The Vulnerability of African Countries to Oil Price Shocks: Major Factors and Policy Options

The Case of Oil Importing Countries

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PURPOSE

The Joint UNDP/World Bank Energy Sector Management Assistance Program (ESMAP) is a special global technical assistance partnership sponsored by the UNDP, the World Bank and bi-lateral official donors. Established with the support of UNDP and bilateral official donors in 1983, ESMAP is managed by the World Bank. ESMAP's mission is to promote the role of energy in poverty reduction and economic growth in an environmentally responsible manner. Its work applies to low-income, emerging, and transition economies and contributes to the achievement of internationally agreed development goals. ESMAP interventions are knowledge products including free technical assistance, specific studies, advisory services, pilot projects, knowledge generation and dissemination, trainings, workshops and seminars, conferences and roundtables, and publications. ESMAP work is focused on three priority areas: access to modern energy for the poorest, the development of sustainable energy markets, and the promotion of environmentally sustainable energy practices.

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FUNDING

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For further information on a copy of the ESMAP Annual Report or copies of project reports, please visit the ESMAP website: **www.esmap.org.** ESMAP can also be reached by email at **esmap@worldbank.org** or by mail at:

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Preface

This study is part of ESMAP's Work Program dedicated to issues of Energy Security. Faced with current concerns over the impact of the large increase in oil prices that has occurred since 2003, the work program is investigating the nature and magnitude of the oil shocks on developing economies with a view to furthering a debate and analysis of possible policy options to ameliorate the impact of the present an possible future price increases.

The current report, which builds on ESMAP's earlier study, The Impact of Higher Oil Prices on Low Income Countries and the Poor, investigates the magnitude of the oil price shock on the net oil importing economies of Sub-Saharan Africa. It highlights the major determinants of the vulnerability of these economies to the shock, with a view to identifying where policies should be directed and what type of policies should be sought.

Further work by ESMAP will undertake a more detailed investigation for certain selected economies, with a view to giving a more refined description of the issues facing various types of economy, and evaluating policies appropriate to their individual situation.

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Executive Summary

1. By the first half of 2005 the average price of oil had risen by 72 percent relative to the price in 2003 (from US$28.8 to US$49.5 a barrel). For countries which are net importers of oil this has delivered a major shock to their economies. Earlier work[1] (ESMAP, March 2005) has established that low income countries and the poorer households within developing countries tend to suffer the largest impact from the oil price rise.

2. In this report, it is shown that net oil importing countries of Sub-Saharan Africa are highly vulnerable to oil shocks, have the highest ratio of external debt to GDP and the lowest per capita income. The recent oil price rises have born on the Sub-Saharan African net oil importing countries severely, being equivalent to a cumulative loss of GDP of around 3.5 percent over the last two years. What distinguishes Africa from other regions is its almost complete reliance on imported oil (apart from the net oil exporters) and its very high oil fuel dependence for its primary energy consumption besides biomass. For example, South Asia's share of oil in total primary energy consumed is about one half of that of Africa. These extreme values are partially offset by its lower total energy intensity and oil intensity, but these may actually increase as the region experiences further development.

3. Apart from a few oil exporters, Sub-Saharan Africa consists of a large number of low-income countries, many of which are highly dependent on oil imports as a source of primary energy. The purpose of this study is to provide information on a number of aspects of energy and oil use in these countries, with a view to highlighting the vulnerabilities of the different countries against sustained or even increasing oil prices, and explore some of the policy implications. The topics investigated are:

- How vulnerable is each country at present to a sustained oil price rise measured in terms of the ratio of net oil imports to gross domestic product (GDP), and in terms of its ability to pay as indexed by the ratio of net external debt to GDP?
- What are the energy and oil intensities of the economies, and what are the recent trends (measured by the ratio of energy use to GDP)? Can countries expect that energy and oil intensity will rise or fall as the level of development improves?
- What is the oil fuel dependence of the economy, and what is its recent history (measured as the share of the use of oil and oil products in total primary energy use)? What has been the pattern of use of other fuels?

[1] *The Impact of Higher Oil Prices on Low Income Countries and on the Poor*. ESMAP Formal Report 299/05.

4. From a macroeconomic standpoint, the vulnerability of an oil importing country is measured by the ratio of the value of net oil imports to GDP, since the higher this ratio the larger the fall in GDP that is required to offset a rise in oil prices. The impact of the oil price shock is calculated as the index of vulnerability multiplied by the percentage increase in oil prices. Oil vulnerability itself is equal to the product of four factors as shown below:

Oil vulnerability ≡ value of net oil imports / GDP
= price of oil × (volume net oil imports / total oil use) × (total oil use / total energy use) × (total energy use / GDP)

5. The vulnerability to oil price changes and its decomposition is shown in Table A for four regions of the world and OECD countries, omitting net oil exporters whose behavior is likely to be different and who stand to gain from higher oil prices.

Table A: Oil Vulnerability for Non-oil Exporting Developing Countries by Region (1990 to 2003)

	Sub Saharan Africa	*Latin America & Caribbean*	*South Asia*	*East Asia*	*OECD*
1990					
Vulnerability	0.0273	0.0193	0.0161	0.039	0.0143
Oil price (US$)	23.7	23.7	23.7	23.7	23.7
Import dependency	0.985	0.619	0.506	0.927	0.705
Energy intensity	10,154	13,697	24,013	15,204	11,122
Oil dependency	0.665	0.543	0.320	0.680	0.425
TPEC per capita*	3.3	33.1	9.0	15.4	203.6
Debt / GDP	0.829	0.365	0.312	0.471	NA
GDP per capita (US$)	261	2,648	327	1,130	20,581
2003					
Vulnerability	0.0351	0.0206	0.0292	0.045	0.0105
Oil price (US$)	28.8	28.8	28.8	28.8	28.8
Import dependency	0.982	0.478	0.744	0.852	0.695
Energy intensity	11,421	16,507	22,150	19,187	6,819
Oil dependency	0.626	0.510	0.352	0.530	0.421
TPEC per capita	3.8	42.8	12.1	27.1	225.3
Debt / GDP	0.723	0.504	0.240	0.520	NA
GDP per capita (US$)	294	3,056	504	1,527	25,414
% change					
Vulnerability	+28.8	+6.3	+82.0	+13.7	-26.7
Oil price	+21.5	+21.5	+21.5	+21.5	+21.5
Import dependency	-0.3	-22.8	+47.1	-8.0	-1.4
Energy intensity	+12.5	+20.5	-7.8	+26.2	-38.7
Oil dependency	-5.8	-6.1	+10.4	-21.1	-0.8
TPEC per capita	5.4	+29.1	+34.3	+76.5	+10.7
Debt / GDP	-12.8	+38.0	-23.0	+10.8	NA
GDP per capita	+12.7	+15.4	+54.0	+35.1	+23.5

6. The table shows that, in terms of vulnerability to oil shocks, Sub-Saharan African (omitting South Africa) and East Asia (excluding China) were the most exposed in both 1990 and in 2003, and that vulnerability in Africa increased between 1990 and

2003 by more than the oil price rise. This high level of oil vulnerability in Africa was coupled with the highest external debt to GDP ratio, and the lowest per capita income, which shows that for Africa the oil shock is large and that it has the least resources to cope with the shock.

7. Turning to the components of oil vulnerability, it can be seen that energy intensity (net of biomass) was the lowest in Africa in both 1990 and 2003, which helped to keep oil vulnerability down, while it was much higher in South Asia, the region whose per capita income is nearest. The pattern of energy use between regions fits the hypothesis that energy intensity experiences a peak as income increases (initially rising and then falling). If more detailed work confirms this pattern, then the implications for Africa are serious since it would then experience rising energy intensity and oil vulnerability as levels of incomes rise.

8. Offsetting the low energy intensity of Africa is its extremely high dependence on imported oil for its primary energy consumption net of biomass. So, the first factor explaining the high oil vulnerability of Africa is that it is almost entirely dependent on imported oil, once the net oil exporting countries are excluded. Since oil import dependency is constrained by the domestic resource endowment of oil, it appears that the near future for Africa on this variable is very bleak, with only Mauritania and Sao Tome likely to join the group of oil exporting countries in the medium term.

9. The second factor explaining the high oil vulnerability of Africa is its high dependency on oil as a source of primary energy, which is much more dominant than in other regions that use more gas, coal or hydro. For three of the regions the changes in this factor were small suggesting that only modest changes can be expected even in periods of a decade or more.

10. Combining these factors to give an overall view of the situation in Africa, the table suggests that:

- Little can be expected in the near future from reductions in oil import dependency.
- Oil fuel dependency has not changed substantially in Africa, Latin America or South Asia, so that large changes are unlikely in the medium term.
- Only in South Asia did energy intensity decline over the period, and the data fits the hypothesis that Africa can expect to see energy intensity increase initially as its level of income rises.

11. The impacts of the oil price rise from 2003 to 2004, and from 2003 to 2005, are shown in Table B for all net oil importing countries in Sub-Saharan Africa grouped by per capita income ranges. The table reveals that, although there is considerable variation between countries, the impact of the oil shock is highest for the group of the lowest income countries. The price rise between 2003 and 2005 is equivalent to a loss of three percent of GDP for this group, and around two percent for all the other

income groups. Over the two year period certain countries experienced extremely large shocks, including Guinea-Bissau (7.4 percent), Liberia (5.5 percent) and Sierra Leone (5.9 percent). However, the shock was quite small in some other countries, such as Uganda (1.1 percent) and Botswana (1.1 percent).

Table B: Impact of Higher Oil Prices on Net Oil Importing Countries Grouped by Per Capita Income as a Percentage of GDP (2003 base)

Per capita income range	*Oil vulnerability*	*Effect of 33% oil price rise on GDP*	*Effect of 72% oil price rise on GDP*
< US$200	0.044	1.4	3.0
US$200 - US$300	0.028	0.9	1.9
US$300 - US$1000	0.034	1.1	2.3
> US$1000	0.030	1.0	2.1
All countries	0.032	1.1	2.2

12. However, the evidence suggests that the level of GDP per capita is not systematically related to differences in the oil intensity (use of oil related to the level of GDP), nor are country-by-country changes in the variables systematically related to GDP, so that other factors are important in understanding what determines a country's vulnerability to oil shocks. However, the statistical analysis did show a strong correlation between the oil intensity and the number of vehicles in relation to the level of GDP and to the degree of urbanization. This finding has important consequences since both are likely to increase over time, and are almost automatic consequences of economic growth.

13. Table C highlights the ratios of the various factors for the top eight and bottom seven countries measured in terms of the change in oil vulnerability between 1990 and 2003. For the group of countries who improved their oil vulnerability, most reduced their oil dependence and also reduced their energy intensity. Guinea, Lesotho, Namibia, Tanzania, and Zambia all increased the share of hydro in total energy very considerably, thus allowing the share of oil used for power generation to drop. At the same time, these countries, most of which grew strongly during the period, increased the total amount of primary energy consumed (TPEC), but at a much lower rate than the increase of GDP, so that energy consumption was partially de-coupled from economic growth. These countries experienced growth from sectors that were less energy intensive than the average for the economy.

14. The worst performers had rather small changes in oil dependency. Five of the countries in the group experienced declines in per capita GDP during the period, but all experienced increases (some very substantial) in the total amount of primary energy consumed. This produced a different type of de-coupling of energy use from GDP; that is, even when income was falling, energy use was rising, which again suggests that there were dramatic shifts within sectoral composition of demand. This demand saw some energy intensive sectors increased despite the overall decrease in output.

Table C: Best and Worst Performances of Oil Vulnerability between 1990 and 2003

	Oil Vulnerability Ratio	*Energy Intensity Ratio Net*	*Oil Dependency Ratio Net*	*GDP Ratio*	*TPEC Ratio*
Best					
Tanzania	0.611	0.589	0.842	2.418	1.425
Namibia	0.713	0.756	0.732	1.817	1.374
Swaziland	0.779	0.700	0.911	2.147	1.504
Zambia	0.840	0.783	0.878	1.318	1.033
Cape Verde	0.846	0.689	1.000	2.354	1.622
Guinea	0.852	0.798	0.873	1.288	1.028
Lesotho	0.853	1.229	0.580	1.851	2.275
Kenya	0.895	0.726	1.016	1.681	1.221
Worst					
Malawi	2.064	1.809	0.940	0.911	1.649
Burkina Faso	2.137	1.895	0.945	1.340	2.540
Ethiopia	2.153	1.845	0.954	0.773	1.426
C.A.R.	2.171	1.709	1.046	0.806	1.377
Rwanda	2.362	1.789	1.087	0.634	1.133
Togo	3.091	2.281	1.169	1.080	2.464
Burundi	3.324	2.652	1.034	0.526	1.395

15. The overall conclusion of the report is that in the near future there is little prospect that African countries can reduce their import dependence on oil, and international evidence suggests also that it may be difficult to achieve large shifts in the dependence on oil as a source of primary energy within a short period.

16. In terms of policy implications, encouraging fuel diversification in the power sector by encouraging the use of hydropower is perhaps the most valuable policy tool to affect oil dependence since it is independent of the price of oil (unlike gas) and can form a direct substitute for the use of more hydrocarbons for power generation. Gas has not yet penetrated into non-oil exporting countries, but for some coastal economies near to oil producers it may be an attractive option (for example, the West African gas pipeline is expected to deliver gas to Togo and Benin as well as to Ghana). Coal may also be an attractive option for some countries well situated for its transportation.

17. The most promising area for policies to reduce oil vulnerability appear to be related to the ability to encourage countries to reduce their use of oil and energy

simultaneously (since there is little short-run prospect of large scale fuel substitution) especially in the transportation sector. One policy to improve the oil intensity of an economy would be to allow prices to rise at least to their international levels, which would allow the effects of price elasticities to work, even though the effect on oil demand may not be large and will not be felt immediately. This policy may adversely affect poorer members of society, so that a careful balance between economy wide objectives and distributional considerations would be needed.

18. The study also found a strong correlation between both vehicle ownership and the degree of urbanization and oil intensity. Therefore, transport related policies may also be suited to the African context to encourage more efficient and less wasteful use of oil. Investigating this possibility, for individual countries, should be a high priority. Although there is little data on the specific sectoral use of fuels, information on the mix of petroleum products that are imported does support the view that the transportation sector is dominant as a user of oil products.

19. The analysis of the best and worst performers, in terms of changes in oil vulnerability over the period 1990 to 2003, indicates that sectoral shifts in demand are likely to have played a major part in determining the current oil vulnerability. More information on individual country experience may be able to provide deeper insights into how changes in the structure of these economies related to the overall demand for energy and oil, and why some economies were able to achieve a higher rate of economic energy use.

20. For countries which are starting to see some better prospects for economic growth, even a reduction in future oil prices is not guaranteed to reduce oil vulnerability, since the likely increase in oil intensity could well offset this. Were African levels of energy and oil intensity to rise toward levels found in South Asia, these would offset the impacts of even a halving of the oil price.

21. The general conclusion of this report is that there is a serious problem of adjusting to the present and potential future oil shocks in Africa. There would appear to be no one or two major policies which could substantially reduce vulnerability to these price increases across the board. Several policy alternatives are available, and detailed study of individual economies may give insights as to which policies could be utilized in the context of the specific economy.

22. A number of important issues are touched on by this report but will need further detailed work. Chief among these are a better understanding of the full macroeconomic impacts of higher oil prices on external debt, on the fiscal deficit, and how the terms of trade will generally impact sectoral growth and economic growth overall. Fiscal policy aspects, in terms of which countries are presently subsidizing oil products and by how much, and the likely impact on demand for oil if price changes are fed through to end users, also need to be quantified, so that a deeper understanding of the response of economies to government policies to contain the oil price shocks will emerge.

