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EVALUATION OF NORWEGIAN ASSISTANCE TO THE ENERGY SECTOR OF SADCC COUNTRIES

GENERAL REPORT
Towards a Development Strategy for Norwegian Assistance

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ENTRE FOR DEVELOPMENT AND TECHNOLOGY
UNIVERSITY OF TRONDHEIM
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FOREWORD

This volume is the **General Report** in a larger set of documents resulting from a study of Norwegian assistance to the energy sector in the SADCC region. The two main reports of the study are:

General Report, and
Summary Report and Recommendations.

In addition there are seven **Project Profiles**, giving a more detailed analysis of the projects/programmes investigated by the team:

1. Review of institutional cooperation between EDM (Mozambique) and NVE (Norway)
2. The Lichinga hydropower project
3. The Cuamba hydropower project
4. Zanzibar rural electrification project (RUREL)
5. Morogoro fuelwood stove project
6. Norwegian co-financing of the World Bank's power rehabilitation project Tanzania
7. Blantyre City fuelwood project

Work on the study began in July 1989 with the publication of an Inception Report. That report was the basis for ideas that were examined during the field work phase of the project, lasting from 4 November to 15 December 1989. The completion of the project reviews allowed the team to rethink the original Inception Report so that the present report includes both the field experience and more recent models of "best practice" that are generally accepted by energy development workers.

The team members were:

Rune Skarstein, senior lecturer
Department of Economics, University of Trondheim - AVH (team leader)

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Ophelia Mascarenhas, director, Central library
University of Dar es Salaam, Tanzania

Jens Erik Torp, senior lecturer
Institute for Industrial Research and Social Development
Copenhagen School of Economics and Social Science

After the field work had been finalised, professor Phil O'Keefe, director of Educational Training Consultants (ETC) in Newcastle, joined the team as editor of the reports. In the write-up of the **General Report** we were also assisted by John Soussan, senior researcher at ETC.

For reasons beyond anybody's control, membership of the team changed during the lifetime of the study. But in spite of that, the continuity of the project was well maintained. The **General Report** contained in this volume, is mainly the product of two workshops held in Trondheim at the end of the project.

The team wishes to express our gratitude to all institutions and persons visited during our field work, for their openness, help and hospitality. We are also much indebted to all those, both within and outside the MDC and NORAD, who commented on the draft reports and gave valuable suggestions for improvements.

Finally, we would like to thank Ms. Birgit Ilstad at CDT and Ms. Anne Welsh at ETC for their conscientious typing of our manuscripts, and Ms. Birgit Ilstad for bringing our reports into an orderly layout.

Newcastle/Trondheim, September, 1991

Phil O'Keefe Rune Skarstein

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ADM	-	Annual Donors Meeting (of SADCC)
BCFP	-	Blantyre City Fuelwood Project
CDT	-	Centre for Development and Technology, University of Trondheim
ETC	-	Educational Training Consultants
EDM	-	Electricidade de Mocambique
ESCOM	-	Electricity Supply Commission (of the Republic of South Africa)
ESMAP	-	Energy Sector Management Assistance Programme (of UNDP and World Bank)
EIA	-	environmental impact analysis
GDP	-	gross domestic product
GJ	-	gigajoule (= 10^9 joule)
GNP	-	gross national product
GWh	-	gigawatthour (= 10^6 KWh)
GWP	-	Government White Paper (Norw. Stortingsmelding)
HEP	-	hydroelectric power
km	-	kilometre
km^2	-	square kilometre
KW (or kW)	-	kilowatt
KWh (or kWh)	-	kilowatthour
LPG	-	liquified petroleum gas
m^3	-	cubic metre
m^3/s	-	cubic metre per second
MDC	-	Ministry of Development Cooperation (of Norway)
MJ	-	megajoule (= 10^6 joule)
MW	-	megawatt (= 10^3 KW)
MWh	-	megawatthour (= 10^3 KWh)
NARSE	-	New and Renewable Sources of Energy
NGO	-	non-government organisation
NIEO	-	New International Economic Order
NOK	-	Norwegian Kroner
NORAD	-	Norwegian Agency for International Development
NVE	-	Norwegian Water Resources and Electricity Board
%	-	per cent

p.a.	-	per annum
RSA	-	Republic of South Africa
SADCC	-	Southern African Development Coordination Conference
TANESCO	-	Tanzania Electrical Supply Company
TAU	-	Technical and Administrative Unit of SADCC Energy Sector (in Luanda)
t	-	tonne
toe (or TOE)	-	tonnes of oil equivalents
TWh	-	terawatthour (= 10^9 kilowatthours)
US$	-	U.S. Dollar
WID	-	women in development
ZACPLAN	-	Zambezi River System Action Plan
ZESA	-	Zimbabwe Electricity Supply Authority
ZESCO	-	Zambia Electricity Supply Corporation

INTRODUCTION

This volume focuses on energy policy issues in SADCC and attempts to draw out policy conclusions for future Norwegian assistance. This is a somewhat difficult task since Norway's own aid policy emphasises equity issues, whereas the major investment programmes concentrate on infrastructure development which does not necessarily serve the majority of the people directly. It raises again the dilemmas of traditional versus modern sector assistance, of rural or urban development. Easy answers are difficult because the use of Norwegian commercial actors is ill-defined as is investment in Norway's comparative advantage in hydropower development. Despite this, there is strong evidence of success in the implementation of SADCC energy projects.

The policy gaps do not only lie with Norway. Within SADCC, the issues of national sovereignty take precedence over regional energy policy, encouraging each member state to strive for energy independence not interdependence. Within the SADCC energy investment budget, electricity projects dominate despite the fact that most of the local population continues to obtain their major energy provision from wood. Again, however, SADCC has a range of energy projects that overcome the drive to national electricity provision.

Addressing these dilemmas is difficult. To help provide some focus, the report concentrates on the different energy demands for rural and urban areas, the experience with hydropower and woody biomass supplies and the experience of Tanzania and Mozambique. The report also tries to keep alive the equity issues which are central to Norwegian policy, namely basic needs, environment and women in development. The report should be read in conjunction with the **Summary Report and Recommendations** which, in a different way, raises similar issues.

What clearly emerges from the experience of Norwegian energy assistance to SADCC is that there is no simple single answer to the question of energy provision. What is required, is an energy policy that defines energy needs in a development, not a technical, context. Of course, such things are easier to say than do.

The strong options for Norwegian assistance to SADCC's energy sector would seem to indicate a two-pronged strategy which would emphasise Norwegian comparative advantage and the nature of the energy problems that face SADCC member countries. In short, this would imply a continued emphasis on hydropower development for rural electrification and an emphasis on the provision and efficient use of woody biomass at household level. Should there be a wish to move beyond these two areas of investment, the logical, but different area, in which to invest would be in the urban energy transition.

It is impossible to review options for assistance without reviewing the institutional context for investment. Energy planning capacity within SADCC remains weak, especially energy planning for the household sector. As a consequence, care must be taken in choosing the right modality for aid delivery through multi-lateral, bilateral or other channels. Most importantly, continued investment in institutional strengthening remains a critical area of investment.

The objectives, priorities and procedures of the multilateral, bilateral and NGO projects vary substantially. The objectives of the multilaterals - notably the World Bank - is to provide loans for investment in commercial energy within a framework of economic restructuring on a least-cost basis; the priority of investment is the electricity utilities, where as in other commercial energy sources, it is seen as the primary responsibility of private not public funding. The procedures are centred around defining pricing policy for project repayment on the basis of long-run marginal cost calculations. Project contracting is based on international competitive bidding.

Bilateral objectives are somewhat more varied. Although for technical reasons the objectives are broadly similar to those of multilateral agencies, Norwegian bilateral aid is a grant not a loan, so there is a willingness to ease commercial against basic needs considerations. This favours rural electrification which might not be approved by multilateral donors. There is also a willingness to undertake smaller projects - especially isolated electricity systems - which has benefits in building towards an integrated system without initially demanding the high investment of an integrated system. Quite simply, Norwegian bilateral aid does not need to burden energy users with the full capital cost of energy development. Most importantly,

there is a potential for technical cooperation unavailable to multilateral agencies. Procedures vary - although competitive bidding is used, there is experience in contract negotiation which favours the phased model of electricity system development.

NGO objectives are small scale, people-focused. As such, they have strengths in the non-commercial fuel sector where their focus is on basic needs provision. At such a level, their priorities encompass equity goals - especially women and environmental issues - but their primary objective is to provide transferable learning experiences. They often, however, rely on committed individuals rather than formal administrative structures which can work against experience transfer, they often ignore economic considerations and they do not seek technical expertise. These criticisms must, however, be expected if NGO activity remains under-funded.

The bilateral channel for assistance provides maximum flexibility for donor and recipient - it should remain the dominant modality and, when used, reflect Norwegian policy and comparative advantage.

Care should be taken with multilateral channels, where cofinancing exists. In particular, cofinancing agreements need to be examined in detail so that the conditionality of the lead agency is not unknowingly imposed on the Norwegian contribution.

With other bilateral donors, individually and together, Norway could explore cofinancing without resorting to multilateral channels. Where there is obviously an advantage in using multilateral channels, such as ESMAP, continued support should be made available.

NGO experience is limited but, while this experience indicates the value of both grassroot intervention and learning by doing, there is need for more substantial support to allow information exchange, to obtain technical support and to cover administrative costs. To this end, it is useful to explore, with local professionals, the possibility of packaging together a number of small projects to build local capacity within the region without overburdening evaluation procedures.

1. NORWEGIAN AID AND SADCC ENERGY

1.1 A Review of Norwegian Aid Policy

Norwegian aid is broadly in the tradition of Scandinavian social democratic assistance to the Third World. This social democratic involvement, perhaps best summarised in its intentions by the Pearson, Brandt, Palme and Brundtland Reports, involves a commitment to devote a substantial part of national income, in excess of 1 per cent of GDP, to development aid through a variety of multilateral, bilateral and NGO channels. The expressed purpose of such an aid policy is to assist developing countries in building greater self-reliance, an emphasis which includes support to progressive liberation movements. Such an emphasis frequently leaves unanswered questions about the role of private, commercial organisations in the delivery of aid. As a consequence the poverty-oriented strategy that seeks to address issues of equity is more of a policy flavour than a programme focus. Norwegian aid continues to support conventional development programme delivery.

There have been changes in emphases in Norwegian development assistance. Since the 1970s, equity considerations have been given high priority in policy statements. The Government White Paper GWP-29 (1971-72) argued the need for profound changes in the economic and social structures of Third World countries so that economic growth could benefit the less privileged. A minimum standard of welfare services was considered the necessary precondition for bringing the mass of the Third World population into productive activity. GWP-29 introduced the concept of *basic needs*, implying that the poorest sections of the population should be the main target group. GWP-29 also made a sharp distinction between development assistance and commercial activity in developing countries. It noted that,

> "it can not be expected that transfers from Norwegian industry and commerce can constitute an important contribution to our support for social and economic development in the backward countries".

GWP-94 (1973-75) assessed Norwegian development assistance in the context of total

relations between Norway and the Third World countries. The New International Economic Order (NIEO) was the focus of the political agenda, and GWP-94 reflected Norway's active involvement in the "North-South Dialogue". The emphasis was not so much on the need to change the internal structures of Third World countries but rather on the need for new trade relationships between North and South. However, the focus of GWP-94 was on improving the terms of trade of developing countries within the existing international division of labour rather than emphasising the need for a profound change in international economic relations. One section of GWP-94, related to development assistance, proposed that Norwegian exports and investment could be promoted in developing countries, an emphasis which contradicted GWP-29.

The economic stagnation in the North, and the consequent struggle for markets, accelerated commercial pressures on aid budgets including Norwegian aid. This was reflected in Norwegian government action, which blurred the principles of GWP-29 that had distinguished clearly between development assistance and the interests of Norwegian industry and commerce. The erosion of this distinction took place gradually, with the "Ship Export" campaign representing an important landmark in the process.

After a decade of policy silence, the Centre/Conservative coalition government released GWP-36 (1984-85). The Foreign Relations Committee of Parliament had not commented on the document when the incoming Social Democratic government withdrew it and presented a supplementary GWP-34 (1986-87) to be added to GWP-36 (1984-85). These two policy papers passed through Parliament, in mid-1987, without much debate. Both agree on the overall objectives of Norwegian assistance, which are:

1) to contribute to lasting improvement in the economic, social and political conditions of the population in the developing countries;
2) to focus particularly on the needs of the poorest groups and countries;
3) to avoid creating dependence on continual aid.

