

Energy Resource Dependence and Use in Southern Africa: Opportunities and Challenges

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1 Introduction

The boom in commodity prices in recent years has led to increasing attention being paid to resource issues around the world, and in resource-rich Africa in particular. A central question is whether the high prices of natural resources represent a blessing or a curse to the citizens of resource-endowed nations. Oil, as the most important global commodity, has received special attention of late, not least owing to the trebling of the oil price between 2003 and mid-2006. As a result of this oil price shock – as some regard it – other fossil energy sources such as natural gas and coal, as well as renewable energy sources, have also come under the spotlight.

Southern Africa, as a reasonably coherent geopolitical region with a range of political, economic and energy linkages, is an interesting case study as regards energy resources. The region is composed of a variety of countries which share certain commonalities, but also differ in some important respects. All countries in the region have pressing developmental challenges such as poverty, inequality, unemployment and underdevelopment. However, a key distinction relevant to this study is between those countries that are net energy exporters, and those that are net energy importers.

The paper aims to provide an overview of energy resource issues in Southern Africa from a political economy perspective. There are two principal dimensions of the energy equation: the supply or resource side, and the demand or usage side; both aspects deserve attention.

An important issue on the supply side is that of energy resource dependence. Such energy dependence (as in natural resource dependence more generally) is usually interpreted as a high degree of reliance on domestic energy resources for economic activity in general (i.e. the gross domestic product), as well as for foreign exchange (via export revenue) and government revenue. The possession of significant natural resources – including energy – is often seen as a mixed blessing, and has even been referred to as a ‘curse’. This is because some resource-rich countries have fallen into debt and/or poverty traps. Several questions arise from this. Does the ‘poverty trap hypothesis’ apply to Southern African countries in relation to energy resource dependence? What are the impacts of energy resource dependence on the economies and politics of SADC countries? How can progressive resource governance be enhanced? What are the appropriate policy interventions to mitigate the dependence problem and promote sustainable development?

An alternative interpretation of energy dependence is when a country is reliant on external sources of energy. To avoid confusion, this issue – which afflicts the majority of SADC countries – will be termed energy *vulnerability* for the purposes of this paper.

The demand side of the energy equation presents another set of challenges. First, how can access to energy be ‘modernised’ (in the sense of energy sources and carriers) and be made more equitable? Second, how sustainable are current patterns of energy consumption? Third, to what extent is there potential for conflict between domestic demand for Southern Africa’s energy resources and demand by foreign countries? These are among the central questions to be addressed in what follows.

In terms of scope, the paper addresses the interaction between energy, economic and political issues in member countries of the Southern African Development Community

(SADC). SADC was initially formed in 1980 to promote economic and political ties between member nations and to present an organised counterweight to the Apartheid regime in South Africa. More recently, SADC has focused on economic cooperation, including steps towards regional trade and monetary integration. The current members of SADC are Angola, Botswana, Democratic Republic of Congo (DRC), Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, South Africa, Swaziland, Tanzania, Zambia and Zimbabwe.¹

Given the breadth of the issues as well as the number of countries involved, the paper does not attempt to provide an in-depth analysis of every country, but rather highlights the essential issues and patterns. It will however include various case studies of special interest. In the context of energy resources, the most interesting case studies within SADC are Angola (as the only major oil exporter) and South Africa (as the economic powerhouse of the region and a major coal and electricity producer and exporter).

The paper is organised as follows. Section 2 sketches an appropriate backdrop by providing a brief overview of SADC countries' salient socio-economic indicators. Section 3 presents a summary and discussion of energy resource availability and production in Southern African countries, delineated by type of energy. Section 4 then analyses the demand for these energy resources, both by SADC countries themselves and by foreign nations. Various social, economic and political issues relating to energy are teased out in section 5. Section 6 deals with matters of governance, focusing on Angola as well as regional cooperation. Policy recommendations are offered in section 7. The concluding section provides a brief summary.

2 Socio-Economic Context

Before launching into an analysis of energy-related issues in SADC, it will be instructive to gain an overview of relevant economic, demographic and social features of the region and its members. Table 1 presents a summary of key economic and demographic indicators for the SADC nations. As can be seen, there is a high degree of variability amongst the various countries' indicators. Population sizes vary from fairly large (DRC and South Africa with over 40 million citizens each) to very small (Botswana, Lesotho, Mauritius and Swaziland with less than two million inhabitants each).

Measured in terms of Gross Domestic Product (GDP), the region has one economic giant and a group of much smaller economies. South Africa accounts for more than two-thirds (68 per cent) of the region's total GDP (but only one fifth of its population). By contrast, the economies of Lesotho, Malawi and Swaziland are miniscule. Even the DRC, the second biggest economy in SADC, has only five per cent of the region's GDP. As we will see later, these economic imbalances are mirrored by the skewed pattern of energy usage.

Botswana, Mauritius and South Africa are classified by the World Bank as upper middle-income countries, each with a per capita GDP in excess of \$10,000 in purchasing power parity (PPP) terms. Angola, Lesotho, Namibia and Swaziland fall into the lower-middle income category; each has a per capita GDP greater than \$2,000. The remaining SADC members are classified as low-income nations; several are extremely poor, with annual

¹ Two other countries are generally considered to fall within the Southern African region, but are not currently members of SADC, namely the island nations of Comoros and Seychelles (the latter having withdrawn from SADC in 2004). These two countries will not form part of this study.

income less than \$1,000 per head. The regional average per capita income of \$3,406 is largely buoyed by the South African economy.

Recent rates of economic growth are also highly variable across SADC members. GDP growth rates in 2005 ranged from a spectacular 11 per cent in Angola (largely due to its booming oil export industry) to a dismal 8 per cent contraction in Zimbabwe, which has been experiencing an economic collapse since 2000. Other countries' growth rates were mostly mediocre, although there were a few more robust performers. In general, countries well endowed with natural resources benefited from strong commodity prices.

Table 1: Economic and demographic indicators, 2005

Country	Population (thousands)	GDP (\$ million at PPP)	GDP per capita (\$ at PPP)	GDP per capita growth rate
Angola	15,941	38,666	2,425	11
Botswana	1,765	19,044	10,790	4
DRC	57,549	43,660	759	3
Lesotho	1,795	4,961	2,764	1
Madagascar	18,606	16,689	897	2
Malawi	12,884	8,596	667	0
Mauritius	1,248	15,545	12,456	3
Mozambique	19,792	26,994	1,364	6
Namibia	2,031	15,850	7,803	2
South Africa	45,192	557,971	12,347	6
Swaziland	1,131	5,810	5,137	1
Tanzania	38,329	27,980	730	5
Zambia	11,668	12,132	1,040	3
Zimbabwe	13,010	26,647	2,048	-8
Total /Average	240,941	820,543	3,406	2.79

Source: World Bank (2006) *World Development Report*

Note: PPP = purchasing power parity

Table 2, which presents several indicators of human development, paints a similar picture of variability across SADC nations. The human development index, compiled by the United Nations Development Programme (UNDP, 2006), includes measures of living standards, life expectancy and literacy rates. Many countries in Southern Africa are ranked amongst the lowest in the world (out of 177 countries ranked by the UNDP). South Africa and Namibia rank significantly lower than their middle income status would suggest, mainly on account of the relatively low life expectancy in these countries, which is in turn partly explained by the HIV/AIDS pandemic. The Human Poverty Index (HPI-1), measuring various deprivations, displays a similar pattern to the HDI. Income inequality, as measured by the Gini coefficient, is fairly low in some cases (Tanzania and Mozambique – where most citizens are equally poor), and extremely high in others (Namibia, Botswana, Lesotho, Swaziland and South Africa – all middle-income countries). In the latter group, income

inequality tends to be closely linked to unequal access to quality, affordable energy resources.