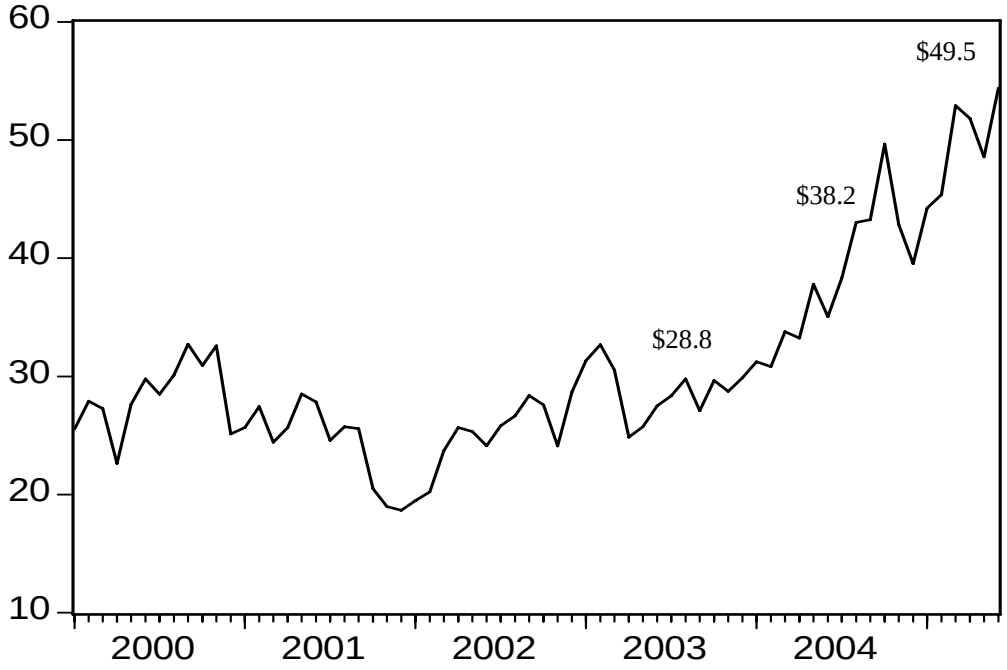
1

The Vulnerability of African Countries to Oil Price Shocks: Major Factors and Policy Options

Introduction

1.1 The steady increase in crude oil prices from an average price for Brent crude of around US$28 per barrel in 2003 to US$55 a barrel in the second quarter of 2005 (Figure 1) is having a major impact on all net importers of oil (crude and products).

Figure 1: The Monthly Average Price of Brent Blend (US$ per barrel)



1.2 The size of the shock to the economy of a sustained given percentage increase in the price of imported oil/products can be measured by the product of the percentage rise in oil prices, and the ratio of net oil imports to gross domestic product (GDP). Earlier calculations [2] for all developing countries, carried out on the basis of a US$10 a barrel increase and 2002 GDP, showed that the largest percentage impact was on the group of the lowest income countries, since these had the highest ratio of net oil imports to GDP. The further evolution of oil prices in the period after these calculations were made means that the sustained oil price increase is at least US$20 a barrel, and indeed may increase further still, and this continued increase in oil prices will effectively double the magnitude of the shock.

1.3 Apart from a few oil exporters, Sub-Saharan Africa consists of a large number of low-income countries, many of which are highly dependent on oil imports as a source of primary energy. The purpose of this study is to provide information on a number of aspects of energy and oil use in these countries, with a view to highlighting the vulnerabilities of the different countries against sustained or even increasing oil prices, and explore some of the policy implications. The topics investigated are:

- How vulnerable is each country at present to a sustained oil price rise measured in terms of the ratio of net oil imports to GDP, and in terms of its ability to pay as indexed by the ratio of net external debt to GDP?
- What are the energy and oil intensities of the economies, and what are the recent trends (measured by the ratio of energy use to GDP)? Can countries expect that energy and oil intensity will rise or fall as the level of development improves?
- What is the oil dependence of the economy, and what is its recent history (measured as the share of the use of oil and oil products in total primary energy use)? What has been the pattern of use of other fuels?

1.4 From the information derived from this analysis, a series of policy options are highlighted, and areas for further investigation are indicated. Detailed country level analysis will be required to understand the reasons for the individual level of vulnerability and changes in vulnerability to oil shocks, and hence to indicate what type of policies should be pursued in different types of economies.

1.5 The report raises a number of important questions for future work and serves as a basis for opening a dialogue on what should be done to manage the impact of the current and possible future oil price rises in Africa.

The Magnitude of the Oil Price Increase

1.6 The immediate impact of an increase in oil and petroleum product prices on net importing countries is to increase the total cost of imports, thus switching demand

[2] *The Impact of Higher Oil Prices on Low Income Countries and on the Poor*. ESMAP, report 299/05.

away from domestically produced goods, and leading to a fall in GDP. The duration and size of the price shocks then determine the impact on GDP. The average yearly Brent prices are shown in table 1.

Table 1: The Average Price of Brent Blend (US$ per barrel)

1990	*2000*	*2001*	*2002*	*2003*	*2004*	*2005 (6 months)*
23.7	28.4	24.5	25.0	28.8	38.2	49.5

Source: Platts Oilgram Price Report

1.7 The data indicate that, following years of relatively small fluctuations, the price in 2004 was on average 33 percent higher than in 2003, and that in the first half of 2005 it was 30 percent higher than in 2004 (or 72 percent higher than in 2003). In effect there have been two successive shocks, where the price rises have not only been sustained, but also increased further during 2005. The cumulative impact of this price rise is calculated on the assumption that the price of oil for the remainder of 2005 will be equal to the average value for the first half of the year.

1.8 Although not every country pays the same amount for crude oil or products, the prices of different crudes and products largely move together so that all importers are likely to have faced average price increases of these orders of magnitude. This is in sharp distinction from the impacts on consumers, who may be protected by the government providing subsidies on oil products, and financing the costs of doing so from the budget. Where governments have provided subsidies, and not cut spending elsewhere in the budget (which would be immediately deflationary), then the budget deficit will rise, which will lead to the need to take deflationary measures in the future. In this case the increase in imports is offset by an increase in aggregate government spending so that there is no change in GDP. The total effect on the economy, discounted to the present, will be the same since the benefits of delay are cancelled by the extra interest cost on the deficit (or interest foregone if a reduced surplus is held) but the political reasons for delaying may have proved very attractive for regimes that currently need approval. Delaying the passing on of price increases to consumers prevents the price elasticities (which may be low) from working at all (there being no effective price change) and so there is no adjustment in oil demand until the government is willing to let consumer prices rise.

1.9 In addition to the direct effects on economies caused by the increased import bill, there will be an indirect effect caused by the reduction in GDP of all net importing countries (especially the large developed countries). The fall in world GDP is likely to result in a reduction in demand for imports, which are the exports of other countries. Developing countries therefore will feel a further reduction in their GDP as exports fall. This effect is not quantified in this report, although it should be noted that the International Monetary Fund (IMF) is forecasting a reduction of world GDP of 0.7 to

0.8 percent in 2005[3] which could have a non-negligible effect on developing country exports.

The Analysis of the Vulnerability to Changes in Oil Prices by Region

1.10 From a macroeconomic standpoint, the vulnerability of an oil importing country is measured by the ratio of the value of net oil imports to GDP, since the higher this ratio the larger the fall in GDP that is required to offset a rise in oil prices. Oil vulnerability itself is equal to the product of four factors as shown below:

Oil vulnerability ≡ value of net oil imports / GDP
= price of oil × (volume net oil imports / total oil use) × (total oil use / total energy use) × (total energy use / GDP)

Net oil imports / total oil use = 1 - self sufficiency in oil production

Total oil use / total energy use = dependence on oil as energy source

Total energy use / GDP = energy intensity

Oil intensity = oil use / GDP = oil dependence x energy intensity

1.11 The vulnerability to oil price changes and its decomposition is shown first for four regions of the world, and for Organization for Economic Co-operation and Development (OECD) countries, omitting net oil exporters whose behavior is likely to be different and who stand to gain from higher oil prices. Results for 1990 and 2003 are shown in Table 2. [4]

1.12 The table shows that, in terms of vulnerability to oil shocks, Sub-Saharan African (omitting South Africa) and East Asia (excluding China) were the most exposed in both 1990 and in 2003, and that vulnerability in Africa increased between 1990 and 2003 by more than the oil price rise. This high level of oil vulnerability in Africa was coupled with the highest external debt to GDP ratio, and the lowest per capita income, which shows that for Africa the oil shock is large and that it has the least resources to cope with the shock.

1.13 Turning to the components of oil vulnerability, it can be seen that energy intensity was the lowest in Africa in both 1990 and 2003, which helped to keep oil vulnerability down, while it was much higher in South Asia, the region whose per capita income is nearest. In three of the four regions energy intensity increased during the period leading to an increase in vulnerability to oil shocks. The pattern of energy use between regions fits the hypothesis that energy intensity experiences a peak as income

[3] IMF. *World Economic Outlook*, 2005.
[4] Details of calculations and sources are given in Annex 1.

increases (initially rising and then falling).[5] If more detailed work confirms this pattern, then the implications for Africa are serious since it would then experience rising energy intensity as income levels rise. Coupled with the other trends identified, this would almost inevitably lead to an increase in oil vulnerability, which is high despite the currently low energy intensity.

1.14 Offsetting the low energy intensity of Africa, the first factor which helps produce its high oil vulnerability is its extremely high dependence on imported oil. Africa is almost entirely dependent on imported oil, once the net oil exporting countries are excluded (there being only two other countries which produce very small amounts of oil). This situation did not change over the period. This is in very sharp contrast to other regions, where oil import dependency was lower and decreased (except for South Asia). Since oil import dependency is constrained by the domestic resource oil endowment, although resources will be exploited where the environment is most conducive, it appears that the near future for Africa on this variable is very bleak, with only Mauritania and Sao Tome likely to join the group of oil exporting countries in the medium term. The reduction in oil import dependency in Latin America is dominated by the experience of Brazil which reduced its oil import dependence by 50 percent, while the reduction in East Asia was due to increasing domestic oil production in Thailand and the Philippines. There are at present no similar possibilities for Africa.

1.15 The second factor explaining the high oil vulnerability of Africa is its high dependency on oil as a source of primary energy which is much more dominant than in other regions that use more gas, coal, or hydro. In East Asia, where oil fuel dependence was higher than in Africa in 1990, some fuel substitution did take place leaving Africa as the most dependent on oil as a primary energy source (excluding biomass) in 2003. For three of the regions the changes in this factor were small suggesting that only modest changes can be expected even in periods of a decade or more.

1.16 The comparisons with the OECD net oil importers are very striking. Oil vulnerability was lower in both periods than in the developing countries and it decreased sharply between 1990 and 2003. This was due almost entirely to a very large reduction in energy intensity, since both oil import dependence and oil fuel dependence remained unchanged. Oil fuel dependency, which does not rely on natural endowments, was also low, and this indicates that relatively speaking the OECD was less dependent on oil as a primary fuel than the other regions, with the exception of South Asia. The improvement in the ratio of energy use to GDP, without a relative substitution away from oil indicates that, at high incomes at least, it is possible to reduce the vulnerability of economies to oil prices. The very low energy intensities demonstrated by the OECD countries also fit the hypothesis that energy (and oil) intensity tend to rise from very low levels of income, then reach a peak, and subsequently decline as income increases further. The analysis of

[5] Sun J.W. "*Energy Intensity Versus per Capita GDP in Seven Developing Countries, 1973-1995". International Journal of Global Energy Issues, 2003. I.E.A.* "Oil Crises and Climate Challenges: 30 Years of Energy Use in IEA Countries." O.E.C.D., 2004.

the International Energy Agency (IEA) demonstrated that about one fifth of the decline in energy demand per unit of GDP was due to sectoral demand shifts toward lower energy using sectors, while the rest was due to improvements in the efficiency of energy use.

Table 2: Oil Vulnerability for Non-oil Exporting Developing Countries by Region (1990 to 2003)

	Sub Saharan Africa	*Latin America & Caribbean*	*South Asia*	*East Asia*	*OECD*
1990					
Vulnerability	0.0273	0.0193	0.0161	0.039	0.0143
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Import dependency	0.985	0.619	0.506	0.927	0.705
Energy intensity	10,154	13,697	24,013	15,204	11,122
Oil dependency	0.665	0.543	0.320	0.680	0.425
TPEC per capita*	3.3	33.1	9.0	15.4	203.6
Debt / GDP	0.829	0.365	0.312	0.471	NA
GDP per capita (US$)	261	2,648	327	1,130	20,581
2003					
Vulnerability	0.0351	0.0206	0.0292	0.045	0.0105
Oil price (US$)	28.8	28.8	28.8	28.8	28.8
Import dependency	0.982	0.478	0.744	0.852	0.695
Energy intensity	11,421	16,507	22,150	19,187	6,819
Oil dependency	0.626	0.510	0.352	0.530	0.421
TPEC per capita	3.8	42.8	12.1	27.1	225.3
Debt / GDP	0.723	0.504	0.240	0.520	NA
GDP per capita (US$)	294	3,056	504	1,527	25,414
% change					
Vulnerability	+28.8	+6.3	+82.0	+13.7	-26.7
Oil price	+21.5	+21.5	+21.5	+21.5	+21.5
Import dependency	-0.3	-22.8	+47.1	-8.0	-1.4
Energy intensity	+12.5	+20.5	-7.8	+26.2	-38.7
Oil dependency	-5.8	-6.1	+10.4	-21.1	-0.8
TPEC per capita	5.4	+29.1	+34.3	+76.5	+10.7
Debt / GDP	-12.8	+38.0	-23.0	+10.8	NA
GDP per capita	+12.7	+15.4	+54.0	+35.1	+23.5

* Total primary energy consumption per capita is measured in millions of British Thermal Units (BTU), and excludes biomass (as does energy intensity).

1.17 Combining these factors to give an overall view of the situation in Africa, the table suggests that:

- Little can be expected in the near future from reductions in oil import dependency in Africa, since only two small economies are likely to be added to the list of oil producers in the medium term.
- Oil fuel dependency has not changed substantially in Africa, Latin America, or South Asia, so that large changes are unlikely in the medium term, although particular economies may be able to benefit from previously untapped sources of energy supply.
- Only in South Asia did energy intensity decline over the period, and the data fits the hypothesis that Africa can expect to see energy intensity increase initially as its level of income rises.

1.18 Putting these factors together supports the view that oil vulnerability in Africa is high, and likely to rise further, rather than fall in the near future, unless policies can be found to counter these trends.

1.19 However, Table 2 illustrates that East Asia also was highly vulnerable to oil prices in 1990, being almost entirely dependent on imported oil, yet it managed to grow substantially during the period, which does suggest that there are ways in which high import bills for oil can be accommodated without a large depressive effect on growth. More detailed analysis of the relation between the oil import bill and the development of economies is clearly needed, in order to understand how this was achieved.