In addition, both emphasise that assistance should be based on the plans and priorities of recipient countries, and Norwegian supplies should only be used when prices are inter-

nationally competitive. Both papers address environmental and ecological issues as an integral part of development assistance. This issue is a major new initiative in Norwegian assistance in the 1980s. GWP-34 makes some effort to formulate a strategy for assistance to check the excessive exploitation of natural resources but the analysis is narrowly tied to demographic questions.

GWP-36 focuses on women as a target group. The focus on women in development was given additional emphasis by the adoption of a special strategy for assistance to women in 1985. The strategy has two main goals, namely:

1) to improve women's living and working conditions;
2) to provide women with opportunities to participate in economic, cultural and political activities.

In sharp contrast to GWP-29, GWP-36 and GWP-34 argue for a more central role for Norwegian industry and commerce, both in relation to bilateral assistance and to promoting industrialisation in developing countries. New arrangements are introduced to support the activities of Norwegian firms, including so-called mixed credits, combining development assistance with commercial export credits.

GWP-34 stresses that the major objective of the arrangements supporting the activities of Norwegian firms should be to,

> "Develop sustainable economic activity in developing countries, and thus, contribute to the social and economic development of these countries".

Moreover,

> "The priorities of developing countries themselves should be the basis for the use of the arrangements".

However, it adds that,

> "At the same time, the arrangements should contribute to making (development) projects economically interesting for Norwegian industry".

With hindsight, it can be argued that the profound change in Norwegian assistance, during the 1980s, was not its policy emphasis on environment or women but the incorporation of Norwegian commercial interests into development programmes. This incorporation of commercial interests raises dilemmas for the continuous policy emphasis on poverty. In Africa, in particular, where few commercial partners exist, official development aid is the major route for commercial penetration. This is not surprising given that developing countries are an expanding market.

Both GWP-34 and GWP-36 present hydropower development and offshore petroleum activities as areas where Norway is especially well qualified for rendering technical assistance (GWP-36:108-109, GWP-34:79). They are also the areas in which commercial interests loom large. No such statement is made about other forms of energy, especially about woodfuel, the dominant energy resource in Africa.

The dilemmas facing Norwegian development policy with regard to energy development are best summarised by drawing attention to what may be called "The Inverse Law of Energy Delivery". This law holds that those who most need energy to increase their standard of living receive least support. The reason for this lack of support is that their energy demand is largely for household and agricultural use, not for industrial or commercial use. Ironically, their per capita energy consumption is high not least because the traditional energy resource of biomass is used inefficiently. The inverse law is further exaggerated because commercial energy delivery is best provided to aggregate locations by high technology development rather than appropriate technologies for disaggregated and scattered use. To date, no-one has resolved the problem of the inverse law of energy delivery so that de facto investment emphasises the development of electrification even such development is known to give poor financial returns.

1.2. Norwegian Aid to SADCC

The SADCC region comprises nine countries:
Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe.

The total population was in 1986 estimated at 73 million persons and will reach approximately 113 million by the year 2000. The countries differ enormously in size and in their resource base. GNP per capita, in 1986, varied between US$ 160 for Malawi and US$ 840 for Botswana. Six of the countries are low income economies with only Botswana, Swaziland and Zimbabwe classified as lower middle-income. Only in Botswana did the annual average growth of GDP exceed population growth in the 1980s. In Angola, Lesotho, Mozambique, Tanzania and Zambia, GNP per capita declined.

Six of the nine countries are landlocked with outlets to the sea through Mozambique, Angola and Tanzania or via the Republic of South Africa. Their economies are dependent on subsistence agriculture, and exports are dominated by minerals, migrant labour and agricultural commodities. Industrialisation is regionally concentrated, with almost half of industrial production in Zimbabwe. With the exception of Angola and Tanzania, the other countries have been historically incorporated into a regional economic sub-system dominated by South Africa. Given this situation, SADCC was formed in an attempt to reduce dependence on South Africa and strengthen the ties of regional integration to facilitate national development efforts.

Bilateral assistance (cf. Table 1.1) accounts for about 33% of total Norwegian development assistance, with multilateral assistance through UN organisations (approximately 22%), and through the World Bank, including co-financing, and regional development banks (about 14%), representing the other main items. Total Norwegian foreign assistance increased from NOK 4370 mill. in 1985 to NOK 7323 mill. in 1990.

Norwegian bilateral assistance has focused on main partner countries, with annual total disbursements to those countries amounting to more than 65% of total bilateral aid

expenditure throughout, but showing a marked relative decline in the 1980s (cf. Table 1.1).

Tanzania is the dominant main partner country in the SADCC, receiving more than 20% of total bilateral aid, with smaller amounts spent on Mozambique, Zambia and Botswana. Zimbabwe counts among other important countries, although in 1984 and 1986, total disbursements to Zimbabwe exceeded those to Botswana. SADCC dominates regional assistance accounting for about 55% of that budget item in 1987 and 1989 (cf. Table 1.1).

Perhaps a better estimate of the aid focus is obtained by looking at the distribution of experts by sector. Public utility provision (shown in Table 1.2) leads the provision of experts. This is largely concentrated in the hydroelectric sector, although disaggregation is difficult to find.

Table 1.3 outlines the number of energy projects financed by Norway in the SADCC region as of end of 1989. These projects, with three exceptions, are all focused on electricity systems with a strong emphasis on hydropower. In addition, there are three projects financed through the World Bank which are electricity system development in Mozambique, Tanzania and Zimbabwe. Details of individual projects are shown in Annexes 1 and 2 to the *Summary and Recommendations* volume.

Table 1.1 Norwegian Bilateral ODA Aid Expenditure *

	1985		1987		1989		1990	
	NOK mill.	%	NOK mill.	%	NOK mill.	%	NOK mill.	%
Main partner countries	1269.2	85.5%	1368.0	68.7%	1208.2	67.0%	1701.9	70.0%
of which:								
Tanzania	337.4	22.6%	402.9	20.2%	396.7	22.0%	541.1	22.3%
Mozambique	142.3	9.5	156.7	7.9	341.4	18.9	224.9	9.3
Zambia	115.7	7.8	153.4	7.7	241.3	13.4	233.6	9.6
Botswana	60.3	4.0	81.2	4.1	129.4	7.2	82.2	3.4
Other partner countries	151.6	10.2%	231.8	11.6%	178.4	9.9%	308.1	12.7%
of which:								
Zimbabwe	55.5	3.7%	114.6	5.8%	119.3	6.6%	80.1	3.3%
Regional development assistance	72.8	4.8%	391.2	19.7%	416.4	23.1%	420.5	17.3%
of which:								
SADCC	72.8	4.8%	212.4	10.7%	231.4	12.8%	204.3	8.4%
TOTAL	1493.6	100.0%	1991.0	100.0%	1803.0	100.0%	2430.5	100.0%

* Including budget items 150 ("bilateral aid, main partner countries"), 151 ("other partner countries"), and 152 ("regional assistance").
Source: St.melding nr. 3: Statsregnskapet, several issues.

Table 1.2 The Distribution by Sector of Expert Man-years in 1986

	Nos.	%
1. Planning and Public administration	11	5
2. Public utilities	75	36
3. Agriculture, fisheries	53	26
4. Industry, mining and handicraft	10	5
5. Banking and finance	5	2
6. Education and science	21	10
7. Health and family	20	10
8. Multisectoral	11	5
9. Other	2	1
TOTAL	208	100

Source: Development Assistance Committee Aid Review, 1987-88

Table 1.3 Energy Project Investments in SADCC by end of 1989.

FOCUS	NUMBER
Angola	1
Mozambique	10
Tanzania	7
Zambia	1
SADCC Regional	13
Via World Bank	3
Total	**35**

Source: NORAD files 1991.

Every measure - volume of assistance, expert advice and sector focus - shows the domination of electricity provision. Current energy investment related to household energy provision (basic needs), wood energy (environment) and NGOs (women) is reletively small.

An agreement on increased economic and cultural cooperation between the Nordic countries and SADCC was signed by the Nordic governments and all SADCC governments in January 1986. This agreement emphasises the need of the SADCC countries to reduce their external

dependence, and it acknowledges the vulnerability of SADCC states towards South African aggression and destabilisation. In the agreement, Nordic countries commit themselves to increase their support to SADCC's intraregional cooperation in areas given priority by SADCC.

This commitment is also reflected in the Norwegian GWP-36 (1984-85) and GWP-34 (1986-87). GWP-36 emphasises that Norway is prepared to support SADCC in the development of transport and telecommunications. Moreover, it is noted that,

> "Energy is another important area of cooperation which SADCC gives high priority" (GWP-36:62).

GWP-34 (1986-87) does not mention the energy sector explicitly, but states that:

> "...the government attaches importance to increasing the cooperation with the SADCC region regarding investments in productive activities, including private investments". (GWP-34:43).

Norwegian aid to SADCC is part of a larger Nordic initiative. The Nordic countries (Norway, Sweden, Denmark and Finland) provide one third of western aid disbursement to SADCC. Nordic countries have upgraded their commitments substantially - almost doubling bilateral net disbursement from 1981-86. It is, however, official SADCC policy that SADCC projects should be owned, managed and operated from within the region. Against this background, it would be difficult to design projects in which private investment by Norwegian industry could be included in Norwegian cooperation to SADCC. GWP-34 (1986-87) notes that the MDC,

> "is in the process of developing policy guidelines for this purpose"(GWP-34:43).

There is, as yet, little written documentation providing such guidelines. As a consequence, long term issues of ownership and, by implication, management are unresolved as both Norway and SADCC operate an *ad hoc* approach to programme formulation. This is

understandable given the changing political reality of southern Africa in which, despite the wars ranging in the SADCC region, the collapse of apartheid was imminent. The wars themselves, however, have led to a collapse of institutions within the SADCC member states thus making long-term firm institutional arrangements, including private investment, extremely difficult. The strong political dimension of SADCC support overrides normal administrative channels, a process that was accelerated because of assistment to war-torn economies. Ironically, in the longer run, the southern African electricity development may be limited: the major donors are already indicating that high value commercial work in electricity will be dominated by the strong regional actor, namely ESCOM of South Africa.

The paragraph on SADCC in the GWP-34 concludes with the following statement.

> "The government will attach great importance to supporting the SADCC region, and contribute to its economic, political and cultural development, and to reducing the SADCC countries' dependence on South Africa"(GWP-34:43).

This conclusion indicates the strong political dimension to SADCC support. Both SADCC's strategy in the initial years, and the Norwegian assistance to SADCC, focused heavily on major infrastructural activities, particularly within energy and communications. In its content, the assistance to SADCC has therefore come to differ from the main policy thrust of Norwegian aid during the 1980s not least because assistance to SADCC has been seen as a political investment not simply an economic investment. Commercial involvement was necessary to deliver major infrastructural activity.

SADCC's role in projects has normally been limited to the financing and investment phase. The operation of the services created by investment is the responsibility of the individual countries. The emphasis, at a regional level, has been on investment projects, with less emphasis on strengthening the institutions that are responsible for the future operation of the projects. Even if some changes have occurred lately, SADCC projects probably still differ in this respect from bilateral projects their operational capacity is weak. This weak organisational capacity, at a regional level, exacerbates the problems of judging the performance of Norwegian aid in SADCC, particularly since the energy policies of individual SADCC

member states are sometimes at odds with regional policy.

With respect to support to the energy sector, the Norwegian government is aware that the policies of individual SADCC governments, emphasising national energy self-sufficiency, are not always consistent with the official policies of SADCC as a whole. If the primary concern is to support regional cooperation within SADCC, it is important that Norwegian support to individual SADCC member countries is well coordinated with SADCC projects.

The major general objectives of Norwegian assistance may be summarised as follows:

- a contribution to lasting improvement in the economic, social and political conditions of the population in the developing countries;
- a basic needs and poverty orientation;
- a recipient orientation;
- an improvement of women's living and working conditions;
- a secure environment, proper management of natural resources and sustainable development; and
- an avoidance of aid dependence.

In addition, there is the general support to SADCC's broader, general objectives of regional cooperation and reduced dependence on South Africa.

SADCC's energy policy is closely related to its broader, general objectives. It is, therefore, in line with the general objectives of the Norwegian assistance to SADCC. With an increased SADCC emphasis on bioenergy, these policies are also in line with the emphasis on environmental and poverty issues in the Norwegian aid objectives although, in the energy sector, Norway does not assist heavily in bioenergy. Similarly, increased emphasis on training and manpower development helps address the dependency issue. The gender dimension is not explicitly spelled out although, by implication, increased attention to bioenergy also means an increased focus on women.