Table 2: Human development indicators

Country	Human development index	HDI rank	Gini coefficient (%)	Human poverty index (HPI-1)
Angola	0.44	161	..	40.9
Botswana	0.57	131	63.0	48.3
DRC	0.39	167	..	40.9
Lesotho	0.49	149	63.2	47.5
Madagascar	0.51	143	47.5	36.3
Malawi	0.40	166	50.3	43.0
Mauritius	0.80	63	..	11.3
Mozambique	0.39	168	39.6	48.9
Namibia	0.63	125	74.3	32.5
South Africa	0.65	121	57.8	30.9
Swaziland	0.50	146	60.9	52.5
Tanzania	0.43	162	34.6	36.3
Zambia	0.41	165	42.1	45.6
Zimbabwe	0.49	151	50.1	46.0
Average	0.51	144	53.0	40.1

Source: United Nations Development Programme (2006) *Human Development Report*

In sum, all Southern African countries have very significant developmental challenges. As will be seen, energy plays a key role in the development process. In the following section we discuss the distribution of energy resources, while section 4 considers how they are used.

3 Energy Resources in Southern Africa

The energy endowment of Southern African is very unevenly distributed across both countries and the various types of energy resources. This section provides an overview of this distribution by country and by energy source.

Before proceeding, two definitional distinctions need to be made. First, energy resources may be divided between those that are non-renewable (coal, oil, natural gas and uranium) and those that are renewable (hydroelectric, solar and wind power, and biomass such as biofuels, wood and waste). Non-renewable energy resources are by definition finite; depletion begins the day they are first mined and consumed and continues until the last usable unit has been extracted. Renewable energy resources are self-replenishing, but some are nonetheless subject to degradation and even exhaustion (in particular biomass such as wood). These two categories of energy resources are discussed sequentially in the following subsections.

Second, it is important to distinguish between resources, reserves and production. In the case of fossil fuels, resources refer to the physical quantity of potentially valuable coal, oil or gas existing in the Earth's crust (in a particular area). Reserves, on the other hand, are a subset of resources which are economically accessible for production given current prices and technology. Reserves in turn may or may not be translated into actual production, depending on the availability of investment capital and technical expertise. Thus, when economic or technological conditions are unfavourable, or the requisite finance and skills are absent, the resources will lie idle as merely potentially useful energy. A similar distinction can be made in the case of renewable energy. Resources are potential energy sources (such as sunlight, wind, flowing water and biomass) that generally require capital and/or labour input to yield useful energy (such as electricity).

3.1 Non-renewable energy²

Southern Africa is endowed with coal, oil and natural gas hydrocarbon resources, as well as significant deposits of uranium, a source of nuclear energy. Some of these resources are being utilised extensively, while others are still in the development phase.

Most countries in Southern Africa have at least some modest coal reserves, with the exception of Angola, Lesotho, Madagascar, Mauritius and Namibia (see Table A4 in Appendix A). However, the region's endowment is dominated by South Africa, which has an approximately 97% share of coal reserves. Production of coal is also overwhelmingly concentrated in South Africa (98%), although there is some limited output in Botswana, DRC, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. Production in some countries, notably Zimbabwe and Malawi, is below potential owing to financial constraints (including a lack of liquid fuels in the former case). However, there have recently been indications of increased investment in coal production facilities in Botswana and Mozambique. As long as energy prices are kept high by rising demand, it is probable that the region's coal reserves will continue to be exploited despite concerns about pollution and environmental degradation.

Angola is the region's only significant producer of crude oil, with output of over a million barrels per day (bbl/d) in 2004 (see Table A2). Although the DRC is also a net crude oil exporter, its production volume is very small (21,000 bbl/d in 2004). South Africa produces a small amount of crude oil (amounting to 10 per cent of its needs) from domestic reserves, and in addition produces a significant amount of liquid petroleum products from coal and gas (resulting in total petroleum production of approximately 251,000 bbl/d in 2004). Nonetheless, South Africa – along with the remaining members of SADC – is a net oil importer. As the DRC's economy develops, it may need to consume its entire oil output domestically, unless production can be ramped up accordingly.

In 2004, Angola produced 79 per cent of the region's petroleum, followed by South Africa with 19 per cent and the DRC with a mere 2 per cent (see Figure A1). Angola's share has since grown even larger as the nation's output has risen to nearly 1.5 million barrels of oil per day (bbl/d) following substantial investment in production capacity. The country's crude oil output is expected to rise further over the next few years as more fields come on stream. Stimulated by the high price of oil, there is currently a major drive for oil exploration in the region, particularly off the west coast of the sub-continent, but also off the coasts of

² Energy data in this and the following section are drawn from the Energy Information Administration (2006) unless otherwise stated.

Mozambique and Madagascar. Any substantial discoveries would help to reduce these nations' oil import vulnerability (which is to be discussed later).

In addition to actual crude oil production, refining capacity is important for supplies of useable fuels. Most of Southern Africa's refining capacity is located in South Africa (about 490,000 bbl/d), with smaller refineries in Angola (39,000 bbl/d), Madagascar (15,000 bbl/d), Tanzania (14,900 bbl/d) and Zambia (23,750 bbl/d). According to the EIA (2006), Angola has plans to build another refinery with a capacity of 200,000 bbl/d. Madagascar's refinery has in recent years been experiencing financial difficulties as a result of mismanagement. The remaining SADC countries rely on imports of refined petroleum, mainly from South Africa. In addition, pipelines transport crude oil from Tanzania to Zambia and refined petroleum from Mozambique to Zimbabwe.

Several SADC countries possess natural gas reserves, notably Angola, Mozambique and Namibia, with smaller deposits in DRC, South Africa and Tanzania (see Table A3 in the appendix). However, production has not yet begun in Namibia, DRC or Tanzania. Several projects are currently underway in Angola to tap liquefied natural gas reserves, but production is still relatively small-scale (25.43 billion cubic feet in 2003). South Africa was the region's largest producer in 2003 (83 billion cubic feet, or 75 per cent), despite that country having the smallest reserves. Exploration for new gas fields is increasingly active off the west coasts of South Africa and Namibia, as well as offshore Mozambique. In Botswana, projects are underway to develop coal bed methane deposits. South Africa has recently begun importing natural gas from Mozambique via a pipeline, principally for conversion to liquid fuels by energy company Sasol.

Uranium is another non-renewable resource that can be used to produce energy via nuclear fission. South Africa and Namibia both possess significant deposits of uranium – the fourth and sixth largest in the world (European Nuclear Society, 2006), and production of this mineral is a valuable source of export revenue. In addition, South Africa uses a portion of its mined uranium for the production of electricity in its Koeberg nuclear power facility.

3.2 Renewable energy

The majority of Southern Africa's renewable energy is derived from hydroelectric power stations and biomass, with solar and wind currently contributing negligible amounts to the region's energy supply.

Several SADC countries possess abundant hydroelectric resources. It has been estimated that the DRC has a potential hydroelectric capacity of some 100,000 megawatts (MW), with over 40,000 MW attributed to the Inga Dam on the Congo River. The latter alone could potentially supply the bulk of Southern Africa's current electricity needs, reducing reliance on fossil fuels. However, as a result of political conflict in the DRC and resulting lack of investment, actual production is estimated to be in the region of only 700 MW (EIA, 2006). Mozambique has a hydroelectric plant on the Zambezi River with a notional capacity of 2,075 MW. Other countries with hydropower are Lesotho, Malawi, Namibia, South Africa, Tanzania, Zambia and Zimbabwe. Reliance on this resource for electricity production varies greatly. Some countries, such as Namibia and Tanzania, experience high seasonal variation in hydropower, with electricity shortfalls having to be imported when river flows are low.

Biomass is a significant source of energy in many Southern African countries, although this is mainly in the form of wood and agricultural waste used in rural areas and reflects the

region's generally low levels of economic development. For instance, Zambia's shares of domestic energy production (measured in tons of oil equivalent) in 2004 were 86 per cent for combustibles and waste (e.g. wood and dung), 11 per cent for hydroelectricity and just 2 per cent for coal (IEA, 2006). The harvesting of trees for energy presents considerable environmental challenges, including deforestation and desertification, as well as health problems from smoke inhalation and death from fires.