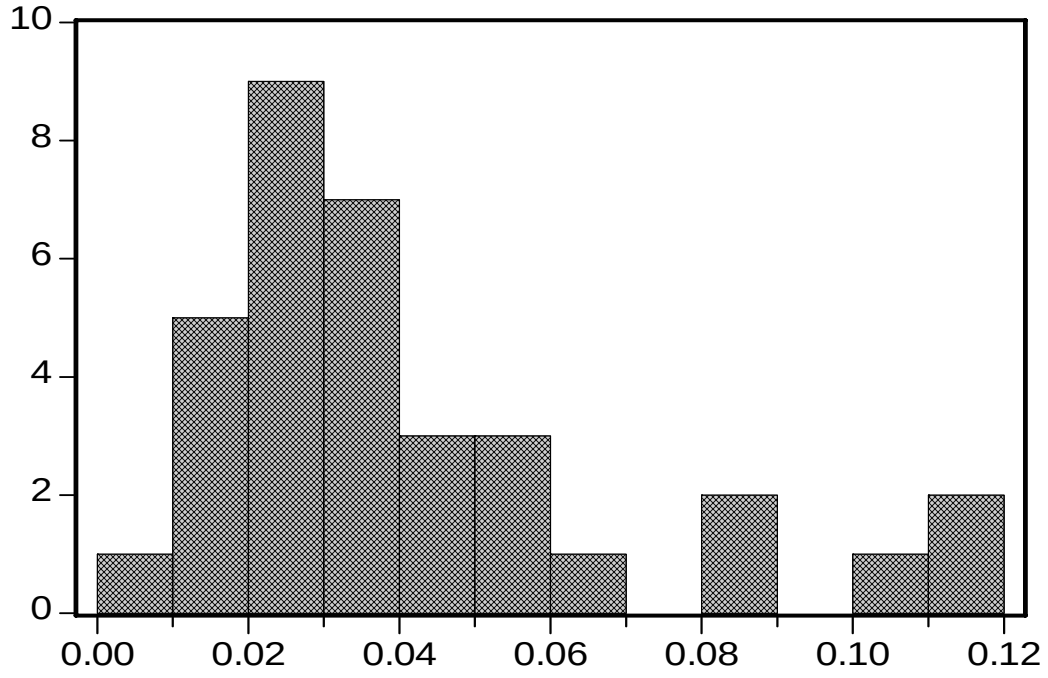
Oil Vulnerability and the Impact of the Oil Shock on Net Oil Importing Countries in Africa

1.20 A revised calculation of the magnitude of the oil shock on net oil importing countries in Sub-Saharan Africa has been carried out (Annex 2) based on data at the time immediately before the oil prices started their climb (2003 average). The vulnerability of the economy to the oil sector varies from extremely high levels (the ratio of the value of net oil imports to GDP is estimated to have been 23 percent in Mauritania and 20 percent in Djibouti) to more typical figures ranging between 3 and 10 percent.

1.21 Figure 2 gives a histogram for oil vulnerability in 2003, excluding the two outliers of Mauritania and Djibouti, for the net oil importing countries. This shows that for many countries net oil imports were less than 4 percent of GDP, but there are a few more vulnerable cases, with ten countries exhibiting a vulnerability of more than five percent (in increasing value: Senegal, Togo, Burundi, Gambia, Eritrea, Liberia, Sierra Leone, Guinea-Bissau, Seychelles, and Sao Tome).

Figure 2: Histogram of Oil Vulnerability

(ratio of value of oil net imports to GDP in 2003)



1.22 The size of the shock to the economy, measured as a percentage of GDP, is calculated by multiplying the index of vulnerability by 33 percent (the price rise between 2003 and 2004) or by 72 percent (the size of the price rise between 2003 and the first half of 2005). Table 3 provides estimates of the magnitude of the impacts of the oil shocks for all net oil importing countries in Sub-Saharan Africa grouped by per capita income ranges (excluding Mauritania and Djibouti but including South Africa).

1.23 The table reveals that, although there is considerable variation between countries, the impact of the oil shock is highest for the group of the lowest income countries. The price rise between 2003 and 2005 is equivalent to a loss of 3 percent of GDP for this group, and around 2 percent for all the other income groups. For Sub-Saharan Africa as a whole, excluding the oil exporters, the shock of the two-year price increase in oil prices is equivalent to a loss of two percent of GDP. The cumulative effect over the two years since 2003 amounts to nearly 3.5 percent of GDP. Over the two-year period certain countries (excluding the two outliers) experienced extremely large shocks, including Guinea-Bissau (7.4 percent), Liberia (5.5 percent) and Sierra Leone (5.9 percent). However, the shock was small in some other countries, such as Uganda (1.1 percent) and Botswana (1.1 percent). The analysis of factors associated with these

variations in vulnerability may give clues as to where to look for policies to ameliorate countries' vulnerability to future oil shocks.

Table 3: Impact of Higher Oil Prices on Net Oil Importing Countries Grouped by Per Capita Income as a Percentage of GDP (2003 base)

Per capita income range	*Oil vulnerability*	*Effect of 33% price rise on GDP*	*Effect of 72% price rise on GDP*
< US$200	0.044	1.4	3.0
US$200 - US$300	0.028	0.9	1.9
US$300 - US$1000	0.034	1.1	2.3
> US$1000	0.030	1.0	2.1
All countries	0.032	1.1	2.2

1.24 A simple test to see whether there is any relationship between the degree of vulnerability to oil shocks and the level of GDP per capita revealed, that at the individual country level, there is no significant correlation between the two, indicating there are a number of country specific factors determining oil vulnerability that are more dominant than the income level.

Oil Self Sufficiency and Oil Import Dependence

1.25 In Sub-Saharan Africa ten countries were net oil exporters in 2003 (Equatorial Guinea, Republic of Congo, Angola, Gabon, Nigeria, Chad, Sudan, Cameroon, Democratic Republic of Congo, and Cote d'Ivoire) and all these were excluded from the analysis. Every other country imported all its oil and oil products, with the exception of South Africa and Ghana, which produced a small amount of oil. It is very likely that the behavior of the government and the economy is quite different for oil exporters and for oil importers in respect to the extent of the domestic use of oil products, especially as oil exporting countries have a tendency to subsidize (implicitly or explicitly) their use. In addition, for exporters the rise in oil prices is equivalent to an increase in GDP, depending on the domestic take from oil prices at the time of the shock, so that there is no need to find a macroeconomic adjustment to the rise in prices. Accordingly they are excluded from the analysis.

1.26 The fact that non-oil exporters import all oil for consumption purposes means that the vulnerability (ratio of the value of net oil imports to GDP) is strictly proportional to oil intensity (ratio of use of oil in physical units to GDP) and that rankings between countries based on these variables will be identical at any one moment of time.

Oil Fuel Dependence

1.27 The level of oil fuel dependence, being the share of total primary energy that is supplied by oil and oil products, gives an indication of the extent to which there

may be room to switch fuels in response to higher oil prices. In addition, patterns of oil dependence which relate to the level of development of economies are very important, since they may indicate likely future dependence.

1.28 Oil dependence is expected to be related to the domestic supply of other primary sources of energy, and the pattern of demand for different fuels, where some sectors are more oil intensive (such as, transport) than others. If the relative size of such sectors increases over time then the economy would be expected to become more oil dependent.

1.29 Annex 3 provides data on the shares of all primary fuels in total energy. Given the great importance of biomass in Sub-Saharan Africa, an estimate of total energy use including biomass has been constructed for a subset of 20 countries for which the IEA provides data on biomass. Where biomass data is available, shares are taken in energy gross of biomass, and where biomass data is not available, shares are taken net of biomass.

1.30 For the 20 countries where information is available, biomass is seen to be extremely important as a source of primary energy—15 countries in this group derive more than 60 percent of total energy supply from this source. Only four countries use substantial amounts of natural gas, and these are all oil exporters, so that at present gas has not influenced fuel choice in net oil importing countries. Six countries use substantial amounts of coal, and these all are probably less dependent on oil than would otherwise be the case. The category of "hydro" (which includes thermal, solar, and wind) consists almost entirely of hydro (only Kenya with 1 percent thermal shows measurable non-hydro, non-biomass renewables) and is very substantial in a number of countries, with 16 countries deriving more than 10 percent, and nine countries deriving more than twenty percent of total energy from this source. Hence, natural endowments in coal or hydro are important for a large number of countries in Africa. South Africa is the one case where nuclear is used but this accounts for only 2 percent of total primary energy. Overall, the table shows that seventeen countries are effectively entirely dependent on either oil or biomass, with no other sources of primary energy presently being utilized.

1.31 Where there are three or more sources of fuel available, then a rise in the share of one fuel does not automatically imply that shares of all other fuels must fall. A rise in the share of one fuel can be coupled with a rise in the share of the second fuel as well as a large fall in the share of the third fuel. Furthermore, if the share of oil fuel falls and the shares of others rise, this does not imply that oil intensity will fall, since the total use of energy could have risen in relation to GDP. Hence, if the share of hydro is high, it does not automatically imply that the intensity of oil use must be low. The relationships between the various fuels are explored in a series of graphs. Figure 3 plots the share of biomass in total energy against oil vulnerability, and Figure 4 plots the share of hydro plus coal in total energy against oil vulnerability (which is equivalent to oil intensity) for the 12 non-oil exporting countries for which there is biomass data. Both graphs illustrate the expected result that, *where other sources of energy are utilized extensively, then the ratio of oil use to GDP tends to be lower. The implication of these findings is that*

countries well endowed with natural resources, whether it be hydro, coal, or biomass, tend to be less vulnerable to oil shocks.

Figure 3: The Relation between Oil Vulnerability and Share of Biomass in Total Energy Use for Non-oil Exporting Countries (2003)

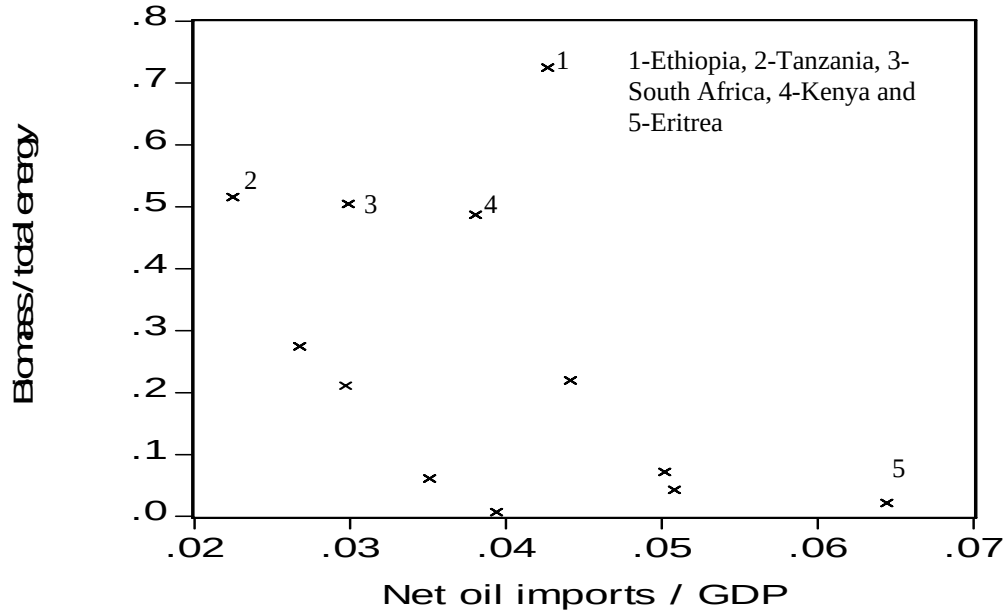
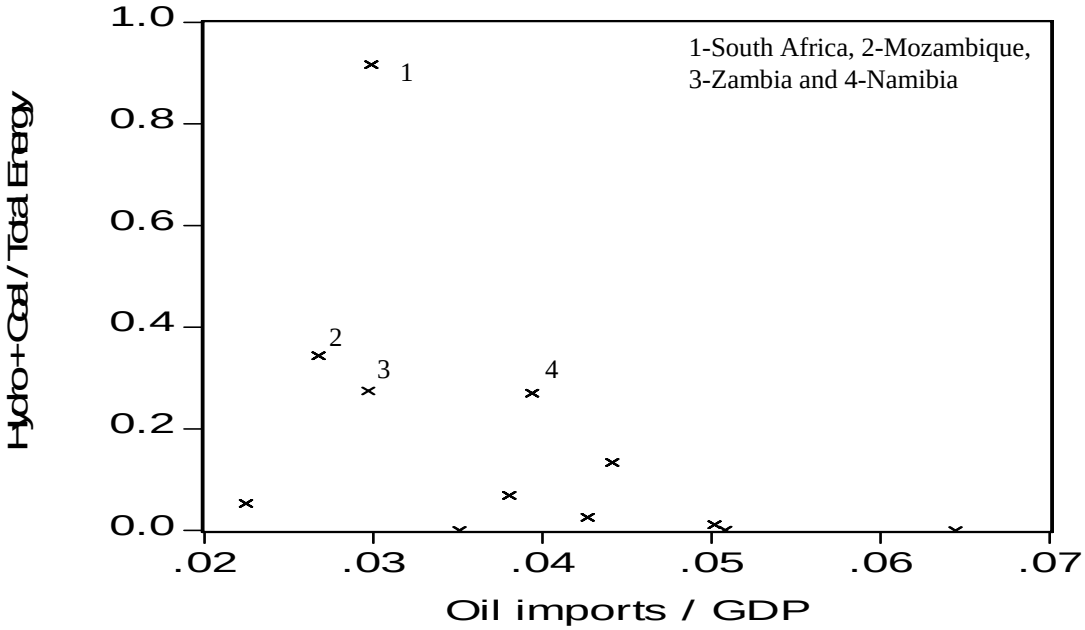
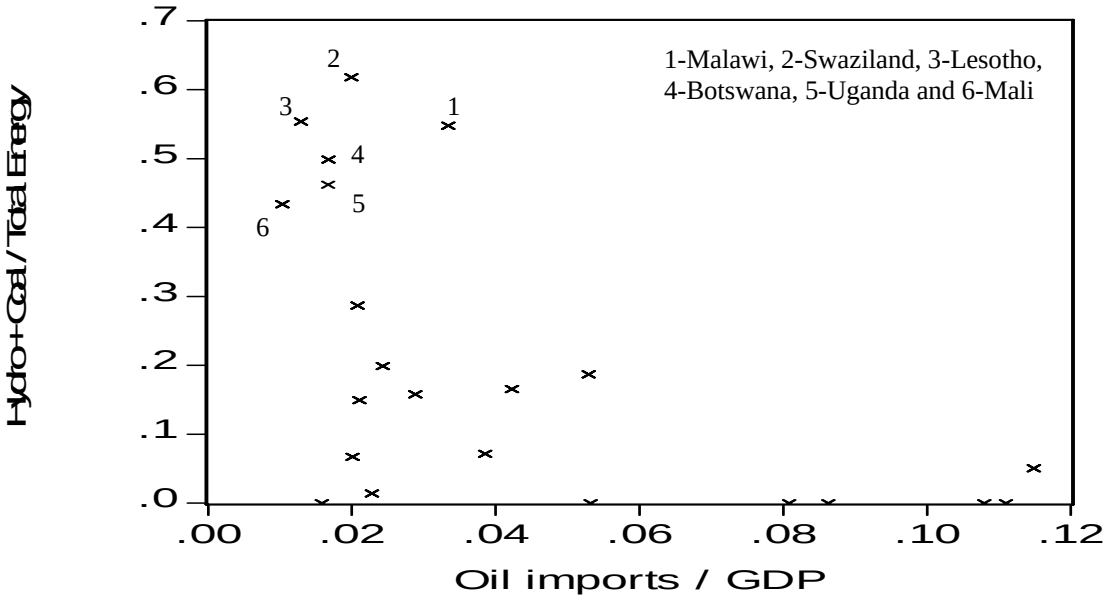


Figure 4: The Relation between Oil Vulnerability and the Share of Hydro and Coal in Total Energy in Non-oil Exporting Countries with Data on Biomass Use (2003)



1.32 For the larger group of countries where there is no data on the biomass use, only the second of these two graphs can be plotted (Figure 5) and this too supports the hypothesis that there is a tendency for those countries which have some endowment in other fuels to import less oil at a given level of GDP, rather than simply to increase the total use of energy with the resulting increase in the levels of energy and oil intensity.

