Excel spreadsheet has been prepared for the updating of this indicator. The information from the above sources is entered into this spreadsheet for each new year.

The liquid fuels information (in kilolitres) is obtained from Caltex South Africa for seven energy carriers (petrol, diesel, paraffin, furnace oil, avgas, jetfuel and liquid petroleum gas). The figures are converted to Tonnes of Oil Equivalent (TOE) and then added to obtain the total liquid fuels consumption.

Annual electricity sales data in gigawatt hours (GWh) can be obtained from NamPower for six main customer categories (municipalities, mines, rural areas, ESKOM, Angola and Botswana). This is added and converted to TOE.

Total coal consumption data (in metric tonnes) is obtained from the Ministry of Mines and Energy. This is converted to TOE.

The three energy carrier consumptions (in TOE) are summarised and added to produce the above trend graphs.

Population figures for the per capita energy consumption trends are derived from the GDP and GDP per capita figures as published by the Central Bureau of Statistics.
**INDICATOR D2: PEAK POWER DEMAND AND ELECTRICITY CONSUMPTION**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Peak Power Demand and Electricity Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Electricity consumption level and trend expressed by source and sector</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Peak power demand is measured in megawatt (MW), while consumption of electrical energy is measured in gigawatt hours (GWh). The shares of power sources are expressed as percentages.</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF THE INDICATOR**

**PURPOSE:**
This indicator provides an indication of the level and trend of the total annual amount of electricity consumed in the country as well as the country’s peak power demand. It should be endeavoured to monitor the trend of sectoral electricity consumption.

**RELEVANCE:**
This indicator provides an overview of the country’s electricity demand and consumption, the extent of self-sufficiency, and sectoral electricity consumption trends.

**LINKAGES TO OTHER INDICATORS:**
The indicator is linked to the national commercial energy consumption indicator (D1), as well as to the rural electrification indicator (D5).

**UNDERLYING VARIABLES AND DEFINITIONS:**
The indicator measures the contribution of the various electric power sources towards meeting the country’s demand for electricity. It monitors the trend of the peak power demand as well as the trend of sectoral electricity consumption.

**MEASUREMENT OF THE INDICATOR:**
Data for this indicator is obtained from the Ministry of Mines and Energy, and NamPower. Complementary information (e.g., GDP and population figures) is available from the Central Bureau of Statistics in the National Planning Commission.

**LIMITATIONS OF THE INDICATOR:**
Currently not possible to disaggregate all data by sector and by region.
D2.1  PAST PERFORMANCE

D2.1.1  Power Source Contribution to Country’s Demand for Electrical Energy

Although Namibia’s installed electricity generation capacity would still be sufficient to meet the country’s demand, electrical energy is increasingly being imported from ESKOM. This is primarily due to the uncontrollable water flow of the Kunene River.

Figure D2.1  Share of power sources

Electricity imports increase while exports to neighbouring countries vary. Since 1998 Namibia is exporting electricity to Angola and Botswana, but this is still insignificant. The bulk of exports go to ESKOM in times when Ruacana generates in excess of the country’s needs.

D2.1.2  Electricity Demand

The country’s peak power demand has been increasing at an average annual rate of 5% since 1990. The peak demand consistently occurred in July every year since 1990.
Figure D2.2  Electricity imports vs exports

Figure D2.3  Namibia's peak power demand
Bulk electricity sales are gradually increasing, with sales to local authorities rising steadily while sales to mines are decreasing slowly. Sales to rural areas are gradually increasing as can be expected with growing rural consumer numbers.

Figure D2.4  Bulk electricity sales by customer group

D2.1.3  Sectoral Electricity Consumption

Electricity consumption trends by sector, for the period 1981 to 1996, are described in the 1998 JICA report, as per Figure D2.5 below. It should be endeavoured to disaggregate sectoral data in this way to further monitor the trends.
D2.2 INTERPRETATION

Local authorities have become the most significant bulk electricity consumer group, overtaking the mining sector in the early 1990s. The decline in mining electricity consumption is primarily due to closure of mines rather than energy efficiency measures. The steady growth of electricity consumption by local authorities can be ascribed to urbanisation and industrialisation in urban areas.