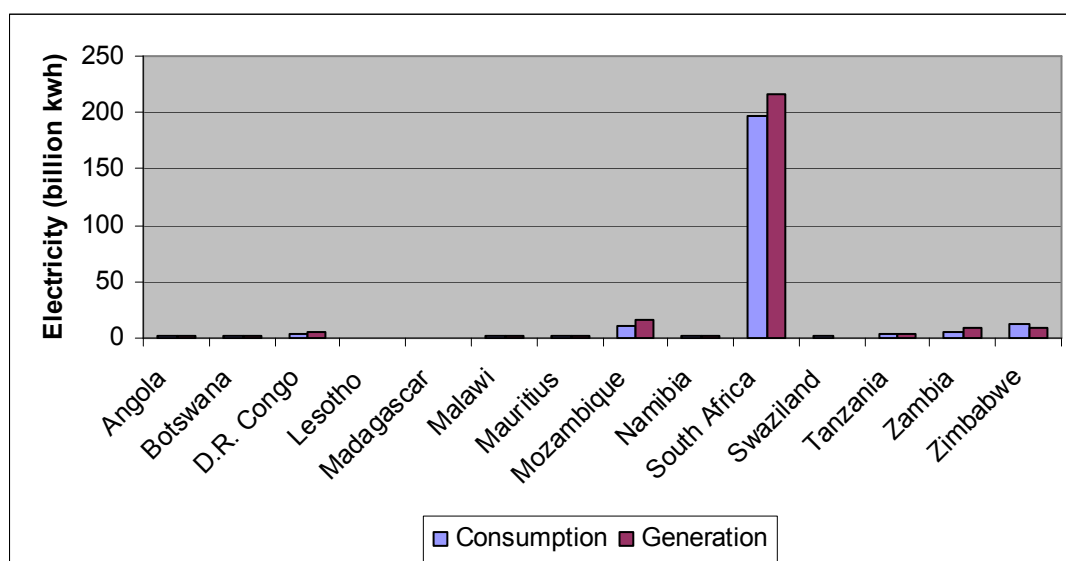
A small amount of commercial biofuel (ethanol and biodiesel) production takes place in South Africa, and the country's government has plans to expand this sector considerably in the next few years.

Most countries in Southern Africa have abundant solar energy resources. However, the ability to convert these resources into usable energy is severely limited due to lack of investment and affordable technology. Wind energy resources are for the most part confined to some coastal areas, notably the Western and Southern Cape in South Africa. As in the case of solar power, however, wind energy production is currently negligible, being limited to a three-turbine demonstration facility outside Cape Town, and a small commercial wind farm at Darling in South Africa's Western Cape Province.

3.3 Electricity

Electricity is a carrier rather than a source of energy, but is a vital part of the economic development process as it enables the use of safer, more efficient and more advanced equipment, products and technologies. Production of electricity in the region is overwhelmingly concentrated in South Africa, which accounted for an 81 per cent share in 2003 (see Figure 1). South Africa relies mainly on coal for electricity generation, although nuclear and hydro contribute small amounts as well. Most other SADC countries rely heavily on hydroelectricity. In addition to South Africa, net electricity exporters include the DRC, Mozambique and Zambia. On the other hand, Botswana, Lesotho, Namibia, Swaziland, Tanzania and Zimbabwe were net importers of electricity in 2003.

Figure 1: Electricity production and consumption, 2003



Source: Energy Information Administration (2006)

4 Demand for Southern African Energy Resources

Demand for energy in Southern Africa emanates from two sources: (1) internally, i.e. from Southern African countries themselves; and (2) externally, i.e. from countries outside the region. These two sources of demand – and related challenges – are addressed in subsections 4.1 and 4.2, respectively.

4.1 Internal demand

For the most part, Southern Africa's energy consumption is low by world standards. South Africa totally dominates energy consumption in the region, accounting for 83 per cent of SADC's total energy consumption in 2003. This proportion is even higher than its share of regional GDP (about two-thirds), which demonstrates South Africa's relatively high degree of energy intensity.

Table 3: Energy consumption by source (per cent), 2001

Country	Coal	Oil	Gas	Nuclear	Hydro-electric	Solid biomass
Angola	0	25.2	5.1	0	1	68.7
Botswana	--	--	--	--	--	--
D.R. Congo	1.4	3	0	0	3.3	93
Lesotho	--	--	--	--	--	--
Madagascar	--	--	--	--	--	--
Malawi	--	--	--	--	--	--
Mauritius	--	--	--	--	--	--
Mozambique	0	6	0	0	9.8	88.3
Namibia	0.2	65.3	--	0	10.2	15.2
South Africa	74.4	9.5	1.6	2.6	0.2	11.9
Swaziland	--	--	--	--	--	--
Tanzania	0.3	6.6	0	0	1.6	91.5
Zambia	1.2	8.9	0	0	10.9	81.5
Zimbabwe	24.8	11.5	--	0	2.6	57.4

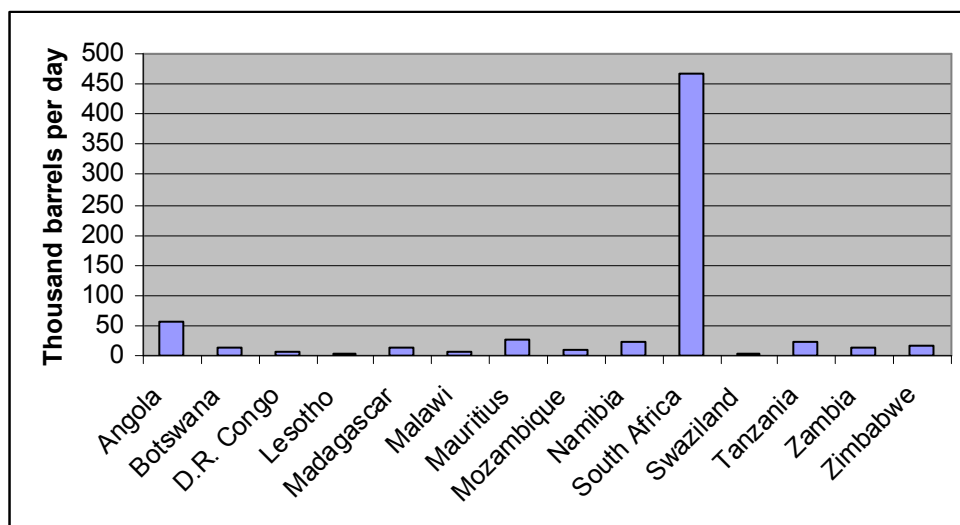
Sources: International Energy Agency (2006); World Resources Institute (2006)

Note: Figures in rows are estimates and do not always sum to 100%.

Energy consumption figures for SADC countries arranged by type of energy are provided in Appendix A in Tables A2 through A5. Table 3 summarises the shares of energy consumption by source for countries for which data were available. Broadly speaking, consumption patterns are similar to production patterns. The major exception to this is Angola, which exports the vast bulk of its crude oil production. All SADC nations use some petroleum, but South Africa consumed 69 per cent of the regional total in 2004 (see Figure 2). Only three countries consumed natural gas in 2003, being the gas producers (Angola, Mozambique and South Africa). Most countries consume some coal, with the non-producers importing modest amounts. South Africa once again dominates the picture with 97 per cent of the region's coal consumption in 2003. Significantly, several SADC nations (e.g. DRC, Mozambique, Tanzania and Zambia) rely extensively on solid biomass for the majority share of their energy consumption. Even Angola, in the face of significant oil exports, uses solid biomass for more than two-thirds of its total energy use. Hydroelectricity comprises a non-

negligible share of energy consumption in several countries, while only South Africa consumes nuclear energy.

Figure 2: Petroleum consumption, 2004



Source: Energy Information Administration (2006)

Energy consumption patterns are closely related to the magnitude of economic activity in Southern Africa. This reflects the well-established linkages between energy use and economic growth internationally (see Stern and Cleveland, 2004). The correlation between total energy use and GDP in the region as a whole is 0.998, while excluding South Africa yields a correlation coefficient of 0.62. The reason for the discrepancy is that South Africa is an outlier in both energy use and GDP, and is highly energy intensive, and therefore skews the correlation. Repeating the calculations for per capita energy consumption and GDP yields correlation coefficients of 0.81 and 0.96 when including and excluding South Africa, respectively. The latter figure is higher because South Africa’s energy consumption is so unequal, being concentrated in industry and amongst the wealthy elite, while a significant proportion of the population has limited access to energy. Low demand for energy in the remaining SADC countries – as well as their heavy reliance on traditional biomass – reflects their low levels of economic development. As a corollary, the possession of abundant (potential) energy resources (e.g. in the case of Angola and DRC) does not necessarily imply high levels of domestic energy consumption.