Figure 5: The Relation between Oil Vulnerability and the Share of Hydro and Coal in Total Energy for Non-oil Exporting Countries without Data on Biomass Use (2003)



1.33 This relationship between other primary fuels and oil vulnerability (intensity) is extremely important for policy work. If the use of gas, coal or hydro is limited by local endowments then, for many countries, as the economy develops and also becomes urbanized, the use of oil will increase, so that ways to substitute or economize for oil need to be found. The scope for such possibilities depends on the sectoral use of petroleum products, and here the information on African countries is very limited. The transportation sector has no alternative fuel source at present in the developing country context, and so efficiency in the use of transportation and vehicles is the only policy tool to reduce consumption from this sector. The use of liquid fuels for household consumption (kerosene and liquefied petroleum gas [LPG] for lighting and cooking) is also difficult to substitute by lower oil-using technologies. The main sector where there are alternatives to oil use is power, where there are various grid and off-grid solutions that do not depend on hydrocarbons, and the current high price of oil gives a strong incentive to explore these more vigorously.

1.34 Although there is no data for sectoral use of fuels some partial evidence can be sought from two variables where there is some limited data – vehicle ownership

and the degree of urbanization. As the ratio of vehicles owned per capita to GDP per capita increases the use of petroleum products would be expected to increase relative to GDP, so that a positive correlation between oil intensity and vehicle ownership relative to GDP is expected. Also, as the degree of urbanization increases (the proportion of the total population living in towns) the use of oil-related energy (both for transportation and for cooking and lighting) may increase, so that a positive correlation could be expected. Data on vehicle ownership by country is very outdated, the most recent year available being 1996, so that the information used does not fully represent the current situation (Annex 5). However, the use of cross country data based on stocks of vehicles may preserve the most important features which distinguish countries from each other. A regression of oil intensity (which is effectively equal to oil vulnerability) on the ratio of vehicles to GDP, and the degree of urbanization (percentage of population living in towns) all measured in 1996 for 32 countries, is shown in Table 4.

Table 4: Regression of Oil Intensity on Vehicles per 1000 population per US$ of GDP per Capita and on Percentage of Population Urbanized in 1996

Variable	*Coefficient*	*Std. Error*	*t-Statistic*	*Prob.*
C	-23.24971	1857.453	-0.012517	0.9901
VEHICLES_GDP_96	97724.75	13026.88	7.501775	0.0000
URBAN_96	107.3016	54.61768	1.964595	0.0595

1.35 The squared correlation for this relationship is 71 percent, indicating a very strong relationship, in which both vehicle ownership and the degree of urbanization are positively and significantly related to oil intensity. Adding GDP per capita made no significant difference to the equation. These results have important implications for future vulnerability to oil shocks. For the short period 1990 to 1996 the average urbanization ratio increased by 15 percent and is likely to continue to increase steadily throughout Africa, and this will lead to a steady increase in oil intensity and oil vulnerability. Since the degree of urbanization is not likely to be affected by any simple policy variable, this must be seen as an exogenous trend which places more weight on finding other instruments to reduce vulnerability. Similarly, the increase in vehicle ownership relative to GDP appears to be a continent-wide phenomenon (the average ratio increased by 16 percent between 1990 and 1996) and one which will continue to increase. Policies to reduce this trend are not likely to be desirable or even effective, so that policy must instead concentrate on vehicle usage, by giving stronger incentives not to use excess fuel, which is also encouraged by the under-pricing of oil products through government subsidies. *Studies on exploring ways to reduce fuel use in transport, parallel to the IEA study for developed countries*[6] *but within the African context, are thus urgently needed.*

[6] IEA. *Saving Oil in a Hurry*. OECD, 2005.

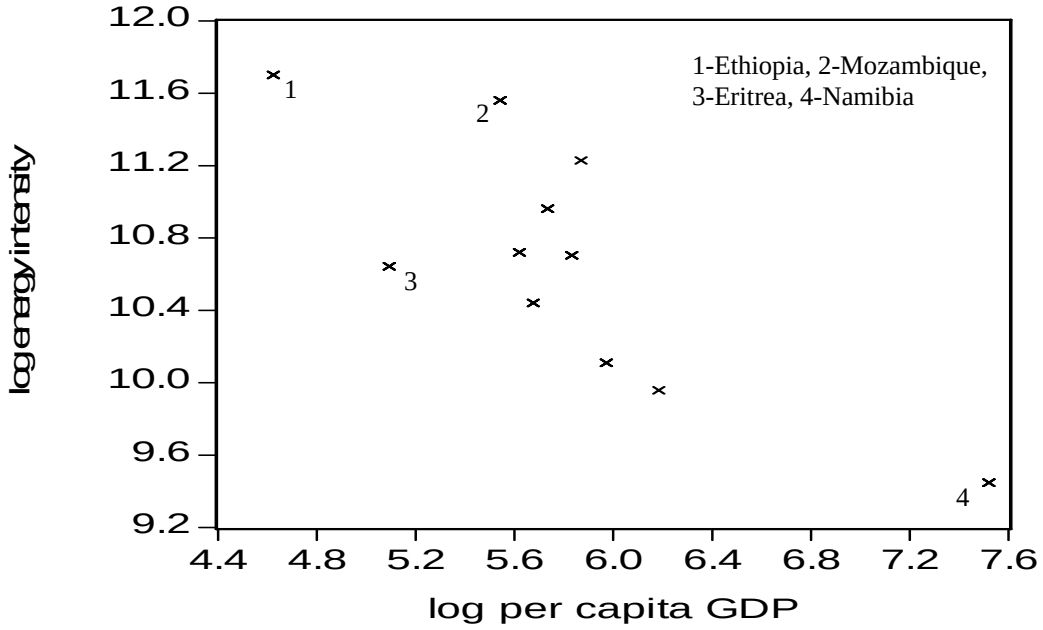
1.36 Annex 6 gives details of the shares of individual petroleum products in total product consumption in the non-oil exporting countries (based on data for those countries which import all their products). This table shows that almost universally the major uses are gasoline, distillate fuel oil, and residual fuel oil. The shares of kerosene and LPG, both of which are consumed by lower income households are in virtually all cases each less than 10 percent of total petroleum product consumption. Policies to target only these fuels for subsidies (or their continuation) would still allow a large part of the total import bill to be priced near to import parity without an excessive burden on the lowest income consumers. There are reasons not to allow the price differentials between different products to become too large, especially adulteration, whereby cheaper kerosene can be mixed into motor diesel both lowering its quality and increasing the demand for kerosene. The data also suggests that the primary use of petroleum products in Africa is for transportation fuel, so that policies to reduce fuel use must focus primarily on the transportation sector.

Energy Intensity

1.37 The second factor which relates to oil vulnerability is energy intensity. For a given level of oil fuel dependence, the higher the level of energy intensity the greater will be the oil vulnerability (for non-oil producers). Energy intensity is determined by a number of factors, including energy efficiency and the sectoral structure of the economy, but for Africa there is little information on these variables. An important finding for developed countries is that energy intensity appears to decline as the income level rises, but various studies have noted that starting at low-income levels energy intensity first rises before it falls as income increases. This is a very important consideration for low-income developing countries since they would then face a period of increasing energy intensity, with concomitant increases in oil intensity and oil vulnerability.

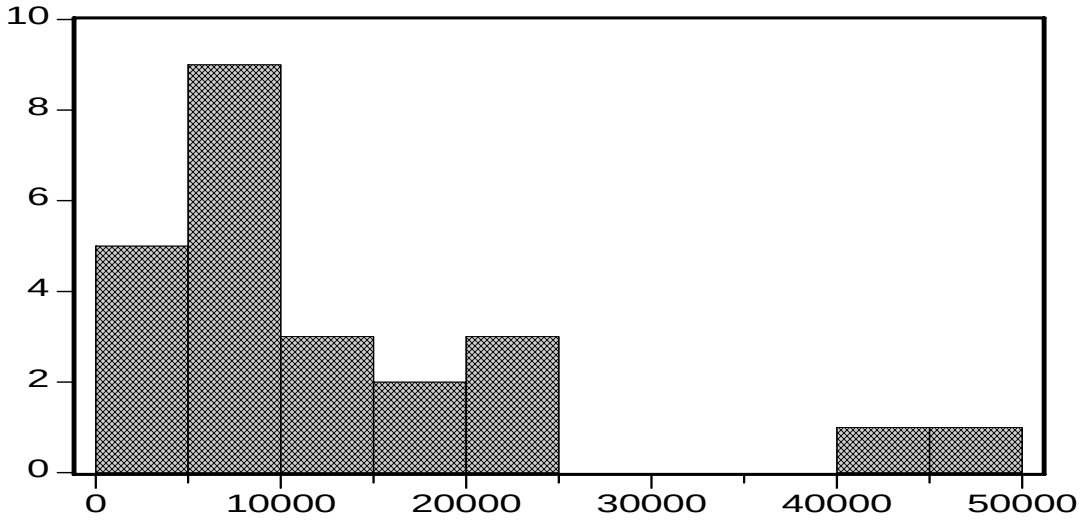
1.38 Annex 2 provides figures on energy intensity, which allow for biomass for those countries where such data is available. For the small group of non-oil exporting countries with biomass data, energy intensity varies enormously from around 12,000 BTU/US$ (Namibia) to 120,000 BTU/US$ (Ethiopia). Because the biomass data is based on surveys it may be less accurate than other energy data, and so exact numbers for total energy may include a margin of error. For the set of non-oil exporting countries for which there is biomass data available a plot of the log of per capita income against log of energy intensity is shown as Figure 6. This reveals an important finding—countries with lower GDP per capita had a higher energy intensity (including biomass). The squared correlation between the two series is 63 percent, and the elasticity is -0.83.

Figure 6: The Relation between GDP per Capita and Gross Energy Intensity (including Biomass)



1.39 For the countries where there is no biomass data, the histogram of net energy intensity is shown in Figure 7. Many of these countries use less than 15,000 BTU per US$ of GDP, but there are a few for which net energy intensity is larger. This latter group is one where policies to improve energy intensity may be able to reduce oil vulnerability substantially.

Figure 7: Histogram of Net Energy Intensity for Countries without Biomass Data (BTU/US$ of GDP in 2003)

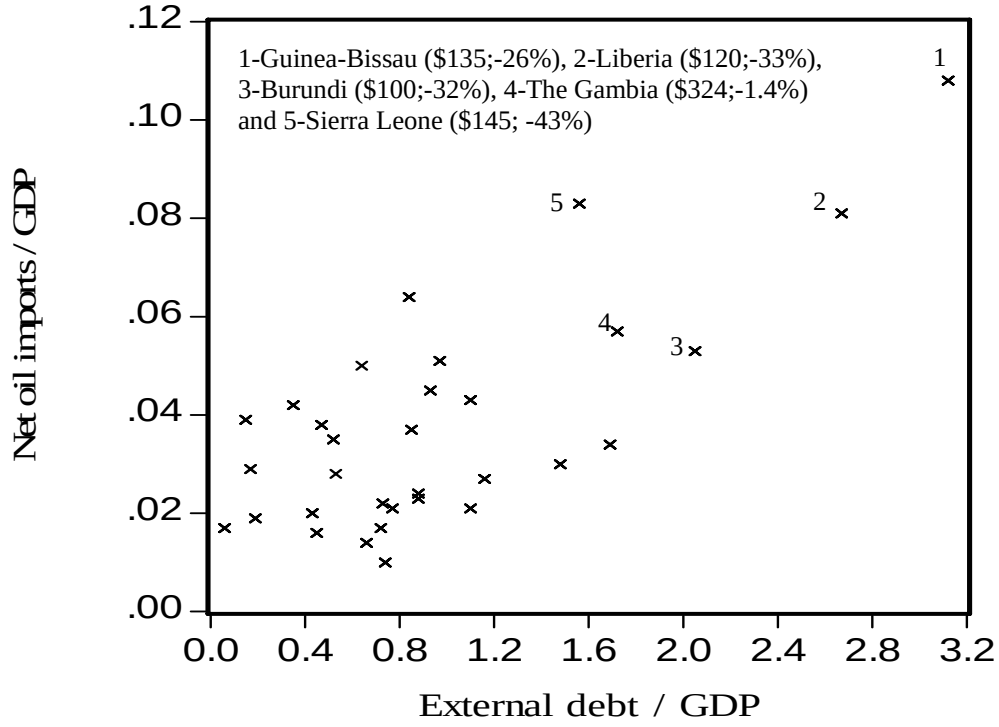


The External Debt

1.40 The ability to finance the increased import bill is related to the external indebtedness of a country. The higher the ratio of external debt to GDP the more important it becomes for the country to use policies to reduce oil imports. Policies of subsidizing consumers may avoid the contraction of GDP but will leave the import bill at its new higher level and require an increased foreign indebtedness. Indeed, countries with extremely high indebtedness may find it difficult to increase borrowing and will be forced to reduce their import of oil (or other goods) to a level where it can be financed by exports. The use of some form of import controls actually leaves GDP unchanged, but of course does result in welfare losses as consumers are forced to switch to less desired domestic products. Annex 2 provides data on the ratio of external debt to GDP in 2003. The debt ratio varies widely from only 6 percent for Botswana to 312 percent for Guinea Bissau. At a time of rapidly increasing oil prices the relationship between the debt ratio and oil vulnerability is of great concern, and this is plotted for non-oil exporting countries in Figure 8.[7]

[7] The case of the Seychelles is omitted, since its external debt ratio of 78 percent is abnormally high for a country with its GDP per capita.

Figure 8: External Debt to GDP versus Oil Vulnerability (2003) for Oil Importing Countries



1.41 The relationship between the external debt ratio and the net oil import ratio is very strong, with a squared correlation of 54 percent, indicating that *the countries which are most indebted are also those which also have the highest vulnerability to oil price rises.* In addition, the group of the five highest vulnerability countries is among the poorest and actually experienced declines in GDP between 1990 and 2003. It is not clear whether there is a direct causal link involved, in that countries importing large amounts of oil have tended to borrow to pay for this, or whether it reflects some common underlying factor. This would require more in-depth country analyses. Whatever the relationship, its policy significance is large. Countries with high oil vulnerability need to find ways to reduce this, especially when this vulnerability is coupled with high external debt.

Trends in Oil Vulnerability

1.42 The analysis above has examined differences between African countries in 2003 with a view to identifying how oil vulnerability is related to income per capita, the fuel mix and the level of energy intensity. Some strong patterns have emerged, but it is also clear that a number of specific country effects are involved, so that there are no simple cross-sectional patterns to oil vulnerability or oil intensity. Accordingly, this

section of the report looks at historical trends country by country. The time series approach is valuable in that it can reveal whether the situation has improved or worsened over time and, if so, whether the degree of change exhibits any pattern with respect to the level of development. Data on the percentage changes in the principal variables between 1990 and 2003 are given in the Annex 4. Although data exists for some of the variables at an earlier date, they are likely to be much more unreliable, so that comparisons over a longer period time could be measured with error. The 14-year period chosen should be long enough to reveal any important changes that are relevant to the current situation.