The Norwegian policy towards SADCC is strongly recipient-orientated. In the agreement on

increased cooperation between the Nordic countries and SADCC it is stated that,

> "the initiative aims at promoting regional cooperation among the SADCC states in accordance with the objectives that are expressed in the declaration `Southern Africa Toward Economic Liberation'" (GWP-34:94).

Traditionally, national energy policies have focused heavily on commercial energy and placed less emphasis on non-commercial fuels, particularly, bioenergy. By implication, they have been more orientated towards an economic development dimension rather than the poverty dimension of the Norwegian aid objectives. This is now changing, and present sector policies also generally include reference to both environmental issues (deforestation) and household energy supply. Explicit discussion of the gender issue is however, generally lacking.

There are three policy issues that MDC needs to address. These are best phrased as questions, these are:

- the dilemma of incorporating commercial interests into an equityfocused development policy;
- the dilemma of matching Norwegian comparative advantage to energy needs;
- the dilemma of providing assistance within a regional framework which does not control national energy programmes.

These dilemmas can only be addressed if Norwegian development assistance in the energy sector has a stronger policy framework. The design of this framework would begin by recognising that the global energy future is unknown and unknowable. Not surprisingly, therefore, the environmental impact of this energy future is equally uncertain. Developing policy, under conditions of uncertainty, will require an emphasis on prevention rather than cure, on proactive rather than reactive assistance. The two princicples that must undelie an energy policy are therefore firstly a commitment to a sustainable energy economy and secondly a commitment to energy security.

The commitment to a sustainable and secure energy future is not only a commitment to

minimising ecological risk while maintaining development opportunities but it is also a commitment to long term opportunities with development partners. In this partnership the acceptance of environmental conditionality implied by the development of a sustainable energy economy will draw out environmental additionality. The notion of environmental additionality is that aid is designed to encourage the rapid spread of models of best practice for energy provision.

Energy is not a goal in itself but an input needed to maintain basic needs and provide development services. The energy demand of the end-user to obtain services in any sector requires analysis so that demand is met in the most efficient and sustainable way. En-duse demand analysis is a cornerstone for planning a sustainable energy economy.

Coupled with the commitment to a sustainable and secure energy economy is the need to analyse the "real costs" of meeting energy needs. Without a commitment to real cost analysis of competing energy systemes it is impossible to choose the models of best practice for choosing and sustaining a secure energy future. Within the energy planning framework the emphasis on end-use and real cost drives investment logically towards an emphaisis on efficiency and new and renewable sources of energy. Such investment ties in well with a commitment to the maintenance and improvement of basic needs. This emphasis on equity can be more sharply focused by emphasising household energy demand which explicitly recognises the central role of women in mangaging the household economy.

Such an explicit energy policy would help remove the dilemmas posed by the current assistance programmes, which is largely commercially focused, while continuing to press ahead with a number of development policies which are broadly poverty-driven.

1.3 SADCC Regional Energy Policy

Within the SADCC framework, Angola has responsibility for the energy sector. This is exercised by means of the Technical and Administrative Unit (TAU) in Luanda. Under its original mandate of 1982, the government of Angola was charged with responsibility for

preparing a regional energy development, conservation and security plan. More recently, TAU has developed a medium term strategy to fulfil part of its mandate by focusing on five key energy sub-sectors namely petroleum, coal, electricity, fuelwood and new and renewable sources of energy (NARSE).

TAU has been charged with responsibility for:

- coordinating the energy sector in the region;
- initiating or supporting contacts with SADCC's international cooperating partners;
- convening and chairing regional meetings of energy officials;
- servicing meetings of Energy Ministers and following up the implementation of decisions;
- overseeing the work and controlling the budget of the SADCC Energy Sector;
- overall editorial and management responsibility for the regional *Energy Bulletin.*

In 1985, a five-year strategy for the SADCC Energy Sector was announced containing short and medium-term objectives. These were eight in number requiring TAU to:

1. reduce the drain on foreign exchange reserves caused by extensive imports of petroleum products;
2. establish emergency supply and distribution mechanisms;
3. reduce the depletion of woodfuel resources;
4. promote better knowledge of the capital and technology requirements of the region;
5. establish detailed knowledge of the energy situation and its inter-relation with macro-economic development in the region;
6. strengthen required cooperation in the various energy sub-sectors;
7. develop expertise in energy technologies and promote technology transfer to the region;
8. continue rehabilitation programmes.

These eight objectives are more functionally obtainable at a national, not a regional level.

A sevenfold prioritisation for action was then outlined:

1. development of conservation programme;
2. increased exploration and development of indigenous reserves;
3. development of substitution programmes;
4. establishment of pilot studies and pilot installations;
5. promotion and development of professional skills;
6. development of Regional Master Plans to complement national programmes and serve as a required frame of reference;
7. support and promotion of national and regional institutions to ensure effective implementation of energy programmes.

The TAU structure has grown considerably with four central departments of planning, administration, technology and a regional *Energy Bulletin*. What distinguishes TAU from other regional energy organisations is the dominant emphasis on project formulation and obtaining financial commitment for projects. TAU has been generally successful with approximately half of the 75 projects until end of 1990 receiving funding. Some thirteen are completed and another twenty-six are underway with a combined value of US$ 164 million. Table 1.4 shows the projects formulated for funding in 1990.

Following an ESMAP evaluation (1989) of the SADCC energy sector, TAU was recommended to keep its mandate under permanent review, not least because of the sovereignty of national energy policy formulation where large capital sums are required. The ESMAP review emphasised TAU's role as best concentrating on those activities that offer member states greater advantages when undertaken at a regional rather than a national level. In particular, ESMAP recommended that TAU should be encouraging efforts to build an economic analysis of energy projects rather than a physical analysis of total energy systems; this would imply a role for TAU that helped member states establish clear priorities in their energy sectors. At no point in the ESMAP review was it suggested that TAU scould become a free standing commission but rather that TAU decentralises its operation to facilitate information flows to member states. Finally, the ESMAP review emphasised that the project portfolio, presented at the Annual Donors Meeting, must give a stronger indication of priority against

the regional energy strategy which, in turn, would require a time frame and a ranking between and within sub-sectors.

Projects in the TAU portfolio have tended to fall into two categories, namely investment projects and activity projects. Capital investment projects are usually national, located in one country, and only catering for the energy demand of that one country. TAU has not yet discussed whether it should take responsibility for such capital investment projects or whether individual countries should find other procedural routes for obtaining finance. Activity projects, however, have a regional or transnational dimension and have largely consisted of seminars, courses, manpower development and researching models of best practice.

Table 1.4 SADCC Energy Projects (formulated for funding by 1990).

Sector	Country	No of Projects
Overall Coordination	Regional	1
Oil	Regional	4
	Tanzania	1
Electricity	Regional	3
	Angola	1
	Botswana	1
	Lesotho	4
	Malawi	4
	Mozambique	4
	Tanzania	1
	Zambia	3
	Zimbabwe	1
Woodfuel	Regional	8
	Angola	1
	Mozambique	1
Conservation	Regional	2
	Zambia	1

Source: TAU, 1990

There is little correspondence between stated policies of the SADCC Energy Sector and actual investment. An easy explanation of this non-correspondence is that electricity *per se* is not the only sector addressed in SADCC energy policy statements, but it tends to be the

major one that donors wish to fund. Table 1.4 quite clearly demonstrates that electricity projects dominate SADCC investments. Clearly, national - rather than regional - projects are being channelled through the SADCC energy sector.

1.4 National Energy Policy - Mozambique and Tanzania

In their national energy policy programmes, all SADCC member countries put emphasis on reducing their dependency on petroleum imports. In addition, they stress a policy of developing domestic energy resources and promoting national energy self-sufficiency. These policies are stressed without any noticeable reference to the potentials and possibilities of regional cooperation. For example, in *Botswana* the focus of the energy programme is to open up new coal resources for export and to supply new thermal power stations with coal, enabling the country to reduce purchases of fuel from the RSA. The government of Botswana prefers developing thermal power based on own coal resources, instead of opting for hydropower imports from Zambia and/or Mozambique. *Malawi* also emphasises national self-sufficiency by constructing new hydro plants rather than investing in transmission lines from Cahora Bassa. The country has, however, agreed to import some hydropower from Zambia.

During the first years of Independence *Mozambique's* energy policy was marked by an optimistic confidence in the possibilities of achieving a high degree of self-sufficiency within the sector. There was a need to reduce the imports of petroleum products, which while representing only 12 per cent of energy needs (1979), demanded a heavy portion of the country's foreign exchange earnings. Exploitation of indigenous energy resources was, therefore, promoted to meet the requirements of an ambitious industrial and agricultural plan. The industrialisation programme aimed at establishing production of among other things, iron and steel, machinery, aluminium, basic chemicals, cement and other construction materials.

The objectives of Mozambican energy policy were summarised through a series of measures:

- intensifying the survey of existing energy resources, giving priority to hydropower;

- profiting from the large existing hydropotential in order to meet new energy requirements by developing larger hydropower schemes, and simultaneously erecting a National Electrical Grid;
- developing a rural energy policy in areas far from the National Electrical Grid based on reforestation programmes, small scale hydropower projects, the use of windmills and watermills for irrigation and solar energy for cooking and heating;
- rationalising the use of oil, primarily by implementing a series of measures in the transport sector, such as improved maintenance, control of purchases and imports and the promotion of public transport.

The major electrification works are now almost complete, but the envisaged associated agricultural and industrial developments have not taken place. From the late 1970s until the mid-1980s, investments in the energy sector, primarily hydropower, amounted to about 20 per cent of the country's total investment expenditure. The government maintains that its economic strategy including the strategy for the energy sector, is now guided by two complementary principles, namely to maintain the viability of productive assets through rehabilitation and maintenance programmes and to promote sustained economic development through exploitation of indigenous resources.

A new element has been introduced as a central focus of the Mozambique's energy policy, an element that emphasises regional cooperation. Regional cooperation has been stimulated through the SADCC cooperation and, in the energy sector, there is now a clear policy to give high priority to *power exchange projects*. In principle, the Mozambican authorities are promoting the use of existing facilities, as well as the exploitation of new hydropower, to realise power export opportunities. There has also been a change in priorities regarding hydropower exploitation. More emphasis is now placed on small-scale projects; and the large projects, dominating the picture during the first period after Independence, have been put aside.

In *Tanzania*, the Government has worked out broad objectives for the energy sector. Firstly, the Government needs to assure the required supply of energy to the various sectors at reasonable costs. In pursuit of this objective, it has actively supported the expansion of

electric power supply facilities with strong emphasis on the utilisation and distribution of hydropower. It owns the electricity utility company (TANESCO) outright, has taken a majority equity position in the country's only refinery and is actively involved in the imports of petroleum products. Because of the heavy foreign exchange burden imposed by oil imports, attempts are made to reduce consumption as much as possible by keeping petroleum prices at least in line with, or above, opportunity costs of oil imports. The Government is also actively promoting the search for oil and gas, generally in cooperation with foreign oil companies.

Secondly, the Government seeks to maintain reasonably uniform prices for commercial energy (petroleum, electricity) throughout the country. In pursuit of the Government's social objectives, fairly uniform prices and tariffs are charged for petroleum products and electricity throughout the country regardless of the local costs of supply.

Thirdly, the Government seeks to maintain and improve the financial viability of various supply organisations. With respect of power prices, the Government has committed itself to maintain the financial viability of TANESCO. This effort is supported through the World Bank Power Rehabilitation Project.

Fourthly, the Government seeks to promote the exploitation of some of the underdeveloped indigenous energy resources for domestic uses and exports. For a number of years the Government has actively promoted the development of its hydro resources for exports to increase foreign exchange earnings. Lately, this option has become more urgent because of the current and possibly future surplus of generating capacity. The only potential market for such exports in the foreseeable future is Kenya. A joint interconnection study between the two countries is underway and there are signs that Kenya is interested in importing electricity from Tanzania to a level of 10 to 15 per cent of their own MW capacity. Finally, the Government seeks to secure and augment the supply of household fuels, particularly fuelwood and charcoal.

1.5 Problems of SADCC Energy Cooperation

There are, especially in the electricity subsector, signs that SADCC member states are hesitant to commit themselves to a close energy cooperation within SADCC. A major task of the TAU is to centralise the data available on energy use in the SADCC countries at one location in Luanda. In their effort to achieve this, TAU faces the problem of time delays within individual member states in the compilation of annual statistics on the production, imports, exports and use of all the major energy sources, with the result that the timeliness of the data available is reduced. Moreover, there has been occasional reluctance on the part of individual governments to share data. In some cases, government agencies will not release information gathered in studies until such studies have been officially accepted and approved by the government, an often quite lengthy process. Contrary to the spirit of SADCC, there have been reported about instances of individual member countries withholding data from TAU especially with regard to the petroleum and electricity subsectors.