Electricity consumption by the rural sector is gradually increasing, giving hope to less dependence on biomass energy.
D2.3 DATA REQUIREMENTS

Data for this indicator is available from NamPower and from the Ministry of Mines and Energy. Unfortunately, it is at present not readily available in the sectoral breakdown format. The Ministry of Mines and Energy and NamPower are urged to compile data in this format for trend monitoring.

If it is desired to measure electricity consumption per capita and per unit GDP, the GDP and population information can be obtained from a booklet titled "National Accounts" published by the Central Bureau of Statistics in the National Planning Commission.

D2.4 CALCULATION AND FUTURE UPDATING OF THE INDICATOR

An Excel spreadsheet has been prepared for the updating of this indicator. The information from the above sources is entered into this spreadsheet for each new year.

Information for shares of power sources and export and import of electricity can be obtained from both the Ministry of Mines and Energy and NamPower. Annual electricity sales data in gigawatt hours (GWh) as well as peak demand information (in MW) can be obtained from NamPower for six main customer categories (municipalities, mines, rural areas, ESKOM, Angola and Botswana).

Population figures for the per capita electricity consumption trends, if required, are derived from the GDP and GDP per capita figures as published by the Central Bureau of Statistics.
**INDICATOR D3: NATIONAL PETROLEUM FUEL CONSUMPTION**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>National Petroleum Fuel Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Petroleum fuel consumption trends</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Measured in Tonnes Oil Equivalent; as % of total energy use; per capita, per sector; per petroleum fuel type.</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF THE INDICATOR**

**PURPOSE:**
The indicator shows the importance of petroleum fuels in the national energy and development scene. It portrays the activities and sectors by their degree of dependency on petroleum fuels and impacts of energy policies on petroleum energy use. It also provides an indication of the weight of each fuel type in the total consumption.

**RELEVANCE:**
Petroleum fuels are imported and thus decrease in consumption results in foreign currency savings. Consumption of most of these fuels results in environmental pollution and thus increase in intensity contributes positively to environmental protection. The cost and extent of increasing energy efficiency and conservation depend on energy service or activity provided and thus on sector.

**LINKAGES TO OTHER INDICATORS:**
The indicator is linked to Total National energy use.

**UNDERLYING VARIABLES AND DEFINITIONS:**
The indicator shows the extent to which consumers adopting environmental friendly measures or fuel types.

**MEASUREMENT OF THE INDICATOR:**
Data is available from the Ministry of Mines and Energy as well as the Oil Companies Secretariat, Caltex. Complementary information is available from Central Statistics Office.

**LIMITATIONS OF THE INDICATOR:**
Currently not possible to disaggregate data by region which could be useful in justifying continued supply in remote areas especially once deregulation take root.
D3.1 PAST PERFORMANCE

D3.1.1 Petroleum Fuel Consumption Trend

Total consumption of petroleum fuels has been increasing since 1990 at an average rate of 7% per annum. Compared to the GDP growth rate of about 3.5%, this figure is quite high. This is due to increased population as well as improved access to vehicles for the share of the population that could not easily own vehicles prior to Independence as well as higher social obligations requiring use of petroleum fuels.

Figure D3.1 Liquid Petroleum Fuel Consumption by Fuel Type
The slowing down in the rate of use from 1996 coincides with the negative real economic growth rate recorded in these years. The low purchasing power of the society hence results in decrease in consumption of petroleum fuels.

Increased petroleum energy use generally indicates increase in air pollution particularly in areas where technologies to control emissions are almost non-existent as in Namibia. Promotion of ULP and policies aimed at conservation of petroleum fuels could decrease consumption without compromising the economy.

D3.1.2 Petroleum Fuel Share Of The Energy Market

Petroleum fuels constitute the largest share of Namibia's energy market, and the trend is increasing. This can be ascribed mainly to the growth in the transport sector. The prospects for substitution of petroleum fuels are rather limited and costly in the short run. It is therefore expected that dependency on these fuels will continue to rise.

![Diagram: Contribution to total commercial energy consumption (TOE)]

Figure D3.2 Liquid fuels share of total commercial energy consumption
D3.1.3 Per Capita Petroleum Fuel Consumption

As the growth of petroleum fuel consumption has been higher than population growth, the per capita consumption of petroleum fuels has been increasing. This is to be expected in a developing country where growth is occurring with minimal concern for conservation.