Oil Vulnerability

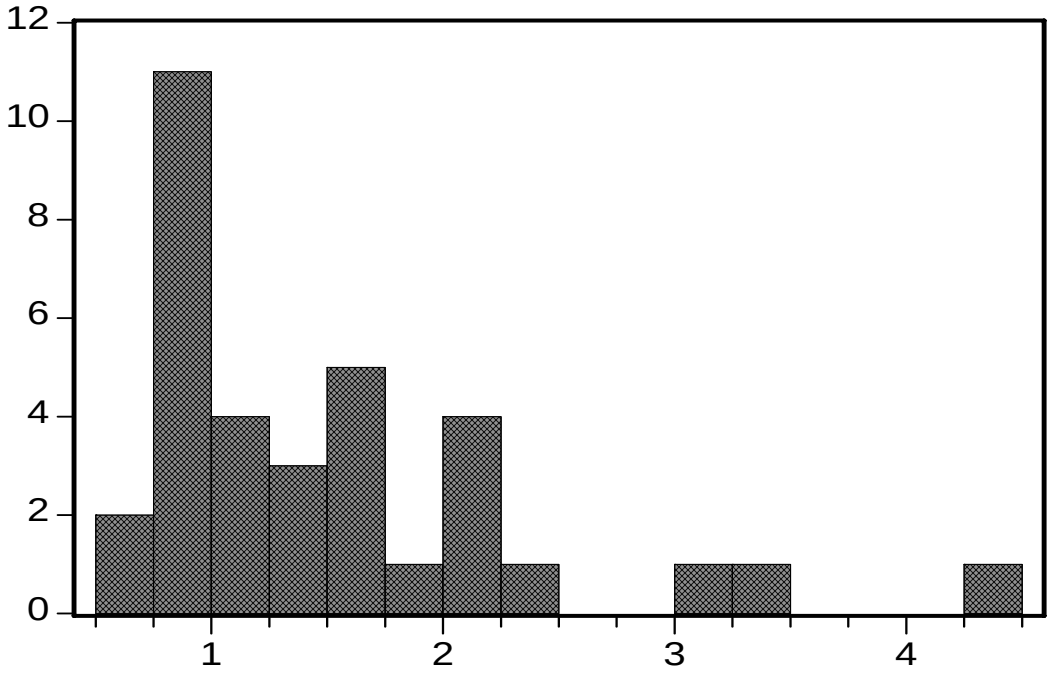
1.43 The central variable in the analysis is the level of oil vulnerability, so it is important to check whether this has risen or fallen over the period, making allowance for the rise in oil prices. The vulnerability in 1990 is calculated by multiplying net oil imports by the then Brent price of oil (US$23.7 a barrel) and dividing by current GDP. *The percentage change in vulnerability for many countries is larger than the 21 percent increase in average oil prices*. Figure 9 presents a histogram of the ratio of vulnerability in 2003 to that in 1990 for non-oil exporting countries.[8] Eight countries experienced a more than 100 percent increase in oil vulnerability and three countries (Burundi, Mauritania, and Togo) experienced an increase of more than 200 percent. For Sub-Saharan Africa as a whole (excluding South Africa whose large GDP dominates other countries) oil vulnerability increased by 29 percent, which is greater than the 21 percent increase in oil prices experienced during the same period, indicating that the physical amount of oil imported in relation to GDP increased by about 10 percent.

1.44 There is no correlation between the country-by-country increase in vulnerability and the increase in GDP or the average GDP per capita during the period, suggesting that changes in oil vulnerability experienced by different countries are not related in any simple fashion to the changes in income. One very important feature of Sub-Saharan Africa during this period was that in several countries GDP per capita (measured in constant 2002 prices) fell sharply between 1990 and 2003, 10 of the 37 oil importing countries experienced a fall more than 10 percent, and five countries experienced a fall of more than 20 percent. For Sub-Saharan Africa as a whole (excluding South Africa which dominates the statistics) income per capita rose only 13 percent during this 14-year period.

1.45 The debt ratio is very variable between countries with some countries experiencing a more than doubling in the ratio of debt to GDP (Burundi, Central African Republic, Malawi, and Rwanda). Again, *for Africa as a whole (excluding South Africa) the ratio of debt to GDP fell from 73 percent to 62 percent, thus slightly reducing the vulnerability to an oil shock compared to 1990.*

[8] Benin is excluded because it was producing most of its own oil consumption in 1990, but virtually none in 2003, leading to a huge increase in vulnerability.

Figure 9: Histogram of the Ratio of Oil Vulnerability in 2003 to Oil Vulnerability in 1990



Linking Changes in Oil Vulnerability to Other Factors

1.46 Using the formula given above, and noting that oil vulnerability is measured in value terms (multiplying by the oil price) while the other terms are in physical units per US$, for relatively small percentage changes, the following decomposition holds:

1.47 Percentage change in oil vulnerability = percentage change of oil price + percentage change of (net oil imports/total oil use) + percentage change of (total oil use /total energy use) + percentage change of (total energy use/GDP). Since for most countries in Africa there is no change in the degree of self sufficiency over the period, the percentage change in vulnerability is approximately equal to the sum of the percentage changes in the oil price, the energy intensity, and the oil dependence.

Energy Intensity

1.48 The change in energy intensity measured in net terms (excluding biomass) is highly variable between countries. Fifteen countries experienced increases of more than 30 percent in the ratio of total commercial energy used per US$ of GDP, while several experienced reductions of more than 20 percent. Overall the weighted average for Sub-Saharan Africa (excluding South Africa) increased by 13 percent. Regressions of the

change in energy intensity on the change in GDP and on the level of GDP per capita indicate that these are only weakly correlated, indicating that there are other important factors leading to changes in energy intensity.

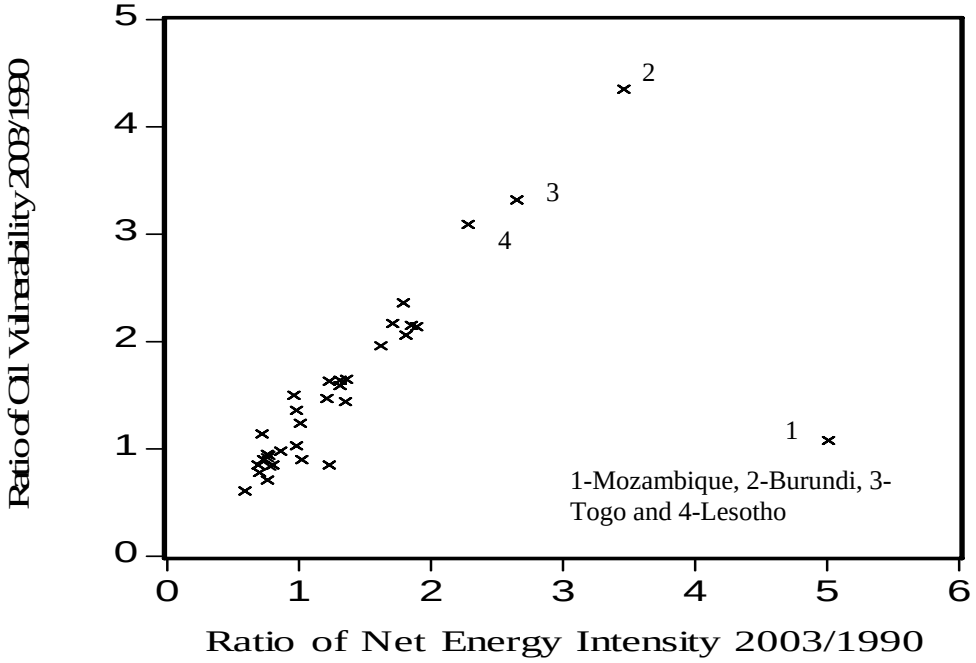
Oil Intensity

1.49 Because most of the countries included in this sample depended entirely on imported oil, the oil intensity between 1990 and 2003 changed similarly to oil vulnerability net of the rise in oil prices. There is no significant correlation between changes in oil intensity and the growth in GDP per capita.

Oil Dependence

1.50 For the set of countries where there is no biomass data available, oil dependency is fairly constant, since in 23 countries it changes by less than 10 percent. In two countries (Ghana and Zimbabwe) it increased by more than 20 percent, while in five countries it fell by more than 20 percent. For Africa as a whole (excluding South Africa) oil dependence (excluding biomass) fell by 6 percent, indicating that there was only a small substitution away to other primary fuels. This indicates that changes in oil vulnerability (and oil intensity) are dominated by changes in energy intensity since the use of oil maintains a fairly constant share of total energy. Figure 10 plots the ratio of oil vulnerability in 2003 to 1990 to the ratio of net energy intensity between the same two years. The data shows an almost perfect fit, with the exception of Mozambique where the additional substantial hydro output in the late 1990s raised total energy use, but did not result in oil use falling. This confirms strongly that where energy intensity changed there were parallel changes in oil vulnerability. Hence the major drivers for changes in oil vulnerability over time were the change in the oil price, which affected all net oil importers in the same fashion, and the change in energy intensity. Since changes in energy intensity are not correlated with growth in GDP per capita, other country specific factors must be involved.

Figure 10: The Ratios of Oil Vulnerability and Net Energy Intensity in 2003 to 1990



1.51 For the countries where there is biomass data available oil dependency was almost constant indicating again that, as total energy use increased, biomass use also increased proportionately, and indeed for some countries (Ethiopia, Ghana, Tanzania, Kenya and Zambia) it increased faster than total primary energy, indicating that these economies had become increasingly dependent on biomass. Moreover, for these countries the share of biomass was high, indicating that if, *as the level of GDP per capita starts to rise in Africa, there is a tendency to switch away from biomass to commercial fuels, then oil dependence is likely to increase further in the future*.

Success and Failures

1.52 Given the wide variety in performance of oil vulnerability between 1990 and 2003, it is instructive to examine the most and least successful countries for common factors over that period. Table 5 highlights the ratios of the various factors for the top eight and bottom seven countries.

Table 5: Best and Worst Performances of Oil Vulnerability between 1990 and 2003

	Oil Vulnerability Ratio	*Energy Intensity Ratio Net*	*Oil Dependency Ratio Net*	*GDP Ratio*	*TPEC Ratio*
Best					
Tanzania	0.611	0.589	0.842	2.418	1.425
Namibia	0.713	0.756	0.732	1.817	1.374
Swaziland	0.779	0.700	0.911	2.147	1.504
Zambia	0.840	0.783	0.878	1.318	1.033
Cape Verde	0.846	0.689	1.000	2.354	1.622
Guinea	0.852	0.798	0.873	1.288	1.028
Lesotho	0.853	1.229	0.580	1.851	2.275
Kenya	0.895	0.726	1.016	1.681	1.221
Worst					
Malawi	2.064	1.809	0.940	0.911	1.649
Burkina Faso	2.137	1.895	0.945	1.340	2.540
Ethiopia	2.153	1.845	0.954	0.773	1.426
C.A.R.	2.171	1.709	1.046	0.806	1.377
Rwanda	2.362	1.789	1.087	0.634	1.133
Togo	3.091	2.281	1.169	1.080	2.464
Burundi	3.324	2.652	1.034	0.526	1.395

1.53 The table highlights the dramatic differences between countries for whom the oil vulnerability improved, despite the increase in the oil price, and those for whom it worsened considerably. In all cases countries were completely dependent on imports for oil and oil products.

1.54 For the group of countries who improved their oil vulnerability, most reduced their oil dependence and also reduced their energy intensity. Guinea, Lesotho, Namibia, Tanzania, and Zambia all increased the share of hydro in total energy considerably,[9] thus allowing the share of other fuels to drop. At the same time, these countries, most of which grew strongly during the period, as shown by the ratio of GDP, increased the total amount of primary energy consumed (TPEC), but at a much lower rate than the increase of GDP, so that energy consumption was partially de-coupled from

[9] The shares of hydro in total primary energy for 1990 were: Guinea (8 percent) Lesotho (0 percent) Namibia (0 percent) Tanzania (29 percent) and Zambia (37 percent); while in 2003 they were: Guinea (20 percent) Lesotho (55 percent) Namibia (31 percent) Tanzania (38 percent) and Zambia (48 percent).

economic growth. These countries experienced growth from sectors that were less energy intensive than the average for the economy.

1.55 The worst performers had rather small changes in oil dependency, some even improving it slightly, but experienced a very large increase in energy intensity. Five of the countries in the group experienced declines in per capita GDP during the period, but all experienced increases (some very substantial) in the total amount of primary energy consumed. This produced a different type of de-coupling of energy use from GDP—even when income was falling energy use was rising, again suggesting that there were dramatic shifts within sectoral composition of demand of a type where some energy intensive sectors increased despite the overall decrease in output.

1.56 The performance of the most successful economies, and the complete failure of other economies, raises very important questions about the role of economic growth in raising the demand for energy but reducing energy intensity and oil vulnerability. *The fact that certain countries have been able to grow quickly while reducing energy intensity does give some hope that policies exist for successful development that do not increase the vulnerability of the economy to higher oil prices. Detailed analysis of these cases is urgently needed to see whether the sectoral evidence provides clues as to how this combination of outcomes was achieved.* The performance of the East Asian economies which managed a rapid increase in growth, and an increase in energy intensity, coupled with only a small increase in oil vulnerability (less than the increase in the oil price) provides evidence that there are growth strategies that can be successful and can contain the costs of the energy used to do so.

Conclusions and Implications for Policy

1.57 It has been shown that on a regional basis Sub-Saharan Africa net oil importing countries are highly vulnerable to oil shocks, have the highest ratio of external debt to GDP and the lowest per capita income. The recent price rises have weighed on the Sub-Saharan African net oil importing countries severely, being equivalent to a cumulative loss of GDP of around 3.5 percent over the last two years. What distinguishes Africa from other regions is its almost complete reliance on imported oil (apart from the net oil exporters) and its very high oil fuel dependence (for example, South Asia's share of oil in total primary energy is about one half of that of Africa). These extreme values are partially offset by its lower total energy intensity and oil intensity, but these may actually increase as the region experiences further development.

1.58 For the near future there is little prospect that countries can reduce their import dependence on oil, and international evidence suggests also that it would be difficult to achieve large shifts in the dependence on oil as a source of primary energy within a short period. Encouraging hydropower is a valuable policy tool to affect oil dependence since it is independent of the price of oil (unlike gas) and can form a direct substitute for the use of more hydrocarbons for power generation. Policies to encourage both large and small hydro schemes will take some time to come to fruition, but should be actively encouraged as part of fuel diversification in any power sector expansion plan.

Such policies would also have to take into account that in some cases, hydro power has also been risky, depending on variable hydrology.

1.59 Gas has not yet penetrated into non-oil exporting countries, but for some coastal economies near to oil producers it may be an attractive option (for example, the West African gas pipeline is expected to deliver gas to Togo and Benin as well as to Ghana). To the extent that gas contract prices are tied to world oil prices the gains over using oil itself may be limited. Coal, which is currently used in Niger, Swaziland, South Africa and Botswana, may also be an attractive option for some countries well situated for its transportation.

1.60 One dimension where there is some hope of short run changes is the energy intensity variable (and by association the oil intensity variable). Within Africa there is considerable variation in energy intensity between countries, and there is little evidence that differences in energy intensity or oil intensity are systematically related to the level of GDP, indicating that country-specific factors appear to dominate the pattern of oil and energy use. Evidence for a limited period suggests that oil intensity is strongly correlated with vehicle ownership and the degree of urbanization, both of which have increased steadily, and are likely to continue to increase with the general level of development.