The energy policy objectives of SADCC are quite ambitious and appropriate for the region. Member states have committed themselves officially to these objectives, but the overriding policy in each country is one of national energy self-sufficiency without much consideration of the SADCC objectives of regional cooperation. On the whole, the individual governments, including Tanzania and Mozambique, are somewhat hesitant to commit themselves to a close energy cooperation within SADCC.

1.6 Moving to an Energy Policy

It is not surprising that the jury is still out on the apparently simple question of the effectiveness of Norwegian aid to the SADCC energy sector. Norwegian aid policy itself offers a wide variety of options which might, or might not, be the flavour to particular programmes and projects. The strong emphasis on equity jars somewhat against the heavy assistance to infrastructure which does not serve the majority of people directly. It raises again the question of traditional versus modern sector assistance, of rural or urban

development. Easy answers are difficult because the use of Norwegian commercial actors is ill-defined as are the criteria for investment in Norway's comparative advantage in hydropower development.

In SADCC policy there are also problems. Issues of national sovereignty take precedence over regional energy policy, encouraging each member state to strive for energy independence not interdependence. With SADCC's energy investment budget, electricity projects dominate despite the fact that the majority of the population do not have access to electricity.

What is required is an energy policy for investment in the SADCC region. It is against this background of dilemmas in light of experience to date, that this volume next explores issues of an energy policy.

2. THE DEVELOPMENT CONTEXT OF ENERGY POLICY

2.1 Sustainable Energy Development

There is a wide awareness that the context of energy policy has changed in recent years. The dual crises associated with oil and woodfuel resources have largely receded to be replaced by wider concerns over sustainable development and environmental degradation. Falling oil prices and the understanding that, while fossil fuels may be finite, they are not scarce, have led to a reappraisal of commercial energy sources. At the same time, while fuelwood problems undoubtedly exist, they are indirect and localised - put simply, biomass problems are specific to people and place. As with oil, fuelwood problems are now more correctly seen as a development, rather than an energy, issue.

The debate has, thus, switched to more complex concerns - debt burdens, restructuring policies and a range of environmental issues at local, national and global levels. The key issue is not how to supply more energy but rather how to ensure that the energy needs of sustainable development paths are met in the most efficient manner. For energy planning, the key is to define energy need not resource availability.

Much uncertainty surrounds the meaning of sustainable development. In essence, it is a call for policies which maximise growth without jeopardising the position of marginal people or depleting the future viability of the resource base. Sustainable development recognises that existing production systems cannot survive unaltered in a changing world. They must adapt to new circumstances if they are to continue to provide for the needs of the majority of poor people.

Sustainable energy policies will have some distinctive characteristics. They will take a long time horizon in which needs are assessed and resources valued in relation to a development trajectory which seeks lasting and secure patterns of growth and change. This can only be done in a context of pursuing the "best practice" technology where "best practice" is defined as the solution(s) acceptable to national professional bodies drawing on advice from scientists, engineers and administrators in their personal, professional, not institutional, capacity.

Inevitably there will be tensions between long-term development and short-term economic needs.

Implicit in this is the recognition of the need to value the environment and treat it as a central dimension of any development path. It rejects the idea of treating environmental factors as "externalities" which are considered, if at all, in terms of "impacts" upon a static system. The real cost of patterns of development needs to be assessed and, in this, the true worth of environmental stocks, flows and sinks must be internalised. As with physical and financial capital, the price paid for the use of environmental "capital" must cover the costs of its production and replication. And as with other forms of capital, environmental "capital" can be "accumulated" according to the way it is used. Sustainable development paths will seek to "add value" to environmental resources by exploiting them in ways which increase their productive capacity without diminishing their quality or durability. Sustainable development thus captures Norwegian policy emphasis on environment.

Sustainable development requires the recognition of policies which enhance equity. Policies must strive to meet needs as their first goal, not to simply increase production or enhance accumulation. Mechanisms for distribution are as important as those for production, and the needs of those with the least must come first. It is the poorest who gain the least from present patterns of development and are most seriously affected by present environmental degradation. This must be reversed if the needs of present and future generations are to be met. Energy policy development must seek to redress these imbalances, and pay attention to the needs and priorities of structurally disadvantaged groups such as the landless and, in particular, women. Again sustainable development thus captures the Norwegian policy emphasis on basic need provision and women.

From this comes the final characteristic of sustainable development policies: the recognition of the need to devolve control over resources and over decisions on development paths as widely as possible. The value of local communities' knowledge of their problems, priorities and potentials for development is now widely recognised. These communities must be given the power to influence the decisions which affect their lives, and in particular development paths which give them greater control over the physical, financial and environmental

resources on which they depend must be found. Part of this is the need for institutional structures which will link local communities to the state and the external economic system in a way which makes their voice heard and produces development which responds to this voice. As such, the need for development trajectories which are sustainable in institutional terms is as important as sustainable forms of economic development or environmental management.

2.2 Energy Development and Economic Restructuring

The sustainable development perspective discussed above recognises that current patterns of economic development in the Third World are not creating patterns of sustainable change and are failing to meet the needs of the most disadvantaged. In many cases, traditional growth-oriented policies are failing in their own terms: throughout Africa and Latin America, in particular, the 1980s saw widespread economic decline.

This economic crisis is a vital conditioning factor for energy policy development. Real tensions exist between these long-term development goals and short-term economic necessities. Capital and foreign exchange are scarce, inhibiting both investment decisions and the ability to pay for imported fuels and technology which are vital to maintaining current activities and building future development. For many of the poorest countries, this is compounded by economies which are vulnerable to international economic cycles and have a weak institutional and human resource capability. *Above all, the burden of debt servicing undermines sustainable development.* Volatile interest rates, changing foreign exchange regimes and poor development policies have all contributed to the debt burden. The current fashion for rigid conditionality and imposed structural adjustments undermines the long-term development potential in order to cope with short-term economic crises.

Energy sector investments, such as large power schemes, which were based on false assumptions about economic growth and which have consistently under-performed, play no small part in current economic problems, although SADCC has largely avoided this experience. Such past mistakes must be avoided. In an international competitive context, it

will be increasingly difficult to argue that electricity investment is a public service with a low or non-existent discount rate. This requires a realistic approach to energy investments. Their role in development trajectories needs to be clearly laid out, and where uncertainty exists, caution needs to be exercised. Energy policies, especially electricity investment projects, must be seen as part of the total development process. Individual projects should be viewed in the light of their contribution to energy transitions defined around the development process.

2.3 Defining Energy Needs

Population growth and urbanisation are changing the ways resources are managed, but both are driven by rural poverty and livelihood insecurity. Real and secure increases in rural standards of living are fundamental development goals if poverty and environmental degradation are to be addressed.

There is some debate over the significance of population growth rates. Fears are frequently expressed on the scarcity of energy resources and the survival of the land resource base, but these tend not to take full account of the significance of the urbanisation processes. Urban growth rates of up to 10 percent per year are the norm in Africa. This is already true of Latin America and, to a lesser extent, Asia. Urban populations will be larger than rural ones in the Third World within a generation and, in many areas, rural populations will grow only marginally in the future. Already many areas face key labour shortages in agriculture, a pattern which will become more widespread if rural opportunities continue to be so limited.

Resource pressures do exist, and are a critical constraint in particular in mountainous, semi-arid and other fragile environments particularly for rural populations. These pressures are more to do with livestock populations and the alienation of rural communities from land resources than simple demographic growth. As land is privatised, the spectre of widespread environmental collapse associated with demographic trends can be discounted. The corollary of this conclusion is that *urban energy demand is of increasing importance and, for many countries, will become the dominant energy policy issue in the near future.*

There is agreement that the different circumstances of different countries, and localities within countries, make generalisations about Third World energy policies problematic. Policy formula-tion must, therefore, be sharply focused to take account of the local nature of energy use, viewing it as a component of local production systems. Putting energy policy formulation in the context of the development potentials of local places is best achieved by adopting an analysis which starts from demand end-uses rather than the supply-side perspective more conventionally adopted. An end-use approach is also better for identifying real energy needs and priorities, and for specifying where and why multi-sectoral and indirect initiatives are desirable. It reflects how energy is used in the real world, and makes it possible to identify policy priorities which make sense to local people.

2.4 Energy Needs in Rural Areas

Despite the growth of energy use in other sectors, throughout the SADCC region energy use is still dominated by household demand in rural areas. Most of this energy is used for cooking, and most is supplied by biomass fuels. These fuels are gathered freely from the local environment, and their production and use cannot be easily separated from other rural development issues. In rural areas, energy problems are just one of the many problems people face, and are often not perceived as an important priority. Biomass fuel problems are rarely generalisable, as they reflect complex and variable interactions between local systems and the environmental resources on which they are based.

Much of the complexity stems from two sets of factors. Firstly, the existence of biomass resources in a locality is not enough to guarantee that all who need them have sufficient fuels available. They must have *access* to the resources. Access is constrained by location, land tenure and land management practices. Secondly, fuelwood problems do not express themselves as a simple and direct shortage of fuel. As local resource stresses emerge, people respond in a variety of ways to cope with the stress. These responses are variable and indirect, and as such, are highly locality specific. Many of these responses, such as conservation and improved management of local resources, contain the seeds of sustainable

change. Others, such as increased fuel collection times, over-exploitation of local biomass resources and the commodification of biomass fuels, have a negative impact, and tend to hit the poorest first and hardest. Rural energy policy must build upon these responses, strengthening those which are desirable and finding ways to mitigate the effects of those which are not. The key is not increasing fuelwood production, but is rather increasing the productivity of the biomass resource base as a whole so that woodfuel may be obtained, as now, as a secondary, not primary, product.

Fuelwood use cannot be separated from other aspects of the local production system, and fuelwood stress is similarly part of a wider development problematic. The rural poor live in a biomass-based economy in which local land resources provide for the bulk of their survival needs. Wood and trees are an integral part of this economy; rural production systems are about far more than the production of the main crop, whether it is for sale or home consumption. Rural communities harness a combination of private and common property resources to produce goods for both the market and subsistence consumption.

There is frequently a gender division of responsibilities in this, with the men typically controlling commercial production and women having prime responsibility for providing food, fuel and a range of other essential needs for household maintenance. Class-based distinctions around the control of land are also important, with larger land-owners more concerned with production for external markets and land-poor and landless households more concerned with access to common resources for domestic consumption. Few of these households can survive by wage labour alone; fuel, fodder, foodstuffs and a range of other essential goods gathered from the local environment are a central part of their household economy. It is within this context that rural energy needs, resources and problems must be identified, and that potential energy interventions should be evaluated.

Fuelwood use has little impact on the resource base where it is gathered for local use, and the argument that growing population will lead to resource depletion is highly suspect. Overall, *there is little evidence to link land degradation, and in particular deforestation, with fuelwood use by rural communities. Declining biomass resources are a product of changes in land use and, in particular, of agricultural colonisation.* These changes result in a

structural change in biomass availability to a new, relatively stable, level. The notion of an inexorable depletion of wood resources until the last tree is felled misunderstands the nature of rural land use systems. As land is converted to new uses, biomass resources are not completely destroyed, and indeed many agricultural landscapes contain large numbers of trees, bushes and other fuel sources. As agricultural landscapes mature, the number and variety of these trees and shrubs often increases, so that recently-cleared areas are typically more sparsely covered than agricultural areas which were cleared some time ago. These trees outside the forest are the most important fuel source for rural people, who have a great deal of knowledge about their propagation, the properties of different tree products, the management techniques best suited to local conditions and so on. This understanding of the local environment is a base from which sustainable solutions to rural energy problems can be built.

2.5 Energy Needs for Urban and Industrial Uses

The most rapidly growing sector of energy demand is in urban areas; urban growth rates of 10 percent or more per annum are the norm throughout Africa, and the economies and societies of these countries are being transformed by urbanisation processes. As with rural areas, household energy use is the largest component of urban energy economies. In urban areas, fuels are commodities whether they be wood and charcoal, fossil fuels or electricity. This commercial relationship sets a very different agenda for energy policy to that of rural areas, in which fuels are mostly non-commodified, and are produced and consumed within the local area. Urban energy consumers choose between fuels on the basis of their *cost*, their *availability*, their *convenience* and the cost and availability of the appropriate *appliances*. These factors combine to drive energy decisions by urban consumers (mostly women in households). It is these decisions which an urban energy policy must influence but on which there is currently little data.