![Per Capita Liquid Fuels Consumption Graph](image)

Figure D3.3 Per capita liquid fuels consumption

Increasing per capita energy consumption is generally associated with development. However, with increasing environmental awareness this is not necessarily a desirable trend. On the other hand, it should be noted that Namibia is a developing country thus an increase in this indicator is a reflection of increase in development.

D3.1.4 Sectoral Consumption Of Petroleum Fuels

The transport sector has been the largest consumer of diesel until 1995. Since 1996, the fishing industry is leading the country’s diesel consumption. Diesel sales by general traders have also been increasing sharply.
The transport sector is by far the largest consumer of petrol, with other sectors only featuring marginally. There is much less diversity in petrol consumption than in diesel consumption.

LPG is mainly consumed by independent markets, the general public and the agricultural sector.
D3.1.5 Fuel Type Share Of Petroleum Fuels Consumption

The dominant petroleum fuels are diesel and petrol. Their consumption has been notably rising since 1990 which can be attributed to increase in vehicle volumes. The high share of diesel is mainly due to transport requirements, but recently also due to increasing consumption by the fishing industry.
LPG and paraffin consumption remains rather low despite growth in population. Since a large share of these fuels is consumed by the household sector, their low usage is an indicator of low uptake or switch to LPG and paraffin. Poor access to these fuels has been the main barrier to increased consumption.

D3.2 DATA REQUIREMENTS

Petroleum fuels data is being collected by the Ministry of Mines and Energy from the oil companies and is readily available. Population estimates to be obtained from the Central Statistics Office.

Information on sectoral petroleum fuels consumption may not be readily available. The Ministry of Mines and Energy should be requested to collect this data.
D3.3 CALCULATION AND FUTURE UPDATING OF INDICATOR

A spreadsheet is used to update the information on an annual basis and to produce the trend graphs.

D3.3.1 Petroleum Fuel Consumption Trend

Annual fuel use in kilolitres per fuel type, summated to yield the total petroleum fuels consumption, and converted to Tonnes of Oil Equivalent (TOE).

D3.3.2 Petroleum Fuel Share Of The Energy Market

Total petroleum fuels consumption divided by total energy consumption and expressed as a percentage.

D3.3.3 Per Capita Petroleum Fuel Consumption

Total petroleum fuels consumption divided by total population.

D3.3.4 Sectoral Consumption Of Petroleum Fuels

Annual petrol, diesel and LPG consumption in kilolitres per sector.

D3.3.5 Fuel Type Share

Annual fuel use in TOE per fuel type, as collected for D3.1.1, expressed as a percentage of the total fuel consumption.
### INDICATOR D4: COST OF PETROLEUM FUEL

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Cost of Petroleum Fuel</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Price of petroleum fuels to the end user.</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>Measured in N$/GJ</td>
</tr>
</tbody>
</table>

#### SIGNIFICANCE OF THE INDICATOR

**PURPOSE:**
The indicator provides an indication of the efficiency across the different fuels. It also enables comparison of Namibian prices with other countries.

**RELEVANCE:**
In general fuel consumption tends to be price related. Thus price can be used to influence use of particular fuels.

**LINKAGES TO OTHER INDICATORS:**
The indicator is linked to Total energy prices

**UNDERLYING VARIABLES AND DEFINITIONS:**
The indicator consists of two variables: fuel price and fuel energy content.

**MEASUREMENT OF THE INDICATOR:**
Data is available from the Ministry of Mines and Energy.

**LIMITATIONS OF THE INDICATOR:**
It is difficult to establish whether the prices reflect the real cost of the fuel since the cost structure is not accessible.
D4.1 PAST PERFORMANCE

Pump prices of diesel and petrol are controlled by the government. The paraffin and LPG prices are not. As for Windhoek, pump prices of petrol and diesel have been rising in all parts of the country.

Figure D4.1  Pump Prices of Petrol and Diesel in Windhoek

4.2 INTERPRETATION

The large distances from source and wholesale markets are the reasons for Namibia’s increasing dependence on transport. Therefore, increases in petroleum fuel prices generally trigger increases in the price of other goods, which has a direct effect on inflation.