It is also interesting to disaggregate energy consumption data by sector, as seen in Table 4. In general, higher proportions of energy use by industry and transport are evident for countries with higher levels of economic development. Conversely, in less developed countries the residential sector consumes the greatest share of energy. The partial exception is Namibia, which partly due to the wide dispersion of its major settlements consumes the bulk of its energy in the transport sector.

Indeed, geography is an important consideration for energy usage (see Appendix B for a map of Southern Africa). Large countries (e.g. DRC and South Africa) may require extensive electricity grids if they are to cover their populations adequately with electrical energy. The type of terrain (e.g. mountains and forests) will clearly influence the costs of such provisioning. Countries such as Botswana and Namibia with very low population densities

have different challenges to those (e.g. Swaziland and Lesotho) with relatively high densities. As mentioned above, liquid fuels for transportation are more critical in countries with widely dispersed settlements. Landlocked countries – of which SADC has six – may depend on their neighbours for access to certain energy supplies, especially refined liquid fuels. By contrast, the island nations of Madagascar and Mauritius are unable to import electricity and rely extensively on ship transport for liquid and solid fuels. Finally, geography also poses particular challenges for transport infrastructure, which serves as a vital foundation for economic development and is usually closely linked to energy usage.

Table 4: Energy consumption by sector (per cent), 2001

Country	Industry	Transport	Agriculture	Services	Residential	Non-energy uses & other
Angola	12.8	13.9	0.0	3.8	66.5	2.9
Botswana	--	--	--	--	--	--
D.R. Congo	21.2	2.0	0.0	0.0	74.9	1.8
Lesotho	--	--	--	--	--	--
Madagascar	--	--	--	--	--	--
Malawi	--	--	--	--	--	--
Mauritius	--	--	--	--	--	--
Mozambique	14.1	4.6	0.1	0.4	80.5	0.3
Namibia	5.5	40.1	14.1	0.3	15.6	24.6
South Africa	46.1	24.1	2.7	4.8	21.2	1.1
Swaziland	--	--	--	--	--	--
Tanzania	10.2	4.6	4.6	0.0	77	3.6
Zambia	22.8	6.0	0.4	1.4	68.8	0.7
Zimbabwe	11.8	9.0	8.1	2.5	67	1.6

Sources: International Energy Agency (2006); World Resources Institute (2006)

The long-term unsustainability of Southern Africa's energy use is a major concern, for two main reasons. First, the region as a whole is heavily reliant on non-renewable fossil fuels. This is chiefly due to South Africa's extensive use of coal and its dominant economic and energy position. In addition, all SADC countries use petroleum products – chiefly for transport – and several use limited amounts of natural gas. Second, as noted earlier many countries in Southern Africa rely extensively on biomass, especially wood, for fuel – chiefly for residential use and in rural areas. This is made even more stark by the proportion of the population relying on solid fuels (see Table 5), which in most SADC countries (for which there are data) is greater than 80 per cent.

Another concern is the inequitable access to energy resources across the region. The dominant position of South Africa has been mentioned several times already, and it is reinforced by the figures in Table 5 showing per capita energy and electricity consumption. But even within this country, there is extensive inequality in the access to energy. Table 5 also reveals that the percentage of the population with access to electricity is pitifully low in many countries, and even South Africa's grid reached only two-thirds of the population in

2000 (although further progress has been made since then). Clearly, lack of access to modern forms of energy (especially electricity) is a major problem confronting many – and especially rural – Southern Africans.

Table 5: Access to energy resources

Country	Energy consumption per capita (kgoe) 2001	Population relying on solid fuels (per cent) 2000	Electricity consumption per capita (kWh) 2001	Population with access to electricity (per cent) 2000
Angola	662	>95	101	12
Botswana	--	65	--	22
D.R. Congo	302	>95	82	7
Lesotho	--	85	--	5
Madagascar	--	>95	--	8
Malawi	--	>95	--	5
Mauritius	--	--	--	--
Mozambique	422	87	272	7
Namibia	601	83	1,334	34
South Africa	2,426	28	4,546	66
Swaziland	--	--	--	--
Tanzania	391	>95	61	11
Zambia	608	87	591	12
Zimbabwe	775	67	813	40

Sources: International Energy Agency (2006); World Resources Institute (2006)

Notes: kgoe = kilograms of oil equivalent; kWh = kilowatt hours;

4.2 External demand

Interest in Southern Africa's energy resources by foreign nations concentrates mainly on oil, but includes to a certain extent coal and uranium as well. The United States (US) and China are currently the world's two leading oil consumers and importers. Both countries have in recent years turned increasing attention to Africa as a source of oil imports. This shift in focus has been prompted both by geopolitical and security concerns surrounding more traditional suppliers such as those in the Middle East, as well as by significant recent discoveries of oil in Africa (especially in deepwater regions off the West African coast). Angola presents a particularly attractive source of oil for major importers at present, given the relative infancy of its oil industry and the fact that it is not a member of the Organisation of Petroleum Exporting Countries (OPEC) cartel. US President George Bush has indicated that the US is aiming to source up to 25 per cent of its oil imports from Africa by 2025. Already Angola is the US's seventh largest supplier of crude oil (Legat, 2006). Even more striking, Angola is now China's largest supplier of crude oil.

Competition for access to oil amongst the major economic powers is likely to intensify in the coming years and decades as global oil reserves become progressively depleted. This had led

to suggestions of a second “scramble for Africa”, the first having been the race to establish colonies in the seventeenth, eighteenth and nineteenth centuries (see Economist, 2006b; Solomon, 2006; Watts, 2006). On the one hand this presents attractive opportunities for energy-rich nations, for instance in terms of foreign direct investment. However, it also raises some serious concerns, amongst which are security and corruption issues (see section 6 for further details).

Foreign direct investment (FDI) into Africa has risen dramatically over the past few years, albeit off a low base. A large part of this FDI – more than 50 per cent – is now in the oil industry (Watts, 2006). US-based oil multinationals have been especially keen investors in West African oil extraction, to the tune of some \$40 billion over the past decade. Lacking the capital and expertise themselves, African countries have sorely needed such FDI to convert their energy resources into actual production.

Increasingly, some foreign countries – most notably China – are resorting to non-market means of gaining access to resources, such as by way of bilateral trade and investment agreements. For example, China hosted the leaders of more than 30 African countries at a China-Africa summit in Beijing in early November 2006. According to the Economist (2006a: 16), China’s interest lies in gaining access to the continent’s resources, including oil, mineral ores and timber, as well as garnering political support in the United Nations. African countries, for their part, are keen to secure financial and technical assistance from the Chinese, such as investments in infrastructure. An unfortunate side-effect of China’s demand for materials is to exacerbate the ‘resource curse’, whereby manufacturing and value-added activities are neglected (Economist, 2006a).

China is especially interested in Africa’s oil. A Chinese company is involved in oil exploration in several areas, and most of China’s \$900 million investment in Africa in 2004 went to oil producers (Economist, 2006b: 53). According to the Economist (2006b: 54), “In Angola a \$4 billion line of low-interest credit enables Chinese companies to help rebuild the bridges, roads and so on that were destroyed in decades of war. The debt is repaid in oil.” Through this type of intervention, China is stealing a march on its competitors such as the US.