1.61 The most promising policies to reduce oil vulnerability appear to be related to the ability to encourage countries to reduce their use of oil and energy simultaneously (since there is little short-run prospect of large-scale fuel substitution). One policy to improve the oil intensity of an economy would be to allow prices to rise at least to their international levels, which would allow the effects of price elasticities to work, even though the effect on oil demand may not be large and will not be felt immediately. This policy may affect poorer members of society, so that a careful balance between economy-wide objectives and distributional considerations would be needed. Policies to encourage oil saving through transport schemes designed to favor mass transportation, as suggested by the IEA for developed countries, are much less applicable to developing countries. However, there may be transport-related policies more suited to the African context to encourage more efficient and less wasteful oil use. Investigating this possibility, for individual countries, should be a high priority.

1.62 For countries which are starting to see some better prospects for economic growth, even a reduction in future oil prices is not guaranteed to reduce oil vulnerability, since the likely increase in oil intensity could well offset this. Were African levels of energy and oil intensity to rise toward levels found in South Asia, these would offset the impacts of even a halving of the oil price.

1.63 The analysis of the best and worst performers, in terms of changes in oil vulnerability over the period 1990 to 2003, indicates that sectoral shifts in demand are likely to have played a major part in determining the current oil vulnerability. More information on individual country experience may be able to provide deeper insights into

how changes in the structure of these economies related to the overall demand for energy and oil.

1.64 The general conclusion of this report is that there is a serious problem of adjusting to the present and potential future oil shocks in Africa. There would appear to be no one or two large policies which could substantially reduce vulnerability to these price increases across the board. Several policy alternatives are available, and detailed study of individual economies may give insights as to which policies could be utilized in the context of the specific economy.

Annex 1

The Calculation of Oil Vulnerability

Oil vulnerability is defined as the value of net oil imports divided by current GDP. It is calculated from data on oil production and oil product consumption (in 000 barrels a day) from EIA database. Values are estimated by multiplying volumes by the Brent price of oil for that year. The measure is dimensionless.

The oil price is for dated Brent blend averaged for the year, and is taken from Platts Oilgram Price Report. Units are US$ per barrel of oil. In practice different regions (and countries) will have paid different amounts per barrel for oil and oil products, but the general price increase over the period will be very similar for all regions.

Import dependency is defined as the difference between oil consumption and oil production divided by oil consumption, using the same data as for vulnerability. The measure is dimensionless.

Energy intensity is measured by the ratio of total primary energy consumption (in quadrillion BTU) divided by GDP in current US$ billion. Total primary energy consumption (which is measured net of biomass) is taken from the IEA database. GDP data are taken from the World Bank Central database. Units are BTU per US$.

Oil dependency is the ratio of the consumption of oil in BTU to total consumption of primary energy in BTU. Data are taken from EIA database. The measure is dimensionless.

The standard conversion factor for 1 barrel of oil is 5.8 million BTU. Oil products, especially gasoline, have lower conversion factors.

Sub-Saharan Africa excludes South Africa, since its dominant size weights the aggregate picture very heavily.

East Asia omits China, since its history of economic development and size distort the picture for the region and affect inter-regional comparisons.

Only developing countries are included in the regional aggregates, and all net oil (crude and products) exporting countries are excluded.

GDP per capita in current US$ is taken from the World Bank Central Database.

The ratio of external debt to GDP (both in current US$) is taken from the World Bank Central Database.

Annex 2

Impact of Oil Shocks on Net Oil Importing Countries in Africa

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Burundi	3.0	0	3.0	1.0	0.60	0.053	1.7	3.6	100	205
Ethiopia	27.0	0	27.0	1.0	6.65	0.043	1.4	2.9	102	110
Liberia	3.4	0	3.4	1.0	0.44	0.081	2.6	5.5	123	267
Guinea-Bissau	2.5	0	2.5	1.0	0.24	0.108	3.5	7.4	135	312
Sierra Leone	6.5	0	6.5	1.0	0.79	0.086	2.8	5.9	141	156
Malawi	5.5	0	5.5	1.0	1.71	0.033	1.1	2.3	157	169
Eritrea	4.6	0	4.6	1.0	0.75	0.065	2.1	4.4	163	84
Niger	5.4	0	5.4	1.0	2.73	0.021	0.7	1.4	178	77
Central African Republic	2.4	0	2.4	1.0	1.20	0.021	0.7	1.4	229	110
Madagascar	15.0	0	15.0	1.0	5.47	0.029	0.9	2.0	233	NA
Burkina Faso	8.0	0	8.0	1.0	4.18	0.020	0.7	1.4	253	43
Mozambique	11.0	0	11.0	1.0	4.32	0.027	0.9	1.8	255	116
Mali	4.3	0	4.3	1.0	4.33	0.010	0.3	0.7	258	74
Rwanda	6.0	0	6.0	1.0	1.64	0.039	1.3	2.6	260	85
Gambia, The	2.0	0	2.0	1.0	.395	0.053	1.7	4.1	324	172
Ghana	39.0	7.0	32.0	0.8	7.62	0.044	1.4	3.0	276	93
Uganda	10.0	0	10.0	1.0	6.30	0.017	0.5	1.1	277	72
Togo	8.5	0	8.5	1.0	1.76	0.051	1.7	3.5	292	97
Tanzania	22.0	0	22.0	1.0	10.30	0.022	0.7	1.5	309	73
Sao Tome and Principe	0.7	0	0.7	1.0	0.06	0.115	3.7	7.9	334	NA
Kenya	52.0	0	52.0	1.0	14.38	0.038	1.2	2.6	341	47
Zambia	12.3	0	12.3	1.0	4.34	0.030	1.0	2.0	354	148
Comoros	0.7	0	0.7	1.0	0.32	0.023	0.7	1.6	365	88
Mauritania	24.0	0	24.0	1.0	1.09	0.231	7.5	15.8	372	NA
Benin	12.0	0.4	11.6	1.0	3.48	0.035	1.1	2.4	392	52
Guinea	8.4	0	8.4	1.0	3.63	0.024	0.8	1.7	431	88
Senegal	31.0	0	31.0	1.0	6.50	0.050	1.6	3.4	485	64
Lesotho	1.4	0	1.4	1.0	1.14	0.013	0.4	0.9	530	66
Djibouti	12.0	0	12.0	1.0	0.62	0.202	6.6	13.8	848	NA
Cape Verde	1.2	0	1.2	1.0	0.80	0.016	0.5	1.1	1290	45
Swaziland	3.5	0	3.5	1.0	1.85	0.020	0.6	1.4	1358	19

	A	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*
Namibia	16.0	0	16.0	1.0	4.27	0.039	1.3	2.7	1845	15
South Africa	484.0	29.6	454.4	0.9	159.89	0.030	1.0	2.0	3026	17
Botswana	12.0	0	12.0	1.0	7.53	0.017	0.5	1.1	3532	6
Mauritius	21.0	0	21.0	1.0	5.22	0.042	1.4	2.9	4161	35
Seychelles	7.6	0	7.6	1.0	0.72	0.111	3.6	7.6	6881	78

Notes to Annex Table 1

A: Oil and oil products consumption in 2003 in 000 barrels per day

B: Domestic oil production in 2003 in 000 barrels per day

C: Net imports of oil and oil products in 2003 in 000 barrels a day (oil consumption minus oil production)

D: Oil import dependence in 2003 (net oil imports / oil consumption)

E: GDP in 2003 in current US$

F: Estimated vulnerability to oil in 2003 (net oil imports* 365*1000* average Brent price [US$28.84] in 2003 / GDP)

G: Estimated size of shock as percentage of 2003 GDP following an average annual price increase of Brent to US$38.21 (vulnerability * 33 percent)

H: Estimated size of shock as percentage of 2003 GDP following an average annual price increase of Brent to US$49.54 (vulnerability * 72 percent)

I: GDP per capita in 2003

J: Ratio of external debt to GDP in 2003

Annex 3

Shares of Primary Fuels in Total Energy, Energy Intensity and Oil Intensity (2003) for Net Oil Importing Countries

	GDP pc	*Oil Products %*	*Gas %*	*Coal %*	*Hydro %*	*Biomass %*	*Energy Intensity Net*	*Energy Intensity Gross*	*Oil Intensity*
Congo D.R. of	87	16	0	6	56	23	14,953	19,298	3,007
Burundi	100	81	0	0	19	NA	12,815	NA	10,420
Ethiopia	102	7	0	0	3	90	11,680	120,676	8,545
Liberia	123	100	0	0	0	NA	16,111	NA	16,111
Guinea-Bissau	135	100	0	0	0	NA	21,617	NA	21,617
Sierra Leone	141	100	0	0	0	NA	17,545	NA	17,545
Malawi	157	45	0	2	53	NA	14,317	NA	6,475
Eritrea	163	31	0	0	0	69	12,996	41,916	12,996
Niger	178	71	0	29	0	NA	5,761	NA	4,110
Chad	218	100	0	0	0	NA	1,149	NA	1,149
C.A.R.	229	85	0	0	15	NA	4,860	NA	4,133
Madagascar	233	84	0	1	15	NA	6,752	NA	5,684
Burkina Faso	253	93	0	0	7	NA	4,273	NA	3,986
Mozambique	255	5	0	0	34	61	41,367	104,953	5,254
Mali	258	57	0	0	43	NA	3,548	NA	2,009
Rwanda	260	93	0	0	7	NA	8,280	NA	7,686
Gambia, The	276	100	0	0	0	NA	10,301	NA	10,301
Ghana	276	23	0	0	13	64	16,416	45,257	10,362
Uganda	277	54	0	0	46	NA	6,060	NA	3,259
Togo	292	29	0	0	0	71	9,870	34,259	9,853
Tanzania	309	8	0	0	5	87	7,530	57,627	4,469
Sao Tome	334	95	0	0	5	NA	23,891	NA	22,686
Kenya	341	17	0	1	5	76	10,642	44,531	7,574

	GDP pc	*Oil Products %*	*Gas %*	*Coal %*	*Hydro %*	*Biomass %*	*Energy Intensity Net*	*Energy Intensity Gross*	*Oil Intensity*
Zambia	354	8	0	1	26	65	26,539	75,264	5,855
Nigeria	357	16	7	0	2	75	16,869	68,281	10,724
Comoros	365	99	0	0	1	NA	4,556	NA	4,492
Mauritania	372	99	0	0	1	NA	45,879	NA	45,363
Benin	392	28	0	0	0	72	6,943	24,595	6,937
Guinea	431	80	0	0	20	NA	6,175	NA	4,948
Sudan	433	20	0	0	2	78	7,787	36,002	7,024
Senegal	485	47	1	0	0	52	10,110	21,148	9,866
Lesotho	530	45	0	0	55	NA	5,682	NA	2,536
Cote d'Ivoire	597	15	17	0	6	62	7,714	20,208	2,987
Cameroon	634	17	0	0	10	73	6,130	22,654	3,765
Angola	814	26	7	0	4	64	10,209	28,181	7,203
Djibouti	848	100	0	0	0	NA	42,098	NA	42,098
Congo Rep. of	943	2	0	0	1	98	4,008	164,429	3,025
Cape Verde	1,290	100	0	0	0	NA	2,964	NA	2,964
Swaziland	1,358	38	0	51	11	NA	9,976	NA	3,812
Namibia	1,845	60	0	0	27	13	11,020	12,692	7,594
South Africa	3,026	18	2	68	0	9	30,728	33.884	6,203
Botswana	3,532	50	0	50	0	NA	6,297	NA	3,157
Eq. Guinea	3,716	5	95	0	0	NA	16,978	NA	860
Gabon	3,865	33	4	0	13	50	6,455	12,908	4,268
Mauritius	4,161	83	0	14	2	NA	9,969	NA	8,320
Seychelles	6,881	100	0	0	0	NA	22,336	NA	22,336

Notes to Annex 3:

Petroleum, gas, coal and hydro (plus thermal, solar and wind) supplies of primary energy are taken from IEA.

For 20 countries data are available from IEA on the use of biomass for primary energy supply.

Total energy supply is defined as the sum of all primary energy sources, including biomass when available. Total energy including biomass is gross, and without biomass is net.

Energy intensity is taken from the ratio of total primary energy supply (including biomass where available) to GDP and is shown as BTU per US$ in 2003 values.

Shares of the various primary energy sources are derived from the relevant total energy figure. Where biomass data is available shares are taken in gross energy, otherwise shares are taken in net energy.

Oil intensity is shown as BTU per US$ in 2003 values.

Annex 4

Percentage Changes from 1990 to 2003

	Oil Vulnerability	*Energy Intensity Net*	*Energy Intensity Gross*	*Oil Intensity*	*Oil Dependency Net*	*Oil Dependency Gross*	*Debt Ratio*	*Mean GDP PC*	*GDP*
Benin	9629	44	-35	56	8	141	-25	3	31
Botswana	14	-28	NA	-7	29	NA	-56	3009.3	42
Burkina Faso	114	89	NA	79	-5	NA	59	224.97	28
Burundi	232	165	NA	174	3	NA	155	124.13	-32
Cape Verde	-15	-31	NA	-31	0	NA	14	1088	46
C.A.R.	117	71	NA	79	5	NA	135	252.03	-17
Comoros	24	1	NA	2	0	NA	NA	399.83	-16
Djibouti	-8	-24	NA	-24	0	NA	NA	1046.7	-32
Ethiopia	115	85	70	76	-5	4	9	98.54	8
Gambia, The	47	21	NA	21	0	NA	47	325.92	-1
Ghana	50	-4	4	45	51	40	42	244.85	29
Guinea	-15	-20	NA	-30	-13	NA	0	398.95	17
Guinea-Bissau	65	36	NA	36	0	NA	10	159.28	-26
Kenya	-10	-27	-26	-26	2	-1	-43	359.73	-10
Lesotho	-15	23	NA	-29	-42	NA	2	460.9	36
Liberia	-5	-24	NA	-24	0	NA	-44	150.93	-32
Madagascar	63	23	NA	34	9	NA	NA	256.97	-17
Malawi	106	81	NA	70	-6	NA	104	150.2	10
Mali	-10	2	NA	-26	-27	NA	-27	225.3	34
Mauritania	335	246	NA	253	2	NA	NA	338.15	22
Mauritius	-2	-14	NA	-20	-7	NA	-8	3341.5	65
Mozambique	8	401	-11	-12	-82	-2	NA	203.16	68
Namibia	-29	-24	-8	-45	-27	-40	NA	1725.4	15
Niger	36	-2	NA	12	14	NA	11	187.32	-10
Rwanda	136	79	NA	94	9	NA	209	258.22	1
Sao Tome	64	31	NA	36	3	NA	NA	335.05	-1

	Oil Vulnerability	*Energy Intensity Net*	*Energy Intensity Gross*	*Oil Intensity*	*Oil Dependency Net*	*Oil Dependency Gross*	*Debt Ratio*	*Mean GDP PC*	*GDP*
Senegal	96	62	35	58	-2	17	-2	456.76	13
Seychelles	59	31	NA	31	0	NA	57	6262.4	22
Sierra Leone	-6	-23	NA	-23	0	NA	-12	198.4	-45
South Africa	3	-2	-1	-11	-9	-10	3257	3041.8	-1
Swaziland	-22	-30	NA	-36	-9	NA	-34	1347.3	2
Tanzania	-39	-41	-40	-50	-16	-17	-52	287.86	16
Togo	209	128	51	167	17	77	23	300.87	-6
Uganda	44	35	NA	19	-12	NA	20	226.69	56
Zambia	-16	-22	-10	-31	-12	-23	-30	371.7	-9