High fuel prices are a good incentive for energy efficiency measures. In non-transport applications (such as water pumping), high fuel prices make renewable energy technologies attractive as these become more competitive.
4.3 DATA REQUIREMENTS

The petrol and diesel costs are regulated by the Ministry of Mines and Energy and are therefore readily available. A regional breakdown should be motivated to MME.

Future deregulation of the liquid fuels industry will lead to the possibility of fuel costs varying widely due to the influence of market forces. MME must put a system in place where changes in fuel prices are tracked for all parts of the country.

4.4 CALCULATION AND FUTURE UPDATING OF INDICATOR

The information is recorded in a spreadsheet as N$/litre.
EXECUTIVE SUMMARY

The Ministry of Works, Transport and Communication (MWTC) is on behalf of Government responsible for developing policy and regulating the transport sector. The Namibian transport sector consists of four main modes or sub-sectors all included in this study, namely Roads, Railways, Aviation and the Maritime modes.

The road sub-sector is by far the most important sub-sector. Traffic volumes are increasing quickly but are by world standards, still small. This sector still has significant available capacity.

The railway sector is declining in importance while the civil aviation industry is characterised by a widely distributed network of aerodromes and landing strips varying significantly in infrastructure quality but all characterised by very low traffic volumes.

The maritime sector mainly services the fishing industry, one of the backbones of the Namibian economy. Namibia has two ports: one at Walvis Bay that handles most of the fishing activities and almost all foreign cargo and passenger transport and Lüderitz that supports only coastal shipping and fishing activities. Both ports are under-utilised due to low traffic volumes.

This Study clearly shows that on a policy level much is presently done to address environmental sustainability in the Transport Sector. Although the current legislation still does not reflect this, the new legislation that are either already in Parliament or will follow soon, shows a clear commitment to environmental sustainability.

Namibia is a large country with a small population mostly concentrated in certain areas or towns. This leads to largely under-utilised infrastructure in the rural areas.
The environmental impact of the development and maintenance operations is also shown to be small. Even in the more populated towns like Windhoek, Oshakati, Ongwediva, and Ondangwa, infrastructure deficiencies are still small.

On the operational level the report showed that the road sub-sector is by far the most dominant and will remain so for the foreseeable future. Even for the road sub-sector very little has to date been done to address possible negative environmental effects caused by traffic. The present level of traffic flows is still too small to cause significant environmental problems.

However on an operational level, the issues of safety and health are already standing out as concerns that need to be addressed in the medium term.

The indicators identified for possible application in Namibia, their use and limitations as well as indicative future trends will be discussed in detail in this report.
INDICATOR E1: TRANSPORT SECTOR CONTRIBUTION

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>TRANSPORT SECTOR CONTRIBUTION (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Net contribution of the Transport Sector to the Economy</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>The % portion of the Gross Domestic Product represented by the Transport and Storage Industry</td>
</tr>
</tbody>
</table>

SIGNIFICANCE OF THE INDICATOR

PURPOSE: This indicator measures the overall importance of the Transport Sector to the Namibian economy.

RELEVANCE: This indicator presents a helicopter view of the importance of the Transport Sector as a whole to the economy. In this regard it can measure changes in the sector relative to the economy.

LINKAGES TO OTHER INDICATORS:

UNDERLYING VARIABLES AND DEFINITIONS: This indicator is a combination of the Transport and Storage Activity and the Gross Domestic Product as defined in the 1993 System of National Accounting.

LIMITATIONS OF THE INDICATOR:

1) The indicator would be more meaningful if separate data sets for the four different sub-sectors under review were available.
2) The indicator would also be more meaningful if all the cost currently expended by Government in this Sector, is reflected under the Transport and Storage Activity.

MEASUREMENT OF THE INDICATOR:

There is presently no policy that provides a national target for this ratio.

RED FLAG:
E1.1 Past Performance

The Central Statistics Office has from 1990 divided the Transport and Communication Activity into Transport and Storage and Post and Telecommunications. In 1990 the Transport and Storage Activity measured 2.59% of the Gross Domestic Product. This level of importance has been increasing slowly and in 1997 stood at 2.79%.