Aside from oil, coal is possibly Southern Africa’s next most important energy resource from a global perspective. South Africa is already one of the world’s foremost exporters of coal. To date, this country has relied on the global coal market for cashing in on its energy resources. However, a recent cooperative agreement on trade and investment signed between South Africa and China has opened the door to possible ‘non-market mechanisms’ in the future. China itself possesses abundant coal reserves, and is primarily interested in acquiring coal-to-liquids (CTL) production capacity, drawing on Sasol’s leadership in this industry. The US has also expressed interest in CTL technology to substitute for declining indigenous oil reserves. If major industrialised countries turn to nuclear power as a response to fossil fuel depletion and concerns over carbon emissions, then demand for Southern Africa’s uranium resources may intensify. Whether this will involve non-market interventions remains to be seen.

This global interest in Southern Africa’s energy resources sets up a potential conflict between internal and external demand. In our highly globalised economy, there is a danger that national energy resources are sold to the highest bidder on world markets (i.e. exported) and not used for internal development or to benefit the country’s citizens. Moreover,

multinational mining or energy companies in some cases command extensive control over domestic energy resources and revenues, expatriating large profits. Similarly, bilateral non-market arrangements with interested nations may enable governing elites to capture the wealth derived from energy resources for their personal enrichment rather than for the upliftment of their countries. These outcomes depend to a large extent on governance issues, which are taken up in section 6. Before that, we consider more broadly the social, economic and political challenges surrounding energy resources and use in Southern Africa, following on from both the demand- and supply-side issues already discussed.

5 Socio-Economic and Political Impacts and Challenges

Southern Africa as a whole is a net energy exporter since its production exceeds its consumption (see Table A1). However, this is mainly due to the large size of Angola's oil exports and South Africa's coal exports. These two countries, along with the DRC as a minor oil exporter, are net energy exporters, while the remaining 11 members of SADC are net energy importers. Several SADC countries import energy (usually in the form of electricity, coal or refined petroleum) from their neighbours (chiefly from South Africa), but most are in addition dependent on energy imports from outside the region. These classifications are important when it comes to analysing energy resource dependence and vulnerability (as defined in the introduction). Put differently, the socio-economic and political challenges facing net energy exporters and importers are very different. Thus three cases will be dealt with separately: Angola as a major oil exporter; South Africa as a net energy (mainly coal) exporter; and other SADC countries which are net energy (and oil) importers. First, however, we consider several important energy-related risks of a global nature which are likely to affect all Southern African countries, albeit somewhat differently.

5.1 Key energy-related risks

Wakeford (2006a) identifies three major risks to the global economy, all of which relate to energy either directly or indirectly. The first risk is that the extensive and growing global monetary imbalances (partially a result of uneven oil trade) will be resolved in a disorderly adjustment of exchange rates and the financial system, triggering a global economic slowdown or recession. Should this eventuality transpire, it will lead to a reduction in demand for primary commodities and hence a fall in their prices. This in turn would put increasing pressure on the balance of payments and economies of SADC countries that rely heavily on natural resources for export revenue. According to the OECD (2006), the non-oil commodity boom may already be petering out even before the financial realignment. This will make it harder for SADC's energy importers to finance their purchases of much-needed oil and electricity (presuming that energy prices do not fall commensurately).

The second risk is posed by climate change, which is expected to hit African countries especially hard – partly because of their relatively higher economic and social vulnerability compared with more developed nations. The scientific consensus holds that emissions of carbon dioxide (CO₂) from fossil fuel burning are the main cause of the current episode of global warming. This has already led to the Kyoto Protocol agreement, which binds industrialised signatories to limit their CO₂ emissions. However, it is becoming increasingly apparent that the Kyoto targets are far too modest, and that even major developing countries will have to reduce their emissions in the future. For Southern Africa, the main implication is that South Africa may need to reduce its consumption of coal, which would have significant implications for the region's energy supply. The remaining SADC countries consume

negligible amounts of fossil fuels relative to industrial and large emerging economies. However, a further probable consequence of global warming in Africa is lower river volumes (de Wit and Stankiewicz, 2006), which would adversely impact on hydroelectric power generation.

The third risk is of an oil price shock, comparable perhaps to those experienced in the 1970s. Such a shock could be triggered in the short-term by supply disruptions caused by geopolitical tensions, local conflict or natural disasters in oil producing regions (see Wakeford, 2006b). More seriously, it is just a matter of time before the world production of oil reaches a peak and begins an inexorable decline (see Hirsch, 2005; Wakeford, 2006a). If this peak occurs within the next few years, as many experts are predicting, it will catch the world unprepared and is likely to entail extensive economic disruption (Hirsch, Bezdeck and Wendling, 2005). Higher and more volatile oil prices will raise transport costs and dampen international trade and investment. Furthermore, unless major oil consumers cooperatively reduce their imports to match the depletion rate, competition over dwindling oil supplies could escalate into trade and even military wars (see Heinberg, 2006).

5.2 Net energy importers

The eleven net energy importing members of SADC suffer from energy vulnerability, which takes at least three forms. First, as oil importing nations they are susceptible to oil price shocks. The degree of vulnerability depends on their energy intensity – measured by the ratio of energy use to GDP – and their energy import ratio, i.e. energy imports as a proportion of total imports (see Bacon and Mattar, 2005; Nkomo, 2006). Second, as mentioned earlier several SADC countries are dependent on one or more of their neighbours for critical energy supplies (e.g. coal, electricity, and refined petroleum products), and are therefore vulnerable to fluctuations in the prices or availability of these imports. Third, several Southern African countries are vulnerable to climatic changes affecting rainfall patterns, which in turn affects the temporal and quantitative availability of hydroelectric power.

Oil price shocks in particular can have devastating effects on the economies of oil importers. Higher oil prices lead to larger balance of payments deficits, a contraction of national income, and higher inflation rates. Bacon and Mattar (2005: 1) have shown that low-income countries and poor households suffer relatively more from oil price shocks than wealthier societies. Oil shocks can also have a potentially severe impact on the governments and politics of vulnerable countries. Since economies are highly reliant on energy resources to support their functioning, unaffordable prices or critical shortages of energy – especially oil – can lead to social and political instability. In the worst cases, such tensions may even cause some states to fail.

We have already seen, in section 4, how the energy-importing members of SADC rely overwhelmingly on biomass fuels for domestic energy needs, and how this contributes to environmental degradation. Shortages of electricity or petroleum would worsen this impact.

5.3 South Africa

South Africa, the region's economic giant, is in a unique position as regards its energy resources and vulnerability. The country produces a significant amount of petroleum, largely converted from coal and gas, but is nevertheless a net oil importer. Hence the South African economy is to some extent vulnerable to oil price shocks (see Wakeford, 2006b for further details). In aggregate, South Africa is a net energy exporter on account of being amongst the world's top five coal exporters. Yet it is not an energy resource dependent economy in the

usual sense, since coal contributes only a small share to a large and diversified economy (services comprise about two-thirds of GDP, and manufacturing more than 15 per cent).

However, coal dominates the domestic energy sector, accounting for some three-quarters of primary energy supply. Cheap coal-powered electricity has been a competitive advantage for South African firms for decades, but has had the adverse effect of entrenching energy inefficiency. This, together with the historical importance of the mining sector, has made the South African economy highly energy intensive (see Kohler, 2006). This presents a serious structural challenge to the government, which has in principle adopted the goal of sustainable development, which requires greater reliance on renewable forms of energy.

At the same time, the authorities have committed themselves to extending cheap electricity to the poorer segments of the population. Especially in rural areas, the majority of poor people are women, who often have to walk long distances to fetch and carry firewood. Significant progress in the provision of electricity has been made in recent years via the National Electrification Programme, although up to a third of households still lack access to electricity. Moreover, the bulk of this electricity is derived from coal. Consequently, some hold the view that a trade-off exists between equity and affordability of energy provision on the one hand, and sustainability on the other (Kohler, 2006).

Given South Africa's abundant coal reserves, which are projected to last for a further 200 years at current usage rates, the main sustainability concerns at present have to do with pollution rather than depletion. Not least amongst these is the contribution of carbon dioxide emissions to climate change, which is expected to have adverse impacts on South Africa through droughts and floods. Despite being a middle-income country, South Africa has one of the world's highest levels of per capita CO₂ emissions due to its extensive use of low-grade coal for electricity generation and industry. Pollution from coal also comes in the form of land degradation, acid rain and smog, which in addition to environmental problems impose serious social costs in terms of health problems such as respiratory diseases.