Annex 5

Vehicle Ownership and Urbanization in 1990 and 1996

Country Name	*Vehicles/ GDP 90*	*Vehicles/ GDP 96*	*Urban 90*	*Urban 96*
Benin	0.0097	0.0248	34.5	39.1
Botswana	0.0073	0.0182	42.3	47.5
Burkina Faso	0.0178	0.0250	13.6	15.3
Cape Verde	0.0098	0.0101	44.2	55.8
C.A.R.	0.0026	0.0016	37.5	39.5
Comoros	0.0297	0.0756	27.9	31.0
Ethiopia	0.0136	0.0145	12.7	14.3
Gambia, The	0.0397	0.0511	24.9	28.3
Guinea	0.0118	0.0132	23.4	25.8
Guinea-Bissau	0.0367	0.0583	23.8	28.4
Kenya	0.0329	0.0360	24.0	29.4
Lesotho	0.0271	0.0403	20.1	24.8
Liberia	0.0756	0.3010	42.0	42.6
Madagascar	0.0217	0.0315	23.6	27.0
Malawi	0.0304	0.0365	11.6	13.4
Mali	0.0181	0.0229	23.8	27.5
Mauritius	0.0235	0.0260	40.5	40.7
Mozambique	0.0268	0.0046	21.1	27.4
Namibia	0.0440	0.0476	26.6	29.0
Niger	0.0307	0.0328	16.1	18.7
Rwanda	0.0094	0.0235	5.3	5.8
Sao Tome and Principe	0.1074	0.1312	39.1	43.9

Country Name	*Vehicles/ GDP 90*	*Vehicles/ GDP 96*	*Urban 90*	*Urban 96*
Senegal	0.0255	0.0338	40.0	44.5
Seychelles	0.0184	0.0191	53.5	60.1
Sierra Leone	0.0401	0.0321	30.0	33.9
Swaziland	0.0496	0.0517	23.8	25.3
Tanzania	0.0185	0.0179	21.7	28.0
Togo	0.0768	0.0963	28.5	31.3
Uganda	0.0094	0.0185	11.2	12.9
Zambia	0.0363	0.0775	39.4	39.3
South Africa	0.0455	0.0470	48.8	53.5
Weighted Average	**0.028**	**0.033**	**24.2**	**27.7**
Weighted Average (less South Africa)	**0.026**	**0.031**	**20.5**	**23.9**

Notes:

Vehicles per 1,000 population divided by GDP per capita. World Bank central database.

Percentage of population living in urban areas. World Bank central database.

Annex 6

Shares (%) of Various Petroleum Products in Total Consumption in 2002 (Non-oil Exporters that Import All Products for Domestic Use)

Country	*Motor Gasoline*	*Jet Fuel*	*Kerosene*	*Distillate Fuel Oil*	*Residual Fuel Oil*	*LPG*
Benin	46	4	22	24	4	1
Botswana	43	0	0	36	1	9
Burkina Faso	22	0	6	22	8	0
Burundi	21	10	3	19	6	2
Cape Verde	17	0	9	49	2	20
Central African Republic	20	25	23	26	4	0
Comoros	20	3	15	42	0	0
Djibouti	4	14	2	16	57	2
Eritrea	8	4	11	47	23	3
Ethiopia	13	8	15	52	10	0
Gambia, The	41	0	11	48	1	0
Guinea	22	2	9	18	39	0
Guinea-Bissau	17	9	6	27	20	1
Lesotho	36	0	21	29	14	0
Liberia	26	3	6	29	25	3
Mali	37	10	9	40	4	0
Mauritania	28	2	7	17	28	7
Mauritius	9	23	2	36	19	9
Mozambique	22	7	7	57	3	3
Namibia	37	4	0	52	2	4
Niger	22	12	3	57	5	0

Country	*Motor Gasoline*	*Jet Fuel*	*Kerosene*	*Distillate Fuel Oil*	*Residual Fuel Oil*	*LPG*
Reunion	17	19	8	27	10	6
Rwanda	14	6	4	32	6	0
Saint Helena	27	0	25	48	0	0
Sao Tome and Principe	22	0	7	67	0	0
Seychelles	6	10	2	67	12	2
Somalia	21	21	10	31	6	0
Swaziland	45	0	4	40	1	3
Tanzania	18	7	12	51	10	1
Togo	36	6	7	28	0	0
Uganda	36	8	10	38	7	0
Western Sahara	8	5	5	55	24	0
Zimbabwe	26	10	7	53	0	1

Joint UNDP/World Bank

ENERGY SECTOR MANAGEMENT ASSISTANCE PROGRAMME (ESMAP)

LIST OF REPORTS ON COMPLETED ACTIVITIES

Region/Country	*Activity/Report Title*	*Date*	*Number*
	SUB-SAHARAN AFRICA (AFR)		
Africa Regional	Anglophone Africa Household Energy Workshop (English)	07/88	085/88
	Regional Power Seminar on Reducing Electric Power System Losses in Africa (English)	08/88	087/88
	Institutional Evaluation of EGL (English)	02/89	098/89
	Biomass Mapping Regional Workshops (English)	05/89	--
	Francophone Household Energy Workshop (French)	08/89	--
	Interafrican Electrical Engineering College: Proposals for Short- and Long-Term Development (English)	03/90	112/90
	Biomass Assessment and Mapping (English)	03/90	--
	Symposium on Power Sector Reform and Efficiency Improvement in Sub-Saharan Africa (English)	06/96	182/96
	Commercialization of Marginal Gas Fields (English)	12/97	201/97
	Commercilizing Natural Gas: Lessons from the Seminar in Nairobi for Sub-Saharan Africa and Beyond	01/00	225/00
	Africa Gas Initiative – Main Report: Volume I	02/01	240/01
	First World Bank Workshop on the Petroleum Products Sector in Sub-Saharan Africa	09/01	245/01
	Ministerial Workshop on Women in Energy	10/01	250/01
	Energy and Poverty Reduction: Proceedings from a Multi-Sector And Multi-Stakeholder Workshop Addis Ababa, Ethiopia, October 23-25, 2002.	03/03	266/03
	Opportunities for Power Trade in the Nile Basin: Final Scoping Study	01/04	277/04
	Énergies modernes et réduction de la pauvreté: Un atelier multi-sectoriel. Actes de l'atelier régional. Dakar, Sénégal, du 4 au 6 février 2003 (French Only)	01/04	278/04
	Énergies modernes et réduction de la pauvreté: Un atelier multi-sectoriel. Actes de l'atelier régional. Douala, Cameroun du 16-18 juillet 2003. (French Only)	09/04	286/04
	Energy and Poverty Reduction: Proceedings from the Global Village Energy Partnership (GVEP) Workshops held in Africa	01/05	298/05
	Power Sector Reform in Africa: Assessing the Impact on Poor People	08/05	306/05
	The Vulnerability of African Countries to Oil Price Shocks: Major Factors and Policy Options. The Case of Oil Importing Countries	08/05	308/05
Angola	Energy Assessment (English and Portuguese)	05/89	4708-ANG
	Power Rehabilitation and Technical Assistance (English)	10/91	142/91
	Africa Gas Initiative – Angola: Volume II	02/01	240/01
Benin	Energy Assessment (English and French)	06/85	5222-BEN
Botswana	Energy Assessment (English)	09/84	4998-BT
	Pump Electrification Prefeasibility Study (English)	01/86	047/86
	Review of Electricity Service Connection Policy (English)	07/87	071/87
	Tuli Block Farms Electrification Study (English)	07/87	072/87
	Household Energy Issues Study (English)	02/88	--
	Urban Household Energy Strategy Study (English)	05/91	132/91
Burkina Faso	Energy Assessment (English and French)	01/86	5730-BUR
	Technical Assistance Program (English)	03/86	052/86
	Urban Household Energy Strategy Study (English and French)	06/91	134/91
Burundi	Energy Assessment (English)	06/82	3778-BU

Region/Country	*Activity/Report Title*	*Date*	*Number*
Burundi	Petroleum Supply Management (English)	01/84	012/84
	Status Report (English and French)	02/84	011/84
	Presentation of Energy Projects for the Fourth Five-Year Plan (1983-1987) (English and French)	05/85	036/85
	Improved Charcoal Cookstove Strategy (English and French)	09/85	042/85
	Peat Utilization Project (English)	11/85	046/85
	Energy Assessment (English and French)	01/92	9215-BU
Cameroon	Africa Gas Initiative – Cameroon: Volume III	02/01	240/01
Cape Verde	Energy Assessment (English and Portuguese)	08/84	5073-CV
	Household Energy Strategy Study (English)	02/90	110/90
Central African Republic	Energy Assessment (French)	08/92	9898-CAR
Chad	Elements of Strategy for Urban Household Energy The Case of N'djamena (French)	12/93	160/94
Comoros	Energy Assessment (English and French)	01/88	7104-COM
	In Search of Better Ways to Develop Solar Markets: The Case of Comoros	05/00	230/00
Congo	Energy Assessment (English)	01/88	6420-COB
	Power Development Plan (English and French)	03/90	106/90
	Africa Gas Initiative – Congo: Volume IV	02/01	240/01
Côte d'Ivoire	Energy Assessment (English and French)	04/85	5250-IVC
	Improved Biomass Utilization (English and French)	04/87	069/87
	Power System Efficiency Study (English)	12/87	--
	Power Sector Efficiency Study (French)	02/92	140/91
	Project of Energy Efficiency in Buildings (English)	09/95	175/95
	Africa Gas Initiative – Côte d'Ivoire: Volume V	02/01	240/01
Ethiopia	Energy Assessment (English)	07/84	4741-ET
	Power System Efficiency Study (English)	10/85	045/85
	Agricultural Residue Briquetting Pilot Project (English)	12/86	062/86
	Bagasse Study (English)	12/86	063/86
	Cooking Efficiency Project (English)	12/87	--
	Energy Assessment (English)	02/96	179/96
Gabon	Energy Assessment (English)	07/88	6915-GA
	Africa Gas Initiative – Gabon: Volume VI	02/01	240/01
The Gambia	Energy Assessment (English)	11/83	4743-GM
	Solar Water Heating Retrofit Project (English)	02/85	030/85
	Solar Photovoltaic Applications (English)	03/85	032/85
	Petroleum Supply Management Assistance (English)	04/85	035/85
Ghana	Energy Assessment (English)	11/86	6234-GH
	Energy Rationalization in the Industrial Sector (English)	06/88	084/88
	Sawmill Residues Utilization Study (English)	11/88	074/87
	Industrial Energy Efficiency (English)	11/92	148/92
	Corporatization of Distribution Concessions through Capitalization	12/03	272/03
Guinea	Energy Assessment (English)	11/86	6137-GUI
	Household Energy Strategy (English and French)	01/94	163/94
Guinea-Bissau	Energy Assessment (English and Portuguese)	08/84	5083-GUB
	Recommended Technical Assistance Projects (English & Portuguese)	04/85	033/85
	Management Options for the Electric Power and Water Supply Subsectors (English)	02/90	100/90
	Power and Water Institutional Restructuring (French)	04/91	118/91
Kenya	Energy Assessment (English)	05/82	3800-KE
	Power System Efficiency Study (English)	03/84	014/84
	Status Report (English)	05/84	016/84

Region/Country	*Activity/Report Title*	*Date*	*Number*
Kenya	Coal Conversion Action Plan (English)	02/87	--
	Solar Water Heating Study (English)	02/87	066/87
	Peri-Urban Woodfuel Development (English)	10/87	076/87
	Power Master Plan (English)	11/87	--
	Power Loss Reduction Study (English)	09/96	186/96
	Implementation Manual: Financing Mechanisms for Solar Electric Equipment	07/00	231/00
Lesotho	Energy Assessment (English)	01/84	4676-LSO
Liberia	Energy Assessment (English)	12/84	5279-LBR
	Recommended Technical Assistance Projects (English)	06/85	038/85
	Power System Efficiency Study (English)	12/87	081/87
Madagascar	Energy Assessment (English)	01/87	5700-MAG
	Power System Efficiency Study (English and French)	12/87	075/87
	Environmental Impact of Woodfuels (French)	10/95	176/95
Malawi	Energy Assessment (English)	08/82	3903-MAL
	Technical Assistance to Improve the Efficiency of Fuelwood Use in the Tobacco Industry (English)	11/83	009/83
	Status Report (English)	01/84	013/84
Mali	Energy Assessment (English and French)	11/91	8423-MLI
	Household Energy Strategy (English and French)	03/92	147/92
Islamic Republic of Mauritania	Energy Assessment (English and French)	04/85	5224-MAU
	Household Energy Strategy Study (English and French)	07/90	123/90
Mauritius	Energy Assessment (English)	12/81	3510-MAS
	Status Report (English)	10/83	008/83
	Power System Efficiency Audit (English)	05/87	070/87
	Bagasse Power Potential (English)	10/87	077/87
	Energy Sector Review (English)	12/94	3643-MAS
Mozambique	Energy Assessment (English)	01/87	6128-MOZ
	Household Electricity Utilization Study (English)	03/90	113/90
	Electricity Tariffs Study (English)	06/96	181/96
	Sample Survey of Low Voltage Electricity Customers	06/97	195/97
Namibia	Energy Assessment (English)	03/93	11320-NAM
Niger	Energy Assessment (French)	05/84	4642-NIR
	Status Report (English and French)	02/86	051/86
	Improved Stoves Project (English and French)	12/87	080/87
	Household Energy Conservation and Substitution (English and French)	01/88	082/88
Nigeria	Energy Assessment (English)	08/83	4440-UNI
	Energy Assessment (English)	07/93	11672-UNI
	Strategic Gas Plan	02/04	279/04
Rwanda	Energy Assessment (English)	06/82	3779-RW
	Status Report (English and French)	05/84	017/84
	Improved Charcoal Cookstove Strategy (English and French)	08/86	059/86
	Improved Charcoal Production Techniques (English and French)	02/87	065/87
	Energy Assessment (English and French)	07/91	8017-RW
	Commercialization of Improved Charcoal Stoves and Carbonization Techniques Mid-Term Progress Report (English and French)	12/91	141/91
SADC	SADC Regional Power Interconnection Study, Vols. I-IV (English)	12/93	-
SADCC	SADCC Regional Sector: Regional Capacity-Building Program for Energy Surveys and Policy Analysis (English)	11/91	-
Sao Tome and Principe	Energy Assessment (English)	10/85	5803-STP
Senegal	Energy Assessment (English)	07/83	4182-SE