Urban energy policy must be driven off the urbanisation process, understanding how urban energy markets work and the factors which influence urban consumers. Past policies have

concentrated almost exclusively on the needs of the well-off and the formal sector, with electricity provision dominating investment. The needs of the small-scale sector, which is the most dynamic component of the urban economy, and of the poor, many of whom are recent and temporary migrants, should move to the centre of urban energy planning efforts. As with other sectors of energy use, the key to policy formation is to define need, and to relate that need to existing and desired development trajectories.

The concept of an *energy transition* is central to any understanding of this sector but, as in all economic transitions, it is important to distinguish trends from cycles. As urbanisation proceeds, there is a tendency for household energy use to increase, diversify and switch fuels from wood and charcoal to commercial fuels. A hierarchy of fuel preference, with wood at the bottom, through charcoal, kerosene and LPG to electricity appears to exist. Over time in a wide range of countries there is an observable tendency for households to move through this transition. The speed of the transition varies, but it can be extremely rapid. Frequently, the rapidity of transition occurs for reasons outside the energy sector, e.g. the increase in the availability of commercially processed food. The stages are typically not discrete; it is common to find several fuels being used for the same job within urban households. This is particularly true for cooking, which is the largest component of household energy use. For example, wood or charcoal may be used to prepare the main meal whilst kerosene is used for snacks, to make drinks and so on. Gradually, as the cost of the fuels varies, supply infrastructures develop and real incomes increase, the proportion of commercial fuels used grows and woodfuels remain only for specialised functions.

Several factors drive this transition. Relative fuel costs are significant, but are not the dominant factor. More important appears to be fuel supply reliability and the cost and availability of appliances. Woodfuels are widely used not because they are cheap, but because they are available in places and quantities which fit in with the lives of the urban poor. In particular, they are sold in local markets in small bundles which poorer urban residents can afford. By contrast, many more preferred fuels, such as LPG, may be cheaper in terms of cost per unit of useful energy, but the stoves needed to use them are expensive and in short supply, the fuel itself (or the bottles used to store it) is scarce, available only in outlets far from poor homes and has to be purchased in large units.

The range of energy-using activities is far greater in cities than in rural areas. Urban areas contain more industry, a greater range of services and better transport facilities than rural areas. Urban households also tend to use energy for a wider range of uses, reflecting in part their higher incomes and in part the superior availability of many goods in cities. In some ways, urban energy planning is more complex than in rural areas. This complexity is mitigated by the existence of an energy market in cities and, as such, urban energy planning will use different mechanisms and involve different institutions than rural energy planning. There is a need to ensure that there is adequate coordination between these sets of institutions around issues, such as urban fuelwood or rural commercial fuel markets, which link cities to rural areas. In the urban household sector policy concerns are:

i) The cost of fuel provision to the urban poor.
ii) Security of fuel supplies.
iii) The impact of urban fuelwood markets on rural supply areas.

For the very poor, any expenditure is a problem. Few have money available to pay for fuel on anything other than a daily basis. Many migrants to the city are only temporary sojourners whose commitment to urban life is low and who are unwilling to invest in expensive appliances even when they have the cash available. For them, remittances to their rural families are their main priority. As such, the form of payment and appliance costs are as important as fuel costs in influencing energy use patterns.

Security of fuel supplies is a more serious problem than their cost. The poor development of the market systems for many fuels means that urban households adopt strategies, such as multiple fuel use or using less preferred fuels like wood, which ensure that some energy is available. Insecurity characterises all commercial fuels. In many cities, electricity blackouts are a way of life, LPG bottles are often not available even when the fuel is, kerosene is cornered by black market dealers and so on. These availability problems also apply to stoves for commercial fuels, which are often harder to find than the fuel itself. Few countries manufacture kerosene or gas stoves themselves, and imports are irregular and expensive.

The impact of urban fuelwood use on rural supply areas is well-established and few commentators would disagree that the consequence of urban wood markets is environmental deterioration and greater pressure on rural fuel supplies. Urban wood dealers do not pay the full cost of the wood, and extraction techniques are damaging. Profit margins are typically high, with wood prices reflecting the cost and availability of alternative fuels rather than wood supply and demand conditions. There can be no doubt that *growing demand and diminishing resources means that urban fuelwood use is unsustainable in many parts of Africa.* Action to mitigate these impacts is an urgent priority if urban energy is to be provided and rural environments preserved.

Large industries and commerce rely on commercial fuels, and often dominate their availability. It is the needs of this sector, including government institutions, which has driven energy policies in the past. In particular, the concentration of investments on the power sector has been justified by the key role the formal sector was assumed to have in the development process. The continual under-performance of these activities has led to a re-assessment of their role and current development strategies assign them a less dominant place. Past experience shows that the promotion of energy efficiency has considerable potential for many of these activities, and has a short pay-back period. Policy directions should centre on efficiency rather than the provision of greater power capacity.

The final type of energy use to consider is transportation. Energy (and especially oil) use in transport is a major component of national energy balances, and improved transport is a key development goal. Despite this, the transport sector has been consistently neglected by energy policy makers. Few alternatives exist to oil for transport, and supply shortages are a major problem in some countries. Demand for transportation fuels is growing rapidly throughout Africa. It presents a problem for energy policy makers, as these fuels are the largest component of the oil imports which are still, despite presently falling crude prices, largely responsible for much of the trade deficit of many African countries. Policies which push up the costs of public or goods transport, while simultaneously encouraging private car use are undesirable for wider economic reasons, but better infrastructure and increased efficiency could improve the situation in many places without significant increases in energy costs. Capital and technology availability are major constraints in this sector, and should be

addressed. Private transport is increasing rapidly, and action to curb its use is desirable but difficult to enforce through energy mechanisms. The most appropriate tools are financial levers, such as car ownership or road use taxes, excise duties or taxes on gasoline.

2.6 Principles for Sustainable Energy Development

At this point, it is possible to draw out the principles of a sustainable approach to energy policy. The first principle of a sustainable approach to energy development must be an energy policy that minimises environmental damage. Such a policy must have, as a first principle, a drive for energy efficiency.

In order to achieve an energy efficient system to minimise environmental damage, it is necessary to build from demand. Thus, the second principle - building from demand, from rural and urban need. In an analysis based on this approach, the focus on end-use provides the link from consumption to specific technologies and energy services and, from them, to energy sources.

End-use demand planning is based on a further principle that should govern supply options. This third principle is the maximum utilisation of renewable sources of energy. While the emphasis must remain on renewable resources, the most widely used energy supply, woodfuel, must be seen as only a conditionally renewable resource. This also applies to water. Conditionality is dependent upon good landuse practice which, in turn, is only possible when SADCC rural households obtain sufficient income from farming to cease mining wood. In turn, this is only possible when there is a substantial readjustment in the terms of trade between Africa and the rest of the world.

If an emphasis on renewables, particularly the conditionality of the wood resource base, is the starting point for analysing SADCC's energy resources, the next step is to look at indigenous non-renewable resources. These are dominated by hydrocarbons, particularly coal and oil, although the distribution is somewhat unequal. As far as possible, SADCC countries

should be encouraged to utilise their own resources and to accelerate the programme of exploration, including the exploration of natural gas, so that the true nature of indigenous reserves are known. For electricity generation, hydropower is an indigenous resource that can be expanded and which has benefits beyond generation and which has no direct problems associated with carbon emissions.

An environmentally sound energy policy cannot, however, be divorced from the macro-economic situation facing SADCC. Physical resources are only a part of the planning process which must be viewed alongside the financial requirements for mounting an environmentally sound energy policy. SADCC's economic position is very difficult since it is experiencing a real decline in per capita income.

In the energy sector, capital is unavailable to finance new requirements, especially in the electricity sector where there is expected to be a significant short-fall of finance for new plants. Simultaneously debt servicing is dominated by payment for existing electricity investments. The insufficiency of capital encourages the continuous use of outdated technology, frequently with negative environmental impact. It also encourages an over-reliance on the recurrent budgets, making long-term efficient planning difficult and consolidating the heavy reliance on oil imports. Substantial allocation of funds for investment is required to implement an environmentally sound energy programme.

Within SADCC countries, there is a need to address issues of equity to ensure that energy is available for all without negative ecological consequences. In particular, there should be a strong focus on rural and urban household energy require-ments, not least because *increasing urban demand will accelerate the problem of peri-urban and rural deforestation.* Within the modern sector, the heavy reliance on private transport in cities is creating pro-blems more associated with the developed world than the develo-ping world. Equity is a critical issue if resources are not to be misallocated.

In the medium-term future, to 2020, SADCC energy investment will need to be focused on an increase in the use of oil and coal and the rehabilitation of wood resources. The requirement is for modern technology that has a high efficiency and a low environmental

impact. Investment is critically required not simply to provide energy but to build landscape that is a sustainable inheritance.

Thus, to minimise environmental damage, to move towards enhancement of energy services, the focus needs to be on development in terms of efficient renewable resources and self-reliance in energy consumption. The need is to look at present trends and from these trends derive a different way of looking at the problem of energy. Essentially this means adopting an end-use approach, specified by rural and urban functions, by considering existing energy resources before moving to consider the environmental impacts of alternative options. Such an approach will demand institutional changes. It is the institutional challenge that will be most difficult to meet.

3. SADCC'S ENERGY OPPORTUNITIES

3.1 From Need to Choice

The previous chapter outlined the basis for forming energy policies, which is to define energy needs now and in the future in relation to desired patterns of development. From this, the key tasks for energy policy are to identify, evaluate and set priorities where problems exist in meeting energy needs, now and in the future.

The criteria used to assess problems and options will, of course, depend on the specific circumstances of particular policy exercises. Energy problems are specific to people and places, reflecting the particular characteristics of resource availa-bility, management and use, social and economic structures and external relations of different localities. Opportunities for intervention are locality specific, as they derive from the particular constraints and opportunities of the area in question. Successful development will build from and adapt what is already there, which means that the existing local production system is the starting point for sustainable planning.

Some general principles for the criteria which should be used to assess intervention options can be established. Firstly, energy options should be judged on the basis of their contribution to the development process as a whole, not just on efficiency of energy generation. Secondly, the implications of energy policies for equity within the community must be assessed. Thirdly, the long-term view means that current problems should not be overcome by mining environmental resources.

These general criteria for policy assessment can be viewed as a series of questions which policy makers must ask themselves when examining alternative development options:

1) What contribution to the overall development process will the project make?
2) What specific needs will it meet?
3) Will it enhance the net sum of economic and environmental resources?
4) What are the full range of long- and short-term costs and benefits?
5) Who will benefit and who will pay for the project?

6) Will the development be able to withstand minor and major economic and environmental disruptions?

7) What form of institutional arrangements are needed for the effective implementation of the project and, in particular, what mechanisms for community participation in all stages of planning and implementation exist?

3.2 Identifying the Options

Table 3.1 shows the aggregate energy balance for the SADCC region in 1990. This energy balance is based on calculations by the Tellus Institute using the LEAP model and data developed in conjunction with the SADCC Energy Secretariat's Technical Advisory Unit. Although such a regional summary inevitably obscures many specific issues which are important at a local or national level, it is a useful guide to the major energy policy issues in the SADCC region and, from this, to the context within which specific energy policy options may have a role to play.

The energy balance illustrates the continued dominance of biomass fuels, which still provide over 80 per cent of energy consumption. Petroleum products provide an additional 10 per cent, with electricity, coal and other minor fuel making up the rest. Household energy use is the main source of demand, some 68 percent of the total. Biomass fuel use in rural households alone is 60 percent of all energy use in the SADCC region. Other sectors are growing more rapidly, however, with urban household demand in particular increasing quickly as urbanisation in the region develops. Energy use in industry and agriculture are also growing, but at a slower rate. The dominance of biomass fuels in aggregate energy demand also, of course, exaggerates their significance, as these fuels are used far less efficiently than other sources of energy. Despite this, there is no doubt that biomass fuels will continue to be the main energy source for most of the SADCC region's people for a long time to come. The provision of these fuels in a sustainable manner is the most important energy policy challenge facing the countries of the SADCC region.