Over the same period the combined growth in the primary and secondary industries as a % of Gross Domestic Product remained at 43%. This shows that growth in the Transport Sector is reliant on growth in industry activities.

E1.2 Interpretation

The past eight years shows that the transport sector is not an independent growth vehicle and is reliant on other industries to make it grow. Its position as a tertiary activity is therefore justified.

It must however be noted that the development of primary and secondary industry is dependent on a reliable and well maintained transport sector. Poor road quality for
example will lead to higher vehicle operating costs and eventually higher commodity and consumer goods prices.

E1.3 Data Requirements

All the data is available in the National accounts published annually by the Central Bureau of Statistics in the National Planning Commission. The specific location is Table B3: Gross Domestic Product by Activity.

E1.4 Calculation and Future Updating of Indicator

The ratio is calculated as follows:

<table>
<thead>
<tr>
<th>Value of Transport and Storage Activity, at current prices and in N$ million</th>
<th>DIVIDED BY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Domestic Product, at current prices and in N$ million</td>
<td>AND THE RESULT TIMES 100</td>
</tr>
</tbody>
</table>
### INDICATOR E2: PORTION OF NATIONAL NETWORK DEVELOPED AT LEAST AT GRAVEL ROAD STANDARD

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Portion Of National Network Developed At Least At Gravel Road Standard (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>Total length of paved and gravel roads as a % of the total national road network length.</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>The % ratio of the sum of paved and gravel roads.</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF THE INDICATOR**

**PURPOSE:** This indicator measures the quality of roads that makes up the national road network. It can also be used as a proxy to measure access to well developed roads.

**RELEVANCE:** This indicator provides a measure of the standard at which the national network is developed. The better the average development standard of the network, the more “useable” the network is.

**LINKAGES TO OTHER INDICATORS:** This indicator should be read with Paved Road Quality. This indicator provides an overview of the development standards while the Paved Road Quality indicator provides an overview of the riding quality of the paved roads, i.e. those roads that carry at least 75% of all traffic.

**UNDERLYING VARIABLES AND DEFINITIONS:** This indicator is a combination of the following variables;
1) the length of the national road network, and
2) the length of the paved and gravel roads that are part of the network.

The national road network consists of all proclaimed roads in Namibia excluding proclaimed farm roads.

The Minister responsible for Transport has the authority to proclaim roads as part of the national network.

**MEASUREMENT OF THE INDICATOR:**
There is no specific value described in policy or vision statements. Namibia should however aim for 100% in the long term. In the short term the indicator value should not decrease over time. The closer the indicator comes to 100%, the closer Namibia be to the goal of having the whole national network developed to roads that have very high accessibility.

**LIMITATIONS OF THE INDICATOR**
Current information does not allow for easy disaggregation between regions to highlight possible deficiencies among regions.

**RED FLAG:** ANY DECREASE IN THE TREND. This will show that the network quality is decreasing.
E2.1 Past Performance

The national road network has over the past sixteen years been developed extensively. In 1981 22 882km or 54.9% of the network consisted of gravel or paved roads. In 1997 31 926km or 75.1% of the network consisted of gravel or paved roads.

As funding became more constrained in the last number of years, this increase in network quality has slowed down. It is the intention to ensure that at least roads that must be upgraded for economical reasons will receive that funding once the road user charging system is put in place later this year.

![Percentage Paved and Gravel Roads Graph]

E2.2 Interpretation

The past performance shows that the road network quality is improving all the time. This has resulted in the introduction of improved transport services and improved accessibility to the areas so affected. Currently there are several planned proposals for further improvements, but constraints on funding have slowed the implementation of these improvements. This directly impacts on the quality of accessibility.
E2.3 Data Requirements

The variables that make up this ratio are the following:

\[ X = \text{The sum of the total paved and gravel road lengths that are part of the national road network.} \]

\[ Y = \text{The total road length proclaimed as part of the national road network} \]

These variables are found in unpublished data kept with the Directorate Infrastructure Planning and Transportation in the Department of Transport of the MWTC. The information is updated annually and can be obtained free of charge from the Deputy-Director: Planning.