While revenue from energy resources does not play a decisive role in the government's budget, the centralisation of energy production and distribution in the state-owned monopoly utility, Eskom, does have political implications. A contentious issue, for example, is the government's support for a pebble bed modular nuclear reactor project, which could further entrench Eskom's dominant position, if indeed it proves viable. In addition, the domestic petroleum industry has not been free of allegations of corruption, for example relating to funds from state-owned PetroSA being diverted to support the ruling party's election campaign. However, these political impacts are minor compared to truly energy dependent countries, such as Angola.

5.4 Angola

In 2002 Angola finally emerged from a 30-year civil war which ravaged the country's people, economy and environment. Any assessment of the role and impact of the energy sector on the nation's socio-economic and political conditions must take due cognisance of this legacy.

Angola, like all major African oil producers, is highly dependent on its 'black gold' (Watts, 2006). In 2005, oil comprised in excess of 52 per cent of Angola's GDP, 78 per cent of government revenue and 93 per cent of exports (OECD, 2006: 108). Rising oil prices and production in the past few years have fuelled a rapid acceleration of economic growth, which

reached double digit rates (11 per cent) in 2005 and is expected to climb to a remarkable 26 per cent in 2006 and 20 per cent in 2007, according to the OECD (2006: 107). On the face of it, this oil wealth would seem to hold a great deal of promise for the rapid development of Angola's economy.

However, there are several obstacles to such a positive outcome, which are characteristic of the so-called 'oil curse'. First, capital intensive investment in oil infrastructure does not create many jobs. Second, the oil sector has few direct backward and forward linkages to other sectors of the economy. Third, the limited resources that are available tend to be drawn to the oil sector so that there is a severe lack of economic diversification, for example into manufacturing, which contributed a paltry 4 per cent to GDP in 2004 (OECD, 2006: 109). Although this lack of diversification is partly attributable to the civil war, it nonetheless presents a major challenge to the government in terms of laying a foundation for long-term sustainable economic development.

In addition, the predominance of the oil industry in the country's economy has important political ramifications. The Movimento Popular de Libertacao de Angola (MPLA) emerged from the civil war as the ruling political party. Elections are scheduled for early 2007, but state control over resources – especially oil – is likely to further entrench the MPLA's power. One commentator has recently suggested that Angola could follow the political and economic path trod by Nigeria and Indonesia, in which dictators consolidated power and siphoned off huge amounts of these countries' oil wealth for personal enrichment (Legat, 2006).

Whether or not democracy is able to prevail, being dependent on oil does present the government of the day with various challenges. First, its revenues are vulnerable to fluctuations caused by oil price volatility. Second, managing external interest (by oil companies and foreign governments) in the country's oil reserves can be a tricky diplomatic game. Third, oil wealth is a catalyst for internal conflict, such as the ongoing violence in the Cabinda region. Fourth, there is the risk, raised in the previous section, that global depletion of oil will result in countries like Angola becoming embroiled in broader geopolitical conflicts and even resource wars.

Further conflict is just what the people of Angola do not need. But even while peace endures, the majority of Angola's citizens derive little or no direct – or even indirect – benefit from the nation's oil endowment. This is due partly to the expatriation of oil revenues by international oil companies, and also to the lack of effective social expenditure by the government. Angola's social indicators are very concerning and do not tally with its per capita GDP: rates of maternal and infant mortality are amongst the highest in the world; life expectancy is around 40 years; most of the population have no access to health care facilities; and illiteracy and malnutrition are rife (see OECD, 2006: 117-8). Furthermore, access to energy by the poor, especially those in rural areas, is severely limited. Even the capital Luanda has suffered from increasingly frequent power cuts and brownouts (OECD, 2006: 115). Regional disparities are exacerbated by the concentration of the oil industry (and its economic spin-offs, limited as they are) in certain areas (notably in the Cabinda enclave) as well as by poor transport infrastructure.

On the positive side, negative micro impacts of large oil projects on local communities are limited in scale by their geographical concentration. Moreover, most of Angola's oilfields are offshore, which means that Angola's people and environment are not as susceptible as

those in other countries (notably Nigeria) to the pollution that often accompanies oil extraction. However, few Angolans would have to resort to cutting down trees as an energy source if the petroleum were shared more equitably.

In sum, it is clear that Angola's oil dependence is indeed a mixed blessing, especially for the ordinary people who have yet to see much in the way of material benefits flowing from the oil wealth. Whether this situation can be transformed to a more equitable one depends to a large extent on matters of governance, which are discussed in the following section.

6 Governance Issues

The OECD (2006) notes the vital importance of good governance for economic development and poverty reduction. This is especially relevant for avoiding the so-called 'oil curse', whereby some oil-producing nations descend into debt and poverty traps. This section concentrates on governance implications of oil dependence in Angola, but also considers some ways in which regional cooperation can help other SADC countries to reduce their energy vulnerability.

6.1 Governance and resource dependence: the case of Angola

As mentioned above, a concentrated source of economic power (such as oil) often provides a platform for concentrated political power. This has been evident in many oil exporting nations, including Nigeria and Indonesia, which were for many years ruled by corrupt dictators. This raises questions of whether and how the potential problems of corruption and dictatorship can be overcome in Angola.

In general terms, the key to good governance is strengthening democratic processes and institutions. These include: fair and free electoral processes; political checks and balances – including independence – between parliament, executive and judiciary; and reducing corruption through greater transparency and accountability.

Transparency of energy sector operations may be improved by publishing regularly updated data on production, prices and revenue. Also important is strengthening the accountability of government institutions and state-owned enterprises, such as through independent auditing, parliamentary oversight and media autonomy (Kaufmann, Pinaud and Wegner, 2006). State-owned monopolies should be effectively regulated by independent institutions. Partnerships between state-owned enterprises and multinational corporations should be transparent so as to help to curtail corruption. The same applies to concessions for exploration and extraction of energy resources and to state royalties on subsequent production. The OECD (2006) further advocates the application of fiscal rules for the use of oil revenues to ensure that windfalls are not misallocated or wasted.

Concerns have been raised that China's trade and investment interests in Angola – as in other African countries – may undermine moves to increase transparency and reduce corruption; however, the jury is still out as far as evidence is concerned (see Economist, 2006b: 54; OECD, 2006: 107). Ultimately, it is up to the Angolan government voluntarily to adopt many of the governance reforms suggested here.

6.2 Regional co-operation

In addition to national-level governance, there is significant potential for institutions such as SADC, the New Partnership for African Development (NEPAD) and the African Union (AU) to facilitate regional and continental cooperation on energy and related issues. This may be of benefit both to energy-dependent and energy-vulnerable countries, in various ways.

First, SADC could act as an economic and political bloc to negotiate with interested parties such as China and the US. Otherwise there is a danger of a ‘divide and conquer’ approach on the part of these major powers, whereby they enter into asymmetric agreements with individual Southern African nations. This has already been happening to some degree, such as China’s trade and investment deals with Zimbabwe (mainly involving minerals) and Angola (over oil). The Economist (2006a: 18) advises that African countries should cooperate with each other as a negotiating bloc, rather than cut independent deals with China.

Second, SADC can promote regional energy security. This could take the form of military cooperation to protect off-shore oil and gas fields, which are particularly vulnerable to interference or attack. This could emanate from militant opposition groups (as in the case of Nigeria), from piracy, or conceivably in the future from other countries desperate to secure oil supplies in an era of declining production. Onshore energy deposits – again especially oil fields – could potentially be a source of local or regional conflict in the future. It might be tempting for neighbouring countries to intervene militarily should Angola see a renewed outbreak of civil conflict. A similar scenario (albeit related to mineral resources) afflicted the DRC during its long civil war. Thus a regional peacekeeping force may have a role to play in such circumstances. In the face of threats posed by global oil depletion, SADC members could agree to sign an international oil depletion protocol along the lines of that described by Heinberg (2006).