Table 3.1. Regional Energy Balance for 1990 (Million Gigajoules)

	Coal/coke	Crude oil	Natural gas	LPG	Gasoline	Kerosene	Diesel	Fuel oil	Oth.Pet. Pr.	Electricity	Hydro/ Geoth	Ethanol	Charcoal	Woodfuel	Concl. Wood	Other Bio	Wind	Solar	All Fuels
Indigenous	61.56	599.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	62.31	0.00	581.52	1230.67	45.81	91.06	0.00	0.02	2672.01
Net Imports	143.29	-495.24	4.73	1.13	20.60	17.04	39.11	-29.48	23.41	-18.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-238.38
Total primary supply	204.85	103.84	4.73	1.13	20.60	17.84	39.11	-29.48	23.41	-18.80	62.31	0.00	581.52	1230.67	45.81	91.06	0.00	0.02	2378.59
Ethanol	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.26	0.00	0.00	0.00	-3.49	0.00	0.00	-2.23
Hill and Harvest	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kilns	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-449.75	0.00	0.00	0.00	0.00	0.00	-449.75
Biogas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Electric Generation	-65.29	0.00	0.00	0.00	-0.87	-0.76	-3.17	-0.69	-2.13	80.71	-62.31	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-54.55
Oil and Gas	-25.56	-103.84	0.00	1.13	10.17	12.02	30.09	39.01	26.56	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-10.44
Coal and Coke	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.88	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-5.88
Dist. losses	-6.19	0.00	0.04	-0.09	-0.86	-1.18	-1.98	-0.39	-2.22	-5.92	0.00	-0.01	-1.03	-9.87	-0.16	0.00	0.00	0.00	-29.98
Other	-18.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.99	-11.78	0.00	0.00	0.01	-34.91
Total Final Consumption	83.83	0.00	4.69	2.17	29.04	27.92	64.05	8.43	45.58	55.95	0.00	1.25	130.73	1215.81	33.85	87.57	0.00	0.00	1790.81
------ Final Consumption by Sector ------																			
Rural Households	5.04	0.00	0.00	0.24	0.00	3.29	0.00	0.00	3.03	0.67	0.00	0.00	28.45	948.74	57.36	58.84	0.00	0.00	1106.51
Urban Households	2.31	0.00	0.00	1.15	0.00	3.96	0.00	0.00	6.13	11.51	0.00	0.00	83.00	28.94	0.00	0.00	0.00	0.00	137.05
Agriculture	9.22	0.00	0.00	0.00	0.13	0.07	6.61	0.52	4.81	3.92	0.00	0.00	0.00	81.90	0.00	14.23	0.00	0.00	121.41
Manufacturing	47.04	0.00	4.69	0.23	0.35	1.93	11.04	6.52	9.70	27.54	0.00	0.00	18.63	121.32	10.31	14.50	0.00	0.00	273.80
Commercial	0.87	0.00	0.00	0.54	5.46	3.49	0.37	1.79	1.79	10.00	0.00	0.00	0.51	34.92	0.00	0.00	0.00	0.00	58.11
Transportation	6.30	0.00	0.00	0.01	27.86	12.94	40.11	1.01	19.09	0.13	0.00	1.09	0.00	0.00	0.00	0.00	0.00	0.00	108.53
Mining	12.85	0.00	0.00	0.03	0.15	0.27	2.17	0.01	0.00	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	16.12
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	83.69	0.00	4.69	1.77	29.04	27.91	63.97	8.43	45.36	53.77	0.00	1.09	130.73	1215.81	67.67	87.56	0.00	0.00	1821.45

Source: EIC, 1990.

The energy balance also reveals how limited the use of other fuels is in rural areas, with biomass fuels providing 99 percent of the energy used by rural households and 80 percent of that used in agricultural production. This limited access to more modern fuels restricts many aspects of rural life, and in particular hinders the development of a range of new energy-using activities which would add significantly to the quality of rural life and to prospects of effective development through the diversification of the rural economy. The provision of energy for new activities in remote rural areas is particularly problematic. Rural electrification is as yet little developed, and a number of structural barriers to growth exist.

Urban households, the most rapidly growing form of demand, rely on a diverse range of energy sources to meet their needs. Oil products, electricity, fuelwood and, in particular, charcoal are all important, and demand for all of them is growing. Each energy source has its own costs and benefits, but there is little doubt that the continued growth of urban wood and charcoal use is neither desirable nor sustainable. This market has a detrimental effect on both urban and rural environments, and is less convenient or efficient than commercial alternatives. The most effective substitutes are oil fuels (especially LPG and kerosene), and a transition to these fuels is occurring in many cities. The main barrier to such a transition appears to be supply insecurity caused by the inadequacy of the market structures for the oil fuels. Such problems affect more than the urban household sector, and improvements to the effectiveness of oil supply and distribution systems is a major area of energy policy concern.

Although electricity demand in the SADCC region is restricted, power sector investments have dominated past energy policies. This dominance is likely to continue, as improving existing supplies and extending the grid is of major economic and political significance. The main indigenous source of electricity is from hydro power (although the use of coal for power generation is growing), and it is difficult to see how the electricity supply system can be expanded in a major way without further hydro power development.

3.3 Institutional Structures

One of the most critical issues for sustainable energy planning is the institutional structures through which energy policy formulation and implementation will occur. Traditional, top-

down institutional arrangements are singularly inappropriate for sustainable energy development, which is inherently cross-sectoral and which must draw the local community in as central actors in the policy and planning processes. Expectations of these institutions is now more modest than in the past, when they were seen as controlling the development of all aspects of energy production and use. Their role should primarily be seen as a facilitating and coordination one, in which the energy implications of development patterns in other sectors is the key. There is little doubt that institutional reforms are necessary. Existing planning capabilities are too weak and poorly orientated. There is a chronic lack of coordination between different agencies. Apart from HEP planning, energy planning institutions frequently have little control over key policies which influence energy development, for example, over import policies or agricultural land use. They are often weak in relation to other institutions in competing for scarce resources and influence over development strategies. This is compounded by their lack of operational capacity.

The availability of skilled personnel is a major problem. This is particularly true for management capabilities, which across all sectors of energy activity are a critical constraint upon the implementation of effective policies. Technical capacities are less of a problem: in many places they are surprisingly good. What is lacking is an effective management structure in which these technical capacities can operate.

Paradoxically, the weakness of existing institutions in many SADCC countries offers an opportunity in itself, as they are not already locked into powerful structures which are likely to resist reform. The strengthening of energy planning capacity in SADCC is consequently a priority area for action, but only if the strengthening is based on the principles outlined below. Simply putting more administrative staff in place will make matters worse by putting up greater barriers to effective participation and procedural reform.

The following basic principles for energy institutions can be identified:

* They must be responsive to *energy need and demand*. This requires an end-use approach in which energy production capabilities are driven off defined needs.

* They must contain effective channels for the *participation* of energy users and providers in the planning process. They must allow effective bottom-up participation in all stages of planning for local communities who are the intended beneficiaries of energy projects.

* They must permit *multi-sectoral cooperation*. It is expected that energy ministries will continue to take a lead role in the planning process, but in many cases other institutions will be the most appropriate executing agency.

* The principles of *sustainability,* in environmental, economic and institutional terms, must be fully integrated into the *operational procedures* and *management structures* of energy planning institutions.

* The role of the state as a facilitator means that effective *decentralisation*, in which control over local resources is given to local communities or, where appropriate, to the market, is needed.

* Positive action to create effective *management structures* and enhanced *management skills* is needed to counter the negative impact that poor capacity in this field produces.

* The role of *external donors* also needs re-evaluation to ensure that their operations facilitate the creation of sustainable planning procedures.

* *Energy planning* must be more flexible, seeking indirect strategies and building a partnership between local people and planning institutions. Central to this is the integration of indigenous technical knowledge into planning.

3.4 Planning Choices in Rural Areas

The preceding chapter stressed the need to approach rural energy needs and choices from an analysis which saw energy as just one of many development problems facing rural areas. Rural energy problems are indirect, localised and varied. To address them solutions which are diverse, flexible and responsive to the needs and opportunities of specific communities in specific localities are needed. The repeated failure of single technology solutions, whether they be large plantations, community forestry, improved stoves or novel energy sources such as wind, solar or biogas, reflects the failure of planners to understand local conditions, and in particular their failure to integrate the people they are trying to help into the identification of problems and the design of solutions. The creation of sustainable solutions requires a different approach, in which the rigorous quantification of demand and supply is subordinated to an analysis of people's perception of and responses to fuelwood stress, the structure of and factors conditioning access to local biomass resources and niches within the production system which offer potential for intervention opportunities.

This approach has as its central tenet local control of the resource base. Where land has been alienated from local people, as is often the case for woodland areas, control must be returned to them. And local people must be supported in establishing appropriate institutions for controlling their biomass resources. Similarly, where traditional systems of resource management are being eroded action must be taken to strengthen and sustain them. These systems are extremely complex and locality specific. Understanding of their operation is poor, and research into them should be encouraged. To an extent the ignorance of outsiders does not matter, since, what is important is that local people understand them, which, of course, they do.

There is little point in trying to pre-determine the form of technical intervention appropriate for rural areas. Some basic principles can be identified, but little more. Where increased production of biomass resources is the objective, and especially where it involves new forms of production, then individual farmers should be the starting point. Where improved management of existing resources is the goal, this is usually best achieved through communal management. This is particularly true for the management of natural woodland areas, which in much of Africa are the main source of fuel. Put simply, biomass is produced individually

but managed communally. Recent calls for the privatisation of communal land miss this vital relationship, and such a policy will do no more than replace land alienation by the state with land alienation through the market. It will result in the marked deterioration of access to biomass resources for many rural people and, in all probability, produce management practices which are less efficient or sustainable than the communal ones they displace.

Household energy, which is dominated by the use of biomass fuels for cooking, is by far the largest component of rural energy use, and indeed in many countries dominates national energy balances. The importance of this sector must be recognised in energy policies. Women are the main providers of fuel, and their inclusion at the centre of any policy initiatives is essential if they are to prove effective. In an end-use approach, women are the end-users of energy at the household level, and it is they who experience the problems which may not be recognised by the men of their community. This means that policy makers and planners must be more sensitive to the specific concerns of women as central actors in rural energy provision. The planning process needs to recognise this by integrating women into all stages of decision-making and, wherever possible, ensuring that it is the women of a community who have control over the management and use of energy resources.

Central policy issues are the productivity of and access to land resources, with greater equity as a main goal. Policy options centre on resource management as part of the wider production system, whether the objective is enhanced supplies through improved biomass productivity or greater efficiency through improved energy management. Local control of resources is the key to this, and care must be taken to ensure that the needs of disadvantaged groups are provided for.

Energy use in agricultural production is extremely limited, and in places is a limiting factor on agricultural productivity. Of particular importance is energy availability for activities such as irrigation or crop processing which can increase income without land colonisation. In many places commercial fuel technologies such as diesel engines are cheaper, more durable and, crucially, easier to service and maintain than any of the "appropriate" NARSE technologies.

Poor fuel security is one of the main reasons why rural energy use is so limited in much of

Poor fuel security is one of the main reasons why rural energy use is so limited in much of the SADCC region. Production activities require secure energy availability, and will typically be willing to pay a higher price to ensure this security.

Energy for general development, whether it be for service provision, such as clinics or schools, or rural industries, is an area in which increased rural energy use should be encouraged. In many cases, these will be new uses of energy which must be promoted if the developmental trap of rural areas is to be broken. Their introduction is decided by development goals outside energy; the role of energy policy is to make it possible to realise these goals. These are specific energy niches in which the potential of electricity can be realised. The total quantity of energy required is very small, but the potential development benefits of activities such as health and education facilities is profound.

3.5 Energy Choices for Urban Areas

Urban energy planning presents a different set of challenges to those of the rural sector. The development context of rapidly-growing cities, along with a fundamentally different energy economy in which all fuels are commodities, means that energy planning in the urban sector will employ different policy tools and be administered through different institutional arrangements to those of rural areas. This means that in some ways urban energy planning is more complex than in rural areas. This complexity is mitigated by the lower need to integrate energy interventions into the production system as a whole, and many urban energy policy tools can be more direct than those of rural areas. More of the key factors to urban energy policy can be directly influenced by policy-makers, and the effects of urban interventions are likely to be felt more rapidly than many of the indirect, gradual approaches which are the main hope of rural areas. Combine these factors with rapid urban growth and the greater political influence of urban residents, and it is clear why urban interventions are increasingly attractive to energy planners.

The question is not whether cities will go through an energy transition, but when it will happen. Urban energy policy should seek to assist the transition from woodfuels to fossil

fuels as rapidly as possible. The mechanisms to do this are through improvements to market systems and action to ensure the availability of commercial fuel supplies. Subsidies are not needed and have other distorting impacts which are undesirable. Action to improve kerosene and LPG stove supplies is also needed, preferably through the development of production facilities within the country. The provision of subsidised stoves for a period is a policy option, as this will produce a critical mass of demand for fuel and stoves which make marketing systems viable.