Once the Roads Authority is established, the data would also be available from there.

E2.4 Calculation and Future Updating of the Indicator

The indicator is calculated as follows:

\[
\text{The sum of the total paved and gravel road lengths (X), in current figures} \div \text{The total road length (Y), in current figures} \times 100
\]
**INDICATOR E3: PAVED ROAD QUALITY**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Paved Road Quality</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>The % of the total paved road network that has a riding quality of Fair or Good.</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>The summed lengths of paved road with a fair and good standard as a percentage of the total paved network length.</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF THE INDICATOR**

PURPOSE: This indicator will immediately show the road quality of that portion of the national road network that is carrying more than 75% of the traffic.

RELEVANCE: This indicator is most useful as a guideline to the cost of using roads. The better the riding quality, the lower the vehicle maintenance cost and the cheaper the overall vehicle operating cost. This impacts on the whole economy, as Namibia is dependent on road transport for most imports and exports. Poor roads will therefore directly affect commodity and goods prices.

LINKAGES TO OTHER INDICATORS: This indicator should be linked with the indicator Portion of National Road Network Developed at least at gravel road standard.

**UNDERLYING VARIABLES AND DEFINITIONS:** This variable is dependent on the road quality measurements that the DOT undertakes regularly. For years where no measurements are made, the indicator cannot be calculated.

It is also dependent on the length of paved road in each quality category as well as the total length of the paved network.

**LIMITATIONS OF THE INDICATOR:** The indicator would be more useful if the road quality could be coupled to the traffic volumes carried by the specific road link. This disaggregation will split the paved road network according to traffic volume and will highlight whether riding quality problems exist on the most travelled road links.

**MEASUREMENT OF THE INDICATOR:**

There is no specific value described in policy or vision statements. Namibia should however aim for as high a percentage as possible in the long term. In the short term the indicator value should not decrease over time.

**RED FLAG:** Continuous decreases over time will point to deteriorating road quality and a potential for increased prices.
E3.1 Past Performance

The paved road network are, although old, still in a very good condition overall. As the paved network aged, the % good roads have been deteriorating steadily. The maintenance efforts have over time covered most of the maintenance requirements in the “Poor” and “Warning” categories. The deterioration has therefore been slow.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>POOR AND WARNING (%)</th>
<th>FAIR AND GOOD (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1985</td>
<td>3</td>
<td>97</td>
</tr>
<tr>
<td>1988</td>
<td>2</td>
<td>98</td>
</tr>
<tr>
<td>1991</td>
<td>4</td>
<td>96</td>
</tr>
<tr>
<td>1994</td>
<td>8</td>
<td>92</td>
</tr>
<tr>
<td>1997</td>
<td>11</td>
<td>90</td>
</tr>
</tbody>
</table>

E3.2 Interpretation

The table shows a steady decline in road quality since 1988. Taking into account the new paved roads that have been completed since 1990, the decline is even more rapid.

E3.3 Data Requirements

This indicator is fully dependent on the frequency of road inspection that the Department of Transport undertakes. The table above shows that these statistics are only available for years during which such inspections were made.

The raw data is captured and converted into the table format above by the Division: Laboratory Services and Materials of the Department of Transport. The information is available free of charge from the said Deputy-Director.
E3.4 Calculation and Future Updating of Indicator

The indicator can therefore be determined without any calculation.
INDICATOR E4: ANNUAL FUEL CONSUMPTION

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Annual Fuel Consumption</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>The annual total amount of fuel consumed by road users</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>A summation of the annual total petrol and diesel consumption of road users.</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF THE INDICATOR**

**PURPOSE:** This indicator measures the volume of fuel consumed by road users annually. As most economic activity in Namibia depends on road transport, this can also be used as a coarse proxy for economic activity.

**RELEVANCE:** This indicator has two areas of specific relevance namely,

1. To act as an indication of the actual utilisation of roads in Namibia. The more fuel used in a period, the more kilometres travelled during that period.
2. To provide a quantity measure of the emission problems that exist in Namibia due to road use. In this regard it presents a highly aggregated picture only.