Another, non-military aspect of energy security has to do with stabilising regional energy supplies. The continental members of SADC are members of the Southern African Power Pool (SAPP), whose objective is precisely to manage the region’s energy supply. Lack of funds to maintain and expand energy generation capacity in some countries means that their neighbours’ energy imports are constrained. Thus it may be in the region’s interest if South Africa were to invest in the DRC’s Inga hydroelectric project, although concerns about the dam’s environmental impact and the impact of climate change need to be taken into account.

The critical importance of energy supplies to functioning economies means that SADC members have an interest in ensuring that energy-related economic problems in some countries do not spill over to their neighbours. For example, Zimbabwe has at times failed to pay for its energy imports from South Africa and Mozambique, resulting in either a financial burden falling on these suppliers, or the cessation of energy flows. Energy shortages, while not a primary cause of the economic meltdown in Zimbabwe, have definitely been a contributing factor to the mass exodus of refugees to South Africa.

Third, environmental impacts of energy projects should also be managed at a regional level, since pollution is often a trans-national problem. For instance, the building of dams affects ecosystems downstream, which might affect other countries. One example is the Namibian national power company’s desire to build a hydro-electric plant on the Okavango River, which could seriously affect the biodiversity of the Okavango Delta in Botswana (see EIA,

2006). In addition, carbon dioxide emissions, whilst generated locally, create global problems by contributing to global warming and climate change. Deforestation similarly affects climate patterns on a regional level.

Cooperation at the Southern African level should ideally be supplemented with continental partnerships. For instance, the African Union can play a similar and supportive role to SADC institutions for the broader African continent. In addition, NEPAD, with its Peer Review Mechanism, holds the potential to contribute to good governance in Southern African countries, provided its assessments are objective. NEPAD should be encouraged to give special attention to the energy sector in energy dependent countries such as Angola.

7 Policy Recommendations

Assuming that some level of democratic governance is maintained in Southern African countries, and bearing in mind the potential for regional collaborative arrangements, this section considers a range of policies that governments could employ to manage energy dependence (in the case of Angola) and energy vulnerability (in other SADC nations), and to promote sustainable development.

7.1 *Managing energy resource dependence*

It is critical for resource-dependent countries such as Angola to realise that extracting and selling raw materials amounts to drawing down a stock of natural capital. Thus the proceeds of such liquidation (e.g. oil revenues) should be invested in other forms of capital to ensure that a foundation is laid for long-term development. Arguably the most important kind of investment is in human capital, both through expanding the quantity and quality of education, and by ensuring better provision of health care facilities and HIV/AIDS prevention and treatment. In addition, windfall oil revenues should be used to build sustainable physical infrastructure, including electric transport infrastructure and renewable energy capacity. Such investments in human and physical capital will foster the diversification of a resource-dependent economy into other sectors which are higher up the value chain, such as manufacturing and services.

7.2 *Reducing oil vulnerability*

Bacon and Mattar (2005) show that net oil importing African countries are highly vulnerable to oil price shocks, both because they are highly reliant on oil as a fuel, and because they lack the resources to cope with such shocks. Unfortunately, these authors further conclude that the prospects for reducing oil vulnerability, by either reducing oil import dependence or substituting for oil as an energy source, are not bright, especially in the short term. However, policies that encourage diversification away from oil for power generation, for instance by investing in hydroelectric and solar power, may bring some respite in the medium to long term. At least as important are measures to reduce oil and energy use, particularly in the transport sector. At a structural level, reducing energy intensity may be bolstered by policies that promote the development of less energy-intensive sectors. Further analysis at a country level would be useful in this regard. A further policy implication is that while price controls on petroleum products may provide temporary respite for beleaguered consumers, they are not financially sustainable in the medium to long term if energy prices remain high, or rise even further, as seems highly likely. Allowing price signals to do their work can help both substitution and curtailment, but some kind of support for the poor – such as efficient public transport – is important.

7.3 Promoting sustainable development

From a long-term perspective, specific policy recommendations for countries that are both oil (or energy) exporters and net importers dovetail within the broader objective of sustainable development. Sustainable development involves the expansion of viable economic livelihoods, enhancing equity in the distribution of income and access to social services, and protecting the integrity of ecological systems. The use of fossil fuel energy resources by industry and households is inherently unsustainable given their non-renewable nature, and the extensive pollution that they generate. The same applies to biomass resources where their rate of use is higher than their rate of regeneration, as is the case in some areas within Southern Africa.

All three dimensions of sustainable development can be promoted via investments in renewable energy, such as hydro, solar and wind power and biofuels – where these resources are available. To poor Southern African countries such investment is a daunting – yet vital – challenge. Efforts should be made to access financing through the Clean Development Mechanism (CDM) for renewable energy projects. As the economic powerhouse of the region, South Africa should lead the way in charting a new course towards a sustainable future. As more funds are invested regionally and globally in renewable energy, their costs will decline as economies of scale are reaped.

Another crucial measure for sustainability is improving the efficiency of energy use by both consumers and producers. This can be achieved via demand side management and also by incentives and regulations designed to stimulate the adoption of more efficient energy-consuming appliances and technology (such as more fuel-efficient cars). Admittedly, this is another major challenge for cash-strapped economies, and has to work hand in hand with the extension of energy services to under-provided communities. More equitable access to energy may be enhanced by extending national electricity grids, but perhaps more importantly by the installation of local, off-grid solar energy and biofuel facilities, especially in rural areas.

8 Summary and Conclusions

When it comes to energy resource and use issues, there are both similarities and diversity amongst the nations of the Southern African Development Community. A factor that unites all SADC members is the widespread incidence of poverty and deprivation, and the generally high reliance on traditional sources of energy by most citizens. However, the differential endowment of fossil energy resources leads to a clear division amongst the neighbours. Angola, where the oil industry contributes very large shares to the economy and government coffers, is the only ‘energy resource dependent’ country in the region. South Africa stands apart by virtue of being the relative economic giant of the region, with by far the most sophisticated economy, infrastructure and financial system. This country relies heavily on its abundant coal reserves for domestic energy production, but not for government revenue or GDP. Crucially, however, the possession of significant energy resources in Angola and South Africa does not guarantee economic prosperity or good social conditions for all the citizens of these countries. The DRC is a net energy exporter but is not dependent on its oil revenues as such. The remaining SADC countries, which are net energy importers, are classified as ‘vulnerable’.

Energy resource availability will continue to play a key role in underpinning economic activity and standards of living in the region. SADC countries face several specific challenges, which may be summarised as follows. On the supply side: (1) Angolan dependence on oil means that there is a danger of its succumbing to the ‘resource curse’, which includes a lack of economic diversification and possible corruption; (2) net oil importing countries are highly vulnerable to oil price shocks; (3) some countries that rely heavily on hydroelectric power face erratic electricity supply; and (4) most SADC nations lack funds and expertise for investment in domestic energy production and distribution. Demand side challenges include: (1) unsustainable reliance on fossil and biomass fuels, both of which contribute to disruptive alterations in the local and global climate; and (2) high levels of energy inefficiency, especially in South Africa.

As with economic development in general, governance plays an important role in nations’ willingness and ability to provide for the needs of their people. Equity and development depend on political dispensations and the strength of democratic institutions. Transparency in the use of oil revenues is especially important in oil-rich Angola. For the region as a whole, there is considerable scope for cooperation amongst SADC countries over energy-related issues, including security.

Finally, Southern African countries can in principle implement several policies aimed at reducing energy vulnerability and promoting sustainable and equitable development. Chief amongst these are investment in clean, renewable energy sources and related infrastructure, and enhancing energy efficiency through demand side management and the use of more efficient physical capital. While such investments may seem to be luxuries in the current socio-economic climate, they will prove increasingly essential in the years and decades to come as the region – along with the rest of the world – grapples with the twin problems of fossil fuel depletion and climate change. Accessing financial resources and technology from wealthier nations may prove decisive in this uncertain future.