The key to policies in the *urban household sector* is the relative price and availability of different fuels, and both conservation and fuel switching options are attractive. Where sustainable fuelwood supplies can be provided then they should certainly be encouraged, but the potential of wood and charcoal as major long-term urban fuels is limited. Stove programmes in urban areas have a good track record, and whilst charcoal continues to be used can mitigate its impacts. They also produce substantial improvements to the household environment and the health of women, and this is probably their main role. The future lies with commercial fuels, however, and in particular with kerosene and gas. Electricity will continue to be an "elite fuel", both because of the costs involved and because of the problems of provision to mobile populations in often temporary housing. Electricity is an option for public use, industry and high income groups.

The energy needs of the *informal sector* have been neglected in most cities. The promotion of small businesses, which are labour intensive, efficient users of capital and highly responsive to local needs and opportunities, is desirable. They operate in similar energy markets to urban households, and face similar problems.

Energy policies for *large industries*, the *commercial sector* and *transport* are already well-developed, and typically dominate current investment policies. The expansion of energy supplies has been the main plank of past policies, with scant attention paid to improving energy efficiency in these energy-intensive activities. This is despite the adverse impact of the high capital and import costs and the poor performance of past policies. A radical change of thinking away from the provision of concentrated supply systems and towards understanding and providing for energy needs in the most efficient manner is as important for the formal sector as it is for households and small businesses. A central part of such

policies will be the introduction of improved energy management and accounting systems, which can produce dramatic savings in energy consumption.

Energy policy makers need to promote a new energy consciousness into government and parastatal institutions (often a major component of energy consumption in the formal sector), and to encourage greater efficiency in the private sector through financial inducements (such as tax incentives), the setting and enforcement of efficiency standards and technical assistance in energy accounting and management at an enterprise level. Such policies do not require heavy levels of investment and will go far to ensuring that the energy needs can be met without an unacceptable drain upon capital or foreign exchange availability.

3.6 Implications for Norwegian Aid

The implications for Norwegian aid that can be deduced from this overview of energy policy are:

* That energy projects should not be viewed in isolation. Energy projects are a substantial investment in the overall development process. As such, it is important to look at energy projects in urban, as well as rural, situations because the significant challenge to development in the 21st century will be establishment of the models of best practice in urban planning.
* That the drive for a sustainable and equitable energy policy must place heavy emphasis on *energy efficiency* and the *use of renewable sources of energy*.
* That a commitment to equity is a commitment to basic needs. Although energy itself is not a basic need, the provision of energy at household level requires a continuing commitment to biomass projects. In such projects, special emphasis should be placed on the role of women who are the producers and consumers of woodfuel.
* That planning for enhanced woody biomass provision is essentially planning to increase capacity for the local management of that woody biomass resource. Such local planning cannot take place without genuine local participation.
* That the focus on enduse planning is a focus which not only matches consumption

need to supply but is one that gives continuing emphasis to equity issues. In particular, a focus on enduse planning demonstrates the importance of maintaining and enhancing the energy position of the household sector.

Rural electrification programmes per se should not be abandoned but there should be two new emphases mainly:

a. that demand should be matched to supply technologies rather than assuming that supply will find demand; there is little need to worry about providing full base load power throughout the year - the provision of even partial electricity supplies is an acceptable local development when no such supply already exists;

b. that the critical task in any energy provision remains the low level of institutional capacity and experience to pursue a sustainable and secure energy future.

4. SADCC'S RESOURCES: OPPORTUNITY AND CONSTRAINT

4.1 SADCC's Resources

Two problems characterise the energy situation in SADCC member countries:

* Dependence, except for Angola, on imports of petroleum products, implying depletion of foreign exchange resources following rising and fluctuating petroleum prices, which is made more difficult by the collapse of primary commodity prices.

* Depletion of woodfuel resources reducing energy supplies to low and medium-income households which are almost exclusively dependent on woodfuel.

At the same time, however, the region is rich in undeveloped energy resources. In developing these resources, however, another major constraint has to be noted, namely that the availability of capital is limited and the rate of transfer of technology from industrial countries is slow. Furthermore, actions by South Africa to destabilise the political and economic development of the region still continue, and such actions further affect both energy production and consumption. It significantly hampers the optimum operation of the generating capacity presently available in the region.

Exploitation, mapping and development of indigenous energy resources are an important part of the SADCC strategy in the energy sector. Table 4.1 shows proven SADCC energy reserves compared to production in 1984.

Table 4.1 SADCC Energy Reserves and Production, 1984

Resource	Reserves	Production (1984)
Renewable Resources		
Hydropower	216 TWh p.a.	15.5 TWh p.a.
Woodfuel	$17,540 \times 10^6$ t	$100 \times 10^6 m^3$ p.a.
Non Renewable Resources		
Coal	$6,400 \times 10^6$ t	4.6×10^6 t p.a.
Grude Oil	250×10^6 t	10.4×10^6 t p.a.
Natural Gas	100×10^9 m^3	$2.3 \times 10^9 m^3$ p.a.

Source: Simoes 1984, ETC 1990.

4.2 Hydropower

The estimated *hydropower potential* in the nine SADCC member countries is in the range 40,000 to 45,000 MW, of which 5,500 MW have been developed so far. This means that there is more than 85 per cent of this energy resource still available. The status of hydropower development and hydropower potential is summarised in Table 4.2 Some of the data are uncertain.

Table 4.2 Hydropower Development and Potential, 1985

Country	Hydropower developed		Hydropower potential	
	Capacity MW	Generation (GWh p.a.)	Capacity MW	Generation (GWh p.a.)
Angola	400	700	15000	75000
Botswana	-	-	3000	15500
Lesotho	2	8	250 (?)	1230
Malawi	126	450	750 (?)	3650
Mozambique	2160	1300 (?)	12500	60000
Swaziland	40	220	(?)	(?)
Tanzania	330	1450	4500	21000
Zambia	1730	9800	1000 (?)	5800
Zimbabwe	630	3400	1500 (?)	11000 (?)

Source: The Economist Intelligence Unit, 1986.

Mozambique's large scale exploitation of the country's hydroelectric potential started in the mid-1950s with the construction of Mavuzi Power Plant in the Manica Province. Exploitation for export purposes was introduced through the construction of the Cahora Bassa Scheme, established in the mid-1970s to supply the South African network. With its 2075 MW installation, it is one of the biggest hydropower projects ever undertaken in Africa. A huge hydroelectric potential can still be developed and several surveys have been carried out over the last three decades. All major areas of the country are now covered, and the total hydropower potential is estimated at 12,500 MW, or an annual production of approximately 60,000 GWh - of this about 2,160 MW is developed.

The hydropower resources can be divided into four geographical zones.

1. *South*, i.e. south of the Save River. Exploitable potential is estimated at 230 MW, of which 15 MW is now under construction at the Corumana hydropower plant.
2. *Central*, i.e. between the rivers Save and Zambezi. Total potential is estimated at 1,150 MW; of which 84 MW is already utilised at the Mavuzi and Chicamba hydropower plants in the Revue River.
3. The *Zambezi River Basin*, with an estimated hydropower potential of 10,300 MW; 2,075 MW of this is already utilised at Cahora Bassa.
4. *North*, i.e. north of the Zambezi River, with a potential of approximately 1,100 MW. Only negligible amounts are so far utilised at mini-hydropower plants on Lichinga and Cuamba.

A practical problem for hydropower development in Mozambique is that many of these sites are located away from the main consumption centres.

Tanzania has a number of potential hydropower resources that could satisfy power requirements for many years. The total hydroelectrical potential has been estimated to be about 4,500 MW producing some 21,000 GWh per year. Of this potential, only 330 MW has been developed. The major hydropower potentials are found in the Rufiji Basin where Kidatu and Mtera hydropower stations have been built. In addition eight more major sites have been identified with a possible installed capacity of 3,700 MW and firm energy of about 15,500 GWh per year. In the Songea area, three sizeable hydropower sites have been located in addition to several small and medium size project possibilities on Ruvuma, the border river with Mozambique. In the North-West, the Malagarazi River represents a possible large scale development while small hydro potentials are found in the Kigoma and Rukwa regions. Small and medium hydropower sites are also found in the central and north-east parts of Tanzania.

4.3 Bioenergy Resource Base

The supply of bioenergy depends largely on natural vegetation rather than plantations. This dependency on natural vegetation for woodfuel will continue for a long time in most parts of the SADCC region. It is unlikely that plantations, either rural and peri-urban, will play a significant role in the supply of wood for fuel.

The main sources of woodfuel are:

i) *surplus from agricultural land clearance*: growing population and extensive agricultural systems lead to clearing of new, often tree-covered, land for cultivation;
ii) *dead branches and twigs* (and cuttings from trees without killing the tree): this probably accounts for a major part of rural firewood collection;
iii) *by-product wood*: from multi-purpose farm trees and commercial forestry;
iv) *non-woody biomass*: grasses, crop residues, and cowdung are used in areas of acute scarcity of wood;
v) *tree cutting for fuel*: mainly for charcoal production around cities.

The source of woodfuel has an important implication that supply of bioenergy, at least for rural areas, can only be considered in the context of the total local land-use system.

Existing information about bioenergy resources in the SADCC region are only rough estimates hinting at the order of magnitudes rather than an accurate assessment. Inventories for biomass and assessment of rate of natural regeneration (i.e. mean annual increment) are complicated and expensive. Most of the forest and woodland inventories done so far have been purposely done for timber and the information is of little value in estimating total woody biomass supplies. More detailed information on the biomass resource base is necessary given that the problem of woodfuel may not necessarily be that of inadequate resources but rather a problem of the distribution of resources and the concentration of population.

Areas of shortage of woodfuel, as well as areas of abundant supply, exist in most SADCC countries, and there is therefore a complicated mosaic of problem areas. Problem areas include most of Lesotho, southern Malawi, the middle veld of Swaziland, central and northern

Tanzania, communal lands in Zimbabwe, the urbanised parts of Zambia (Cooperbelt, Lusaka) and south-eastern Botswana. Local problem areas also exist around most urban areas. Rapid deforestation is taking place in all SADCC countries. Though woodfuel consumption is not the major cause of deforestation, deforestation creates a worsening supply situation and hardship for the consumers.

4.4 Non-Renewable Energy Sources

a) Oil and Natural Gas

The situation with respect to *oil and natural gas* is shown in Table 4.3 for each country and is summarised to yield SADCC totals. Table 4.3 lists separately the requirements for crude oil and production of refined oil products.

Angola is the member country which currently produces crude oil but there are preliminary indications of possible oil deposits in other SADCC countries. Angola's crude oil production was in 1980 three times the import of crude oil in the rest of the SADCC region. With regard to refined oil products, Table 4.3 shows that the region's refinery output in 1980 was 86 per cent of the requirements. However, one-third of this output was exported out of the region, implying that some 42 per cent of refined product requirements had to be imported with additional foreign exchange burdens.

The situation is skewed across the member countries. Botswana, Swaziland, Malawi and Zimbabwe have no operating refineries, and are completely dependent on imports. Mozambique, Zambia and Tanzania have refinery capacity but must import their crude oil inputs. In addition, in the case of Mozambique and Tanzania, substantial refined exports take place due to the mismatch between refinery output mix and national end-use demand mix. These exports are complemented by imports of lighter petroleum products.

b) Coal

The *coal resources* in the SADCC region are substantial but unevenly distributed and exploited. Currently proven resources are estimated at about 11 billion tonnes. The area is net exporter of coal, and coal is an important source of foreign exchange for some countries, especially Botswana. The coal situation is summarised in Table 4.4 for each country. Coal deposits have been identified in seven of the nine member countries, while coal is currently being mined in six of these countries. Coal has not been found in Angola and Lesotho and has not yet been exploited in Malawi due to the low quality coal and long transportation distances. Significant increase in output is expected in Botswana. World average per capita coal reserves are 130 tonnes which is less than the SADCC per capita figure of 200 tonnes.