A third but smaller area of relevance is the growth in economic activity. Namibia's economy is dependent on road transport and changes in economic activity will also be seen as changes in fuel consumption patterns.

**LINKAGES TO OTHER INDICATORS:** This indicator can be linked to Access to vehicles. They both attempt to measure the impact of road utilisation.

**UNDERLYING VARIABLES AND DEFINITIONS:** This variable consists of two variables namely, the total volumes of petrol and diesel sold to road users annually.

As regards diesel, only about 44% of the national sales is consumed on-road, the rest is consumed by the mining, fisheries and agricultural sectors as well as Transnamib in the rail sector.

**MEASUREMENT OF THE INDICATOR:**

The indicator is used to represent road use and its environmental effects in a highly aggregated way. The study showed that Namibia does not experience pollution problems from road use yet and the development of more focused indicators are not relevant yet.

**LIMITATIONS OF THE INDICATOR:** This indicator could be applied on a local authority level should disaggregated data be available.

**RED FLAG:** None, but the road sector should be reviewed every five years to determine if more focused indicators should not replace this indicator.
E4.1 Past Performance

This indicator shows a significant increase in fuel consumption since Independence. The years before Independence are inflated because of the South African war effort in Angola. The growth rate for the years 1987 to 1988 shows the same trend. From 1991 to 1998 this trend is represented as an annual compound growth rate of 8.86%.

![TOTAL ON-ROAD FUEL CONSUMPTION IN THOUSAND LITERS](chart)

E4.2 Interpretation

This is faster than the annual growth rate in Gross Domestic Product but in line with growth rates experienced by similar developing countries around the world.

E4.3 Data Requirements

The variables for the determination of this indicator are presently collected from two Ministries. The Ministry of Mines and Energy collects all data around fuel sales, while the Ministry of Finance maintains a register for all economic sectors that may request fuel subsidies.
The to be established Road Fund Administration will however collect all the data in the format required to develop the indicator. As the RFA will be established this year still, this section will be forward-looking and will describe the data requirements as if the RFA is already in place.

The variables are as follows:

\[ X = \text{The total annual volume of petrol sold} \]

\[ Y = \text{The Total volume of diesel sold for on-road use.} \]

These quantities will in future be part of the annual reporting system of the RFA as these figures form the basis of road user charging revenue collected through fuel sales.

**E4.4 Calculation and Future Updating of Indicator**

The indicator is calculated as the sum of \( X \) an \( Y \) for each year.
**INDICATOR E5: ANNUAL LEAD EMISSIONS**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Annual Lead Emissions</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>The Total amount of Lead emitted into the atmosphere due to unleaded petrol combustion.</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>The total ton quantity of lead emitted annually</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF THE INDICATOR**

**PURPOSE:** This indicator measures the extent of lead emissions caused by the use of leaded fuel. It is also a measure of the national concern that ambient lead is a major agent causing lead poisoning.

**RELEVANCE:** The indicator gives a highly aggregated measure of the health risks involved in the use of leaded fuel.

**LINKAGES TO OTHER INDICATORS:** This indicator is not linked to other indicators.

**UNDERLYING VARIABLES AND DEFINITIONS:** The indicator is relying on the total volume of leaded and unleaded petrol sold annually. It furthermore relies on the lead concentration of leaded petrol sold in Namibia.

**MEASUREMENT OF THE INDICATOR:** Practice around the world shows that this indicator is usually measured in the concentration of lead in the atmosphere, usually in congested city centres. Namibia does not have problems with high lead concentrations yet. This indicator therefore measures the total lead emitted by vehicle use in tons of lead emitted annually.

**LIMITATIONS OF THE INDICATOR:** This indicator could be applied on a local authority level should disaggregated data be available.

**RED FLAG:** Any increases
E5.1  Past Performance

The Ministry of Mines and Industry facilitated the introduction of unleaded petrol into Namibia in 1997. This was done mainly in support of the latest engine technology where more and more engines are designed to run on unleaded fuel only.

Total lead emissions increased steadily from just over 72t in 1987 to over 107.8t in 1996. With the introduction of unleaded petrol in 1997, lead emissions decreased to 101.7t, a decrease of 5.7%.