Region/Country	*Activity/Report Title*	*Date*	*Number*
Senegal	Status Report (English and French)	10/84	025/84
	Industrial Energy Conservation Study (English)	05/85	037/85
	Preparatory Assistance for Donor Meeting (English and French)	04/86	056/86
	Urban Household Energy Strategy (English)	02/89	096/89
	Industrial Energy Conservation Program (English)	05/94	165/94
Seychelles	Energy Assessment (English)	01/84	4693-SEY
	Electric Power System Efficiency Study (English)	08/84	021/84
Sierra Leone	Energy Assessment (English)	10/87	6597-SL
Somalia	Energy Assessment (English)	12/85	5796-SO
Republic of South Africa	Options for the Structure and Regulation of Natural Gas Industry (English)	05/95	172/95
Sudan	Management Assistance to the Ministry of Energy and Mining	05/83	003/83
	Energy Assessment (English)	07/83	4511-SU
	Power System Efficiency Study (English)	06/84	018/84
	Status Report (English)	11/84	026/84
	Wood Energy/Forestry Feasibility (English)	07/87	073/87
Swaziland	Energy Assessment (English)	02/87	6262-SW
	Household Energy Strategy Study	10/97	198/97
Tanzania	Energy Assessment (English)	11/84	4969-TA
	Peri-Urban Woodfuels Feasibility Study (English)	08/88	086/88
	Tobacco Curing Efficiency Study (English)	05/89	102/89
	Remote Sensing and Mapping of Woodlands (English)	06/90	--
	Industrial Energy Efficiency Technical Assistance (English)	08/90	122/90
	Power Loss Reduction Volume 1: Transmission and Distribution System Technical Loss Reduction and Network Development (English)	06/98	204A/98
	Power Loss Reduction Volume 2: Reduction of Non-Technical Losses (English)	06/98	204B/98
Togo	Energy Assessment (English)	06/85	5221-TO
	Wood Recovery in the Nangbeto Lake (English and French)	04/86	055/86
	Power Efficiency Improvement (English and French)	12/87	078/87
Uganda	Energy Assessment (English)	07/83	4453-UG
	Status Report (English)	08/84	020/84
	Institutional Review of the Energy Sector (English)	01/85	029/85
	Energy Efficiency in Tobacco Curing Industry (English)	02/86	049/86
	Fuelwood/Forestry Feasibility Study (English)	03/86	053/86
	Power System Efficiency Study (English)	12/88	092/88
	Energy Efficiency Improvement in the Brick and Tile Industry (English)	02/89	097/89
	Tobacco Curing Pilot Project (English)	03/89	UNDP Terminal Report
	Energy Assessment (English)	12/96	193/96
	Rural Electrification Strategy Study	09/99	221/99
Zaire	Energy Assessment (English)	05/86	5837-ZR
Zambia	Energy Assessment (English)	01/83	4110-ZA
	Status Report (English)	08/85	039/85
	Energy Sector Institutional Review (English)	11/86	060/86
	Power Subsector Efficiency Study (English)	02/89	093/88
	Energy Strategy Study (English)	02/89	094/88
	Urban Household Energy Strategy Study (English)	08/90	121/90
Zimbabwe	Energy Assessment (English)	06/82	3765-ZIM
	Power System Efficiency Study (English)	06/83	005/83
	Status Report (English)	08/84	019/84

Region/Country	*Activity/Report Title*	*Date*	*Number*
	Power Sector Management Assistance Project (English)	04/85	034/85
	Power Sector Management Institution Building (English)	09/89	--
Zimbabwe	Petroleum Management Assistance (English)	12/89	109/89
	Charcoal Utilization Pre-feasibility Study (English)	06/90	119/90
	Integrated Energy Strategy Evaluation (English)	01/92	8768-ZIM
	Energy Efficiency Technical Assistance Project: Strategic Framework for a National Energy Efficiency Improvement Program (English)	04/94	--
	Capacity Building for the National Energy Efficiency Improvement Programme (NEEIP) (English)	12/94	--
	Rural Electrification Study	03/00	228/00

EAST ASIA AND PACIFIC (EAP)

Asia Regional	Pacific Household and Rural Energy Seminar (English)	11/90	--
China	County-Level Rural Energy Assessments (English)	05/89	101/89
	Fuelwood Forestry Preinvestment Study (English)	12/89	105/89
	Strategic Options for Power Sector Reform in China (English)	07/93	156/93
	Energy Efficiency and Pollution Control in Township and Village Enterprises (TVE) Industry (English)	11/94	168/94
	Energy for Rural Development in China: An Assessment Based on a Joint Chinese/ESMAP Study in Six Counties (English)	06/96	183/96
	Improving the Technical Efficiency of Decentralized Power Companies	09/99	222/99
	Air Pollution and Acid Rain Control: The Case of Shijiazhuang City and the Changsha Triangle Area	10/03	267/03
	Toward a Sustainable Coal Sector In China	07/04	287/04
Fiji	Energy Assessment (English)	06/83	4462-FIJ
Indonesia	Energy Assessment (English)	11/81	3543-IND
	Status Report (English)	09/84	022/84
	Power Generation Efficiency Study (English)	02/86	050/86
	Energy Efficiency in the Brick, Tile and Lime Industries (English)	04/87	067/87
	Diesel Generating Plant Efficiency Study (English)	12/88	095/88
	Urban Household Energy Strategy Study (English)	02/90	107/90
	Biomass Gasifier Preinvestment Study Vols. I & II (English)	12/90	124/90
	Prospects for Biomass Power Generation with Emphasis on Palm Oil, Sugar, Rubberwood and Plywood Residues (English)	11/94	167/94
Lao PDR	Urban Electricity Demand Assessment Study (English)	03/93	154/93
	Institutional Development for Off-Grid Electrification	06/99	215/99
Malaysia	Sabah Power System Efficiency Study (English)	03/87	068/87
	Gas Utilization Study (English)	09/91	9645-MA
Mongolia	Energy Efficiency in the Electricity and District Heating Sectors	10/01	247/01
	Improved Space Heating Stoves for Ulaanbaatar	03/02	254/02
Myanmar	Energy Assessment (English)	06/85	5416-BA
Papua New Guinea	Energy Assessment (English)	06/82	3882-PNG
	Status Report (English)	07/83	006/83
	Institutional Review in the Energy Sector (English)	10/84	023/84
	Power Tariff Study (English)	10/84	024/84
Philippines	Commercial Potential for Power Production from Agricultural Residues (English)	12/93	157/93

Region/Country	*Activity/Report Title*	*Date*	*Number*
Philippines	Energy Conservation Study (English)	08/94	--
	Strengthening the Non-Conventional and Rural Energy Development Program in the Philippines: A Policy Framework and Action Plan	08/01	243/01
	Rural Electrification and Development in the Philippines: Measuring the Social and Economic Benefits	05/02	255/02
Solomon Islands	Energy Assessment (English)	06/83	4404-SOL
	Energy Assessment (English)	01/92	979-SOL
South Pacific	Petroleum Transport in the South Pacific (English)	05/86	--
Thailand	Energy Assessment (English)	09/85	5793-TH
	Rural Energy Issues and Options (English)	09/85	044/85
	Accelerated Dissemination of Improved Stoves and Charcoal Kilns (English)	09/87	079/87
	Northeast Region Village Forestry and Woodfuels Preinvestment Study (English)	02/88	083/88
	Impact of Lower Oil Prices (English)	08/88	--
	Coal Development and Utilization Study (English)	10/89	--
	Why Liberalization May Stall in a Mature Power Market: A Review of the Technical and Political Economy Factors that Constrained the Electricity Sector Reform in Thailand 1998-2002	12/03	270/03
	Reducing Emissions from Motorcycles in Bangkok	10/03	275/03
Tonga	Energy Assessment (English)	06/85	5498-TON
Vanuatu	Energy Assessment (English)	06/85	5577-VA
Vietnam	Rural and Household Energy-Issues and Options (English)	01/94	161/94
	Power Sector Reform and Restructuring in Vietnam: Final Report to the Steering Committee (English and Vietnamese)	09/95	174/95
	Household Energy Technical Assistance: Improved Coal Briquetting and Commercialized Dissemination of Higher Efficiency Biomass and Coal Stoves (English)	01/96	178/96
	Petroleum Fiscal Issues and Policies for Fluctuating Oil Prices In Vietnam	02/01	236/01
	An Overnight Success: Vietnam's Switch to Unleaded Gasoline	08/02	257/02
	The Electricity Law for Vietnam—Status and Policy Issues—The Socialist Republic of Vietnam	08/02	259/02
	Petroleum Sector Technical Assistance for the Revision of the Existing Legal and Regulatory Framework	12/03	269/03
Western Samoa	Energy Assessment (English)	06/85	5497-WSO

SOUTH ASIA (SAS)

Bangladesh	Energy Assessment (English)	10/82	3873-BD
	Priority Investment Program (English)	05/83	002/83
	Status Report (English)	04/84	015/84
	Power System Efficiency Study (English)	02/85	031/85
	Small Scale Uses of Gas Pre-feasibility Study (English)	12/88	--
	Reducing Emissions from Baby-Taxis in Dhaka	01/02	253/02
India	Opportunities for Commercialization of Non-conventional Energy Systems (English)	11/88	091/88
	Maharashtra Bagasse Energy Efficiency Project (English)	07/90	120/90
	Mini-Hydro Development on Irrigation Dams and Canal Drops Vols. I, II and III (English)	07/91	139/91
	WindFarm Pre-Investment Study (English)	12/92	150/92
	Power Sector Reform Seminar (English)	04/94	166/94

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India	Environmental Issues in the Power Sector (English)	06/98	205/98
	Environmental Issues in the Power Sector: Manual for Environmental Decision Making (English)	06/99	213/99
	Household Energy Strategies for Urban India: The Case of Hyderabad	06/99	214/99
	Greenhouse Gas Mitigation In the Power Sector: Case Studies From India	02/01	237/01
	Energy Strategies for Rural India: Evidence from Six States	08/02	258/02
	Household Energy, Indoor Air Pollution, and Health	11/02	261/02
	Access of the Poor to Clean Household Fuels	07/03	263/03
	The Impact of Energy on Women's Lives in Rural India	01/04	276/04
	Environmental Issues in the Power Sector: Long-Term Impacts And Policy Options for Rajasthan	10/04	292/04
	Environmental Issues in the Power Sector: Long-Term Impacts And Policy Options for Karnataka	10/04	293/04
Nepal	Energy Assessment (English)	08/83	4474-NEP
	Status Report (English)	01/85	028/84
	Energy Efficiency & Fuel Substitution in Industries (English)	06/93	158/93
Pakistan	Household Energy Assessment (English)	05/88	--
	Assessment of Photovoltaic Programs, Applications, and Markets (English)	10/89	103/89
Pakistan	National Household Energy Survey and Strategy Formulation Study: Project Terminal Report (English)	03/94	--
	Managing the Energy Transition (English)	10/94	--
	Lighting Efficiency Improvement Program Phase 1: Commercial Buildings Five Year Plan (English)	10/94	--
	Clean Fuels	10/01	246/01
Regional	Toward Cleaner Urban Air in South Asia: Tackling Transport Pollution, Understanding Sources.	03/04	281/04
Sri Lanka	Energy Assessment (English)	05/82	3792-CE
	Power System Loss Reduction Study (English)	07/83	007/83
	Status Report (English)	01/84	010/84
	Industrial Energy Conservation Study (English)	03/86	054/86
	Sustainable Transport Options for Sri Lanka: Vol. I	02/03	262/03
	Greenhouse Gas Mitigation Options in the Sri Lanka Power Sector: Vol. II	02/03	262/03
	Sri Lanka Electric Power Technology Assessment (SLEPTA): Vol. III	02/03	262/03
	Energy and Poverty Reduction: Proceedings from South Asia Practitioners Workshop How Can Modern Energy Services Contribute to Poverty Reduction? Colombo, Sri Lanka, June 2-4, 2003	11/03	268/03
	EUROPE AND CENTRAL ASIA (ECA)		
Armenia	Development of Heat Strategies for Urban Areas of Low-income Transition Economies. Urban Heating Strategy for the Republic Of Armenia. *Including a Summary of a Heating Strategy for the Kyrgyz Republic*	04/04	282/04
Bulgaria	Natural Gas Policies and Issues (English)	10/96	188/96
	Energy Environment Review	10/02	260/02
Central Asia and The Caucasus	Cleaner Transport Fuels in Central Asia and the Caucasus	08/01	242/01
Central and Eastern Europe	Power Sector Reform in Selected Countries	07/97	196/97

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Central and Eastern Europe	Increasing the Efficiency of Heating Systems in Central and Eastern Europe and the Former Soviet Union (English and Russian)	08/00	234/00
	The Future of Natural Gas in Eastern Europe (English)	08/92	149/92
Kazakhstan	Natural Gas Investment Study, Volumes 1, 2 & 3	12/97	199/97
Kazakhstan & Kyrgyzstan	Opportunities for Renewable Energy Development	11/97	16855-KAZ
Poland	Energy Sector Restructuring Program Vols. I-V (English)	01/93	153/93
	Natural Gas Upstream Policy (English and Polish)	08/98	206/98
	Energy Sector Restructuring Program: Establishing the Energy Regulation Authority	10/98	208/98
Portugal	Energy Assessment (English)	04/84	4824-PO
Romania	Natural Gas Development Strategy (English)	12/96	192/96
	Private Sector Participation in Market-Based Energy-Efficiency Financing Schemes: Lessons Learned from Romania and International Experiences.	11/03	274/03
Slovenia	Workshop on Private Participation in the Power Sector (English)	02/99	211/99
Turkey	Energy Assessment (English)	03/83	3877-TU
	Energy and the Environment: Issues and Options Paper	04/00	229/00
	Energy and Environment Review: Synthesis Report	12/03	273/03

MIDDLE EAST AND NORTH AFRICA (MNA)

Arab Republic of Egypt	Energy Assessment (English)	10/96	189/96
	Energy Assessment (English and French)	03/84	4157-MOR
	Status Report (English and French)	01/86	048/86
Morocco	Energy Sector Institutional Development Study (English and French)	07/95	173/95
	Natural Gas Pricing Study (French)	10/98	209/98
	Gas Development Plan Phase II (French)	02/99	210/99
Syria	Energy Assessment (English)	05/86	5822-SYR
	Electric Power Efficiency Study (English)	09/88	089/88
	Energy Efficiency Improvement in the Cement Sector (English)	04/89	099/89
	Energy Efficiency Improvement in the Fertilizer Sector (English)	06/90	115/90
Tunisia	Fuel Substitution (English and French)	03/90	--
	Power Efficiency Study (English and French)	02/92	136/91
	Energy Management Strategy in the Residential and Tertiary Sectors (English)	04/92	146/92
	Renewable Energy Strategy Study, Volume I (French)	11/96	190A/96
	Renewable Energy Strategy Study, Volume II (French)	11/96	190B/96
	Rural Electrification in Tunisia: National Commitment, Efficient Implementation and Sound Finances	08/05	307/05
Yemen	Energy Assessment (English)	12/84	4892-YAR
	Energy Investment Priorities (English)	02/87	6376-YAR
	Household Energy Strategy Study Phase I (English)	03/91	126/91

LATIN AMERICA AND THE CARIBBEAN REGION (LCR)

LCR Regional	Regional Seminar on Electric Power System Loss Reduction in the Caribbean (English)	07/89	--
	Elimination of Lead in Gasoline in Latin America and the Caribbean (English and Spanish)	04/97	194/97

Region/Country	*Activity/Report Title*	*Date*	*Number*
LCR Regional	Elimination of Lead in Gasoline in Latin America and the Caribbean - Status Report (English and Spanish)	12/97	200/97
	Harmonization of Fuels Specifications in Latin America and the Caribbean (English and Spanish)	06/98	203/98
	Energy and Poverty Reduction: Proceedings from the Global Village Energy Partnership (GVEP) Workshop held in Bolivia	06/05	202/05
	Power Sector Reform and the Rural Poor in Central America	12/04	297/04
	Estudio Comparativo Sobre la Distribución de la Renta Petrolera en Bolivia, Colombia, Ecuador y Perú	08/05	304/05
Bolivia	Energy Assessment (English)	04/83	4213-BO
	National Energy Plan (English)	12/87	--
	La Paz Private Power Technical Assistance (English)	11/90	111/90
	Pre-feasibility Evaluation Rural Electrification and Demand Assessment (English and Spanish)	04/91	129/91
	National Energy Plan (Spanish)	08/91	131/91
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	Petroleum Procurement, Refining, and Distribution Study (English)	11/86	061/86
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