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Appendix A

Table A1: Total Energy and Carbon Dioxide Emissions, 2003				
Country	Total Commercial Energy Consumption (Quadrillion Btu)	Total Commercial Energy Production (Quadrillion Btu)	Net Energy Exports (Quadrillion Btu)	Carbon Dioxide Emissions (Million metric tons of carbon)
Angola	0.135	1.96	1.825	4.34
Botswana	0.052	0.023	-0.029	1.04
D.R. Congo	0.08	0.112	0.032	0.49
Lesotho	0.007	0.004	-0.003	0.06
Madagascar	0.037	0.006	-0.031	0.61
Malawi	0.025	0.013	-0.012	0.22
Mauritius	0.052	0.001	-0.051	1.01
Mozambique	0.166	0.157	-0.009	0.47
Namibia	0.051	0.015	-0.036	0.63
South Africa	4.901	5.916	1.015	112.16
Swaziland	0.021	0.011	-0.01	0.37
Tanzania	0.078	0.032	-0.046	0.96
Zambia	0.108	0.09	-0.018	0.61
Zimbabwe	0.189	0.136	-0.053	3.01
Total	5.902	8.476	2.574	125.98

Source: Energy Information Administration (2006)

Table A2: Petroleum Overview					
Country	Petroleum Production, 2004 (Thousand Barrels Per Day)	Petroleum Consumption, 2004 (Thousand Barrels Per Day)	Petroleum Net Exports, 2004 (Thousand Barrels Per Day)	Crude Oil Reserves, 1/1/2005 (Million Barrels)	Crude Oil Refining Capacity, 1/1/2005 (Thousand Barrels Per Day)
Angola	1,051.20	57	994.2	5,412.00	39
Botswana	0	13	-13	0	0
D.R. Congo	21.1	7	14.1	187	0
Lesotho	0	2	-2	0	0
Madagascar	0	12	-12	0	15
Malawi	0	6	-6	0	0
Mauritius	0	27	-27	0	0
Mozambique	0	11	-11	0	0
Namibia	0	23	-23	0	0
South Africa	250.8	466	-215.2	15.7	489.5
Swaziland	0	3	-3	0	0
Tanzania	0	22	-22	0	14.9
Zambia	0.1	13	-12.9	0	23.8
Zimbabwe	0	18	-18	0	0
Total	1,323.2	680.0	643.2	5,614.7	582.2

Source: Energy Information Administration (2006)

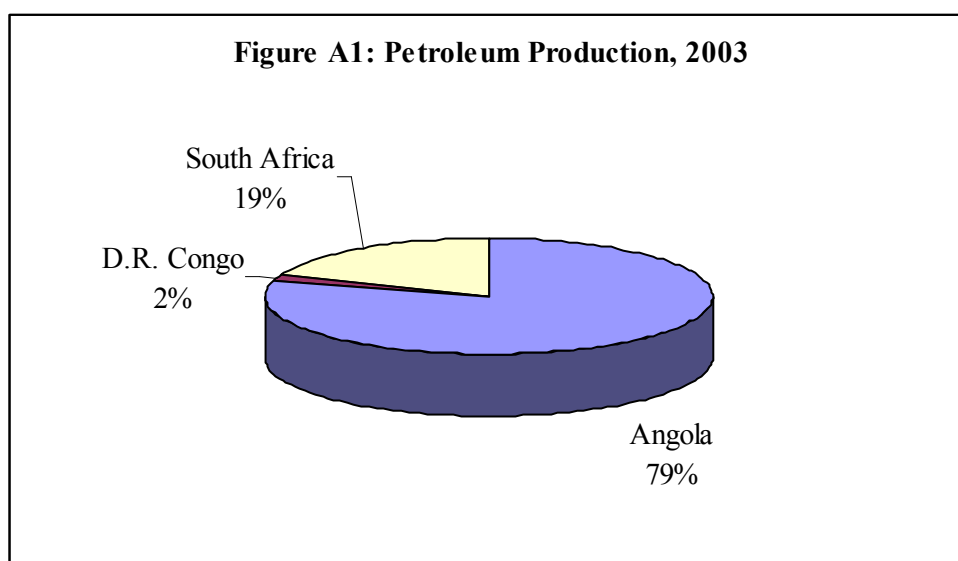
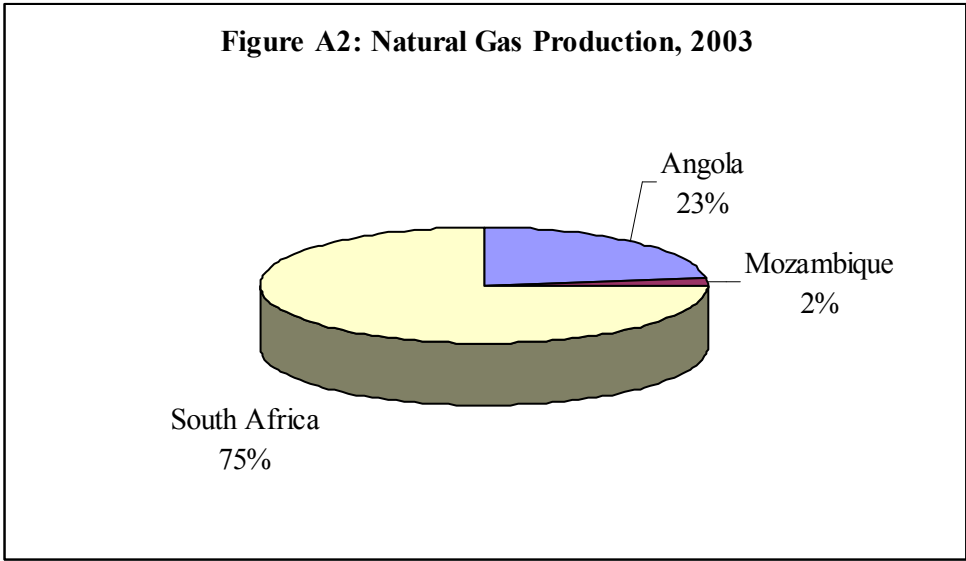


Table A3: Natural Gas Overview (Billion Cubic Feet)			
Country	Production, 2003	Consumption, 2003	Reserves, 1/1/2005
Angola	25.43	25.43	1,620
Botswana	0	0	0
D.R. Congo	0	0	35
Lesotho	0	0	0
Madagascar	0	0	0
Malawi	0	0	0
Mauritius	0	0	0
Mozambique	2.12	2.12	4,500
Namibia	0	0	2,200
South Africa	82.99	82.99	1
Swaziland	0	0	0
Tanzania	0	0	800
Zambia	0	0	0
Zimbabwe	0	0	0
Total	110.54	110.54	9156

Source: Energy Information Administration (2006)



Country	Production	Consumption	Reserves
Angola	0	0	0
Botswana	0.99	1.02	44
D.R. Congo	0.11	0.26	97
Lesotho	0	0	0
Madagascar	0	0.01	0
Malawi	0	0.02	2
Mauritius	0	0.32	0
Mozambique	0.05	0.01	234
Namibia	0	0	0
South Africa	263.78	187.76	53,738
Swaziland	0.41	0.41	229
Tanzania	0.09	0.09	220
Zambia	0.22	0.21	11
Zimbabwe	3.74	3.53	553
Total	269.39	193.64	55,128

Source: Energy Information Administration (2006)

Country	Consumption	Generation	Capacity (gigawatts)	Exports	Imports
Angola	1.78	1.92	0.635	0	0
Botswana	2.26	0.94	0.132	0	1.39
D.R. Congo	4.32	6.04	2.548	1.3	0.01
Lesotho	0.36	0.35	0.076	0	0.04
Madagascar	0.77	0.83	0.284	0	0
Malawi	1.21	1.3	0.303	0	0
Mauritius	1.81	1.94	0.655	0	0
Mozambique	10.46	15.14	2.392	9.5	5.88
Namibia	2.37	1.46	0	0.06	1.07
South Africa	197.37	215.88	40.481	10.14	6.74
Swaziland	1.16	0.39	0.124	0	0.8
Tanzania	2.96	3.15	0.862	0	0.03
Zambia	5.76	8.35	1.786	2	0
Zimbabwe	11.56	8.88	1.961	0	3.3
Total	244.15	266.57	52.239	23.00	19.26

Source: Energy Information Administration (2006)

Appendix B

Map of Southern Africa