![LEAD EMISSIONS](image)

E5.2  Interpretation

The net result of the introduction of unleaded petrol is still small, but the health benefits of unleaded petrol have not yet been explained as part of media campaigns. Should the negative effects of ambient lead be explained to the general public, the total phasing out of leaded petrol will become reality.

E5.3  Data Requirements
The Ministry of Mines and Energy collects fuel sales data from the petroleum industry. The lead content of leaded petrol is also controlled by the MME. Therefore all data requirements can be satisfied in the Directorate of Energy of the MME who supplies the information free of charge.

The required information is as follows:

\[ X = \text{The total volume of Leaded Petrol sold, in liters} \]

\[ Y = \text{The average lead content of leaded fuel sold in Namibia in g/l.} \]

E5.4 Calculation and Future Updating of Indicator

The total lead emitted by petrol-driven vehicles as ton per period is calculated as follows:

\[
\text{The total volume of Leaded Petrol sold, in litres (X)} \times \frac{\text{The average lead content of leaded fuel sold in Namibia in g/l (Y)}}{1000}.
\]
**INDICATOR E6: ACCESS TO VEHICLES**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Access To Vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>The average number of vehicles per capita.</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>The total number of vehicles divided by the total population, both in current figures.</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF THE INDICATOR**

**PURPOSE:** This indicator measures the average mobility of the Namibian population in terms of their possible access to the road network.

**RELEVANCE:** In the absence of information to develop more focused indicators, this indicator is a proxy of the average mobility of the Namibian population. It also provides a highly aggregated indication of the accessibility of the road network to the average Namibian.

**LINKAGES TO OTHER INDICATORS:** This indicator can be linked to Annual Fuel Consumption. They both attempt to measure the impact of road utilisation.

**UNDERLYING VARIABLES AND DEFINITIONS:** This indicator is dependent on the current vehicle and population numbers.

**MEASUREMENT OF THE INDICATOR:** There is no norm for this indicator. Internationally it is a measure of the affluence of a nation, the higher the ratio, the more affluent the society.

**LIMITATIONS OF THE INDICATOR:** Both current vehicle and population numbers are estimates. In the case of vehicles, reliable numbers on a regional and district basis will provide a basis for local and regional comparisons.

**RED FLAG:** None. However, the Transport Sector must be reviewed regularly to determine whether this indicator should not be replaced with more focused indicators.
E6.1 Past Performance

E6.2 Interpretation

E6.3 Data Requirements

E6.4 Calculation and Future Updating of Indicator
**INDICATOR E7: ACCESSIBILITY TO PORTS**

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Accessibility to Ports</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>The total volume of cargo handled.</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td>The sum of all cargo handled through port operations, summed in ton</td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF THE INDICATOR**

**PURPOSE:** This indicator measures the size of port operations to provide a proxy for accessibility. (This is a weak indicator and its final inclusion should be left for the workshop discussions planned for 14 June.)

**RELEVANCE:**

<table>
<thead>
<tr>
<th>UNDERLYING VARIABLES AND DEFINITIONS</th>
<th>LINKAGES TO OTHER INDICATORS:</th>
<th>MEASUREMENT OF THE INDICATOR:</th>
<th>LIMITATIONS OF THE INDICATOR</th>
<th>RED FLAG:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
INDICATOR E8: AVIATION SAFETY

<table>
<thead>
<tr>
<th>INDICATOR NAME</th>
<th>Aviation Safety</th>
</tr>
</thead>
<tbody>
<tr>
<td>DEFINITION</td>
<td>The total number of deaths per passenger transported.</td>
</tr>
<tr>
<td>MEASUREMENT</td>
<td></td>
</tr>
</tbody>
</table>

**SIGNIFICANCE OF THE INDICATOR**

**PURPOSE:** This will measure the relative safety of the aviation industry in Namibia. (As this is also a very insignificant indicator within the Transport Sector, it is suggested that its final inclusion be decided at the workshop of 14 June).

**RELEVANCE:**

**LINKAGES TO OTHER INDICATORS:**

**UNDERLYING VARIABLES AND DEFINITIONS**

**MEASUREMENT OF THE INDICATOR:**

**LIMITATIONS OF THE INDICATOR**

**RED FLAG:**