Table 4.3 Petroleum Resource Summary (million tonnes/year)

	1980				1990			
	Production	Imports	Exports	Requirements	Production	Imports	Exports	Requirements
Angola								
Crude*	6.8	-	5.57	1.23	10.10	-	7.31	2.79
Refined	1.16	-	.66	.50	2.63	-	1.88	.75
Botswana								
Crude	-	-	-	-	-	-	-	-
Refined	-	.14	-	.14	-	.15	-	.15
Lesotho								
Crude	-	-	-	-	-	-	-	-
Refined	-	.07	-	-	-	.09	-	.09
Malawi								
Crude	-	-	-	-	-	-	-	-
Refined	-	.16	-	.16	-	.22	-	.22
Mozambique								
Crude	-	.68	-	.68	-	.79	-	.79
Refined	.66	.14	.26	.54	.77	.21	.26	.72
Swaziland								
Crude	-	-	-	-	-	-	-	-
Refined	-	.11	-	.11	-	.15	-	.15
Tanzania								
Crude	-	.69	-	.69	-	.73	-	.73
Refined	.66	.37	.13	.90	.70	.67	.13	1.24
Zambia								
Crude	-	.82	-	.82	-	1.09	-	1.09
Refined	.78	-	.03	.75	1.04	-	.08	.96
Zimbabwe								
Crude	-	-	-	-	-	-	-	-
Refined	-	.61	-	.61	-	.84	-	.84
SADCC								
Crude	6.80	2.19	5.57	3.42	10.10	2.61	7.31	5.40
Refined	3.26	1.60	1.08	3.78	5.14	2.33	2.35	5.12

* Angola's resource base and near term production potential for crude oil has been estimated to be 400 millon tonnes recoverable (technologically exploitable) resources and 2500 million tonnes overall potential (theoretically feasible).
Note: Data for 1990 represent forecasts made in 1984.
Source: Simoes 1984; ETC 1990.

Table 4.4 Coal Resource Summary (millon tonnes)

Country	Resource base		1980				1990			
	Total	Proven reserves	Prod.	Imports	Exports	Require-ments	Prod.	Imports	Exports	Require-ments
Angola	0	0	0	0	0	0	0	0	0	0
Botswana	160,000	7,000	.37	.02	0	.39	6.0	0	5.45	.55
Lesotho	0	0	0	.07	0	.07	0	.11	0	.11
Malawi	7	12	0	.05	0	.05	0	.07	0	.07
Mozambique	395	240	.36	.14	.25	.25	2.0	0	1.73	.27
Swaziland	5,020	2,020	.18	.08	.14	.12	1.5	0	1.31	.19
Tanzania	360	35	.01	-	0	.01	.34	0	0	.34
Zambia	130	32	.40	0	0	.40	1.9	0	1.34	.56
Zimbabwe	29,220	2,200	3.26	0	.23	3.03	4.6	0	.29	4.32
SADCC	195,105+	11,509	4.58	.36	.62	4.32	16.34	.18	10.12	6.40

Note: Data for 1990 represent forecasts made in 1984.
Sources: UN 1979 Yearbook of World Energy Statistics 1981; World Bank 1970; Simoes 1984,

4.5 National Energy Problem Profiles

Angola is the only major oil producer in southern Africa. However, the national energy budget is dominated by woody biomass. The continuing political instability in the country means that there is limited opportunity for investment in conventional energy beyond investment in the off-shore oil basin. The most critical problem that Angola faces is the provision of household energy in the highly urbanised coastal belt. The security of household energy supplies is not simply a problem of the energy sector. Continued deforestation in the coastal belt, especially around Luanda, has led to a general ecological crisis. This is especially true of Luanda itself, where continued deforestation has led to the collapse of the water and sewage systems of the city.

Botswana has adequate conventional resources, particularly of coal, but continues to rely heavily on South Africa for commercial energy imports. Woody biomass is particularly a problem in the east of the country.

Lesotho is heavily dependent on South Africa for commercial energy supplies; and the country, which has virtually no forests, even imports considerable quantities of fuelwood. Within the country itself, there are possibilities of hydro-electricity production, particularly the Highlands Water Scheme (Muela), with an estimated installed capacity of approximately 110 MW. In the household sector, there are serious problems which are best illustrated by the high use of crop and animal residues and the difficulty of providing space heating in a montane climate.

Malawi, essentially being a country with a rural population, has an energy balance that is dominated by woodfuel. The rural energy problems, especially in the middle and the south of the country require continued support to agroforestry initiatives. Oil and coal, the major commercial fuels, are imported; and continued investment in the development and maintenance of adequate transport facilities is important. In focusing on areas within Malawi which show signs of stress, particular attention should be paid to the changing situation in the Dedza-Ntcheu Highlands and the continuing problems in the south of the country where a massive refugee influx is placing stress on a fragile resource base.

Mozambique has a potentially productive energy future but the continuing political and economic crisis jeopardises realising this potential. As a consequence of that crisis, strategic intervention is limited to the Maputo, Beira and Nacala urban areas and the Beira corridor and to the building of electricity infrastructure, especially hydroplants, in secure sites. Deforestation around the urban areas is an ongoing process. There is need to encourage agroforestry, using fast growing species, in the zonas verdes where food production (the pressing need) can be tied to fuel production.

Swaziland has coal and HEP resources but relies heavily on commercial energy imports form South Africa. There is significant industrial use of biomass but there is a severe problem with biomass availability for household energy consumption, particularly in the middle veld.

Tanzania's energy balance is dominated by fuelwood. This is unlikely to change in the near future, not least because of the continuing balance of payments problem. But, while the balance of payments crisis continues, the nature of the woodfuel problem changes. There is a need to focus on the growing urban household energy problem so that a range of

an energy transition in urban areas.

Zambia is undergoing profound economic change particularly as the mining sector becomes less important in the overall economy. Consequently, the overall commercial energy consumption, particularly oil, will cease to dominate the balance of payments problems. Electricity production is growing but is not extensively used at a household level. Particularly along the "Line of Rail", there is a growing household energy problem.

The urban household energy problem in Zambia is largely unknown. There needs to be emphasis on integrating woody biomass management into agriculture as rural development becomes the major focus of strategic economic planning. Significant efforts are also required to understand the ecology of Miombo woodland production and maintenance.

Zimbabwe faces three energy problems, namely, reducing imports, developing least-cost programmes for the use of indigenous resources and increasing the efficient use of both imported and local energy. Two major opportunities are available to Zimbabwe for addressing the problems in the household energy sector. These opportunities will also carry implications for neighbouring states. These are the development of agroforestry models of "best practice" across ecological zones with particular reference to the communal area and the possibility of fuel substitution in urban households, especially by kerosene, coal and gas.

4.6 Technology Choice

Against the policy options discussed in Chapter 3 and the resource availability discussed in this section, it is important to consider the choice of technology. In this discussion, the issue of appropriate technology will focus on hydropower and biomass supplies, both renewable resources, and a focus for Norwegian investment.

a) Hydropower

The main choice in hydropower development is related to choice of scale, i.e. components and implementation of the civil works part of a project. This choice also drives the environmental impact of hydropower projects. Attempts to define categories of hydropower projects by installed capacity have failed for obvious reasons. Compare two projects, one with a head of 200 m and a discharge of 3 m^3/s and another project with a head of 20 m and a discharge of 30 m^3/s. The two projects will have an installed capacity of approximately 5000 KW, but are two very different projects.

A better way to approach the problem is to identify ranges of investment cost. It is not an obvious approach for engineers, but it is an approach which is more easily understood by decision makers. The following ranges of investment costs at 1990-prices, all based on international cost levels, allow some categorisation:

Category 1: Less than 3 million US $
Category 2: 3 to 15 million US $
Category 3: More than 15 million US $

Category 1 represents rather small projects, normally with an installed capacity of less than 1000 KW, but more likely around 500 KW. The most economical projects have a head of 50 m or more, thus the rate of flow will be small (in the order of 1 m^3/s) with channel rather than tunnel or pipe. The power house is a small structure, and the design work is based on experience, not detailed investigation. In selecting a less costly design, operational problems may develop, for instance during floods due to heavy sediment transport.

Category 2 is the range of installed capacity of 1000 to 10,000 KW, that is often referred to as Small Scale Hydro. Normally there is the possibility of choosing different lay-outs with respect to the civil works, i.e. construction methods and sophistication in design. However, with an investment in the range of 3 to 15 million US $, the capital cost (including interest on capital during construction) becomes important. Economic consideration tends to become so significant that the choice of layout is limited.

Category 3 is hydro projects with installed generating capacity of generally more than 10,000 KW, i.e. medium or large-size power plants. These projects must be designed according to the usual economic criteria and, for reasons indicated above, the choice of technology is very limited. A comprehensive planning is essential as investment cost may otherwise vary by 20 per cent. A very important design criterion is to avoid undue operational difficulties as the consequent loss of revenue is not acceptable.

One planning criterion does have a significant impact on hydropower projects. The criterion is referred to as the "90% certainty level" stating that water shall be available throughout 9 out of 10 years to meet a specified demand for firm energy delivery. This criterion is very strict and costly as it tends to increase the needed reservoir volume significantly. It also implies additional negative environmental consequences. More flexible criteria should be considered which do not place so much emphasis on firm power, on over-design. It is important to note that a good solution (choice) in a given situation (case) is not usually the good solution in a different situation (locality). There is, however, much scope for new thinking about mixed systems for electricity generation.

b) Biomass

While biomass dominates energy accounts, and at household level, remains the issue of basic need, it is difficult to choose technologies because wood production is a land management not an energy management issue. In reviewing successful interventions in SADCC, the conclusion that emerges is that a new approach is needed for fuelwood interventions not because of technical problems but because of the complexity of the socio-cultural context. Table 4.5 contains details of this new approach in context with the traditional institutional approach.

Table 4.5 Contrasting Approaches to Biomass Intervention

Project stages/design features	Project characteristics New approach to woody biomass management	Traditional institutional approach
Intervention	Indirect	Direct
Capital cost	Low	High
Technology/management	Multipurpose (eg. integrated land use)	Single purpose (eg. tree plantation)
Output(s)	Multiple products	Single product
Activity	Immeasurable	Measurable
Environmental impact	Positive	(Negative?)
Niche	Integrated, diffuse	Firm project boundary
Objectives	Broad goals	Narrow goals
Group focus	Female and male	Male

The successful cases of intervention seem to be those which tackle the problem in an indirect way. The concept of the indirect approach has several dimensions to it. The foundation of the indirect approach is not simply to tackle the symptoms of the fuelwood shortage, rather it is to get at the fundamental cause by discussing with the local community what are their own pressing concerns in the woody biomass area. This will reveal not only their own prioritisation of the problems they face, but it will also ensure their involvement from the beginning in strategies to find solutions to the problems that they define, and which are closet to their hearts. This is an essential feature of a genuine development strategy. Thus by assuming that *the problem is one of improving land-use management rather than of growing more fuelwood trees*, one achieves both an openness to the local participants' own priorities and establishes the foundations for developing an integrated approach.

A second important dimension of the indirect approach is that government agencies should encourage people to do more for themselves, in the sense that the people rather than the government take on the responsibility for tree production. Encouraging farmers themselves to grow more trees offers a number of potential benefits: it provides a means of assisting families to become more self-sufficient in wood, fruit and other tree products; it may create new sources of income; and it can help to improve the local environment. Here local

community groups and NGOs have a vital role to play. They can help direct the indigenous knowledge base into the development initiative. However, although indigenous knowledge may exist in pockets, it is not always widespread within the community. The case for producing fuelwood indirectly by meeting people's other higher priority needs from trees appears to offer a practical new approach to the fuelwood problem. A corollary to this is that a woody biomass component can be integrated into non-tree specific projects.

The indirect approach can frequently be a low-cost rather than a high-cost option. Encouraging people to grow more trees themselves is not simply a more cost-effective option, it is one which is likely to ensure a wider level of impact. Low-cost ways of encouraging more tree planting include the use of cuttings, particularly useful for establishing hedges and the use of "wildings" or wild seedlings.

There are many dimensions to this element of low-cost tree planting interventions. Agroforestry combinations which include nitrogen fixing trees, such as acacia albida, can increase crop yields and reduce the cost of chemical fertilizers. As perennials, trees provide several advantages over nitrogen-fixing annuals, such as alfalfa and clover. Trees are often active throughout the year which increases the total productivity of the land. Their root system absorb nutrients from deeper in the earth and therefore compete little with shallow rooted crops. They offer protection against erosion and provide other benefits to the farmer. For example, trees which provide fodder release land for other uses. Generally, interventions to grow trees should aim to have low unit costs to governments, low recurrent costs and a low reliance upon imported items. This is important given the economic difficulties facing many SADCC member states.

The traditional forestry approach has been concerned with single purpose tree management in plantations or protected gazetted forest reserves. The approach suggested here, is more directed to multipurpose management based upon integrated land use. Intercropping of trees with crops is one example and with the right combination it is possible to achieve higher production than if the crops and trees were growing separately. Another aspect of multipurpose management is multiple products. Instead of producing a single end-use product or stated more accurately growing a product with a single end-use in mind, such as fuelwood plantations, tree species can be chosen which meet multiple end-uses.

Two broad conclusions emerge from this survey of technical choice. Firstly, there is a need not to over-specify high technology interventions. With hydropower, commitment to the conventional 90% firm power requirement is not essential for the success of the project. Secondly, with reference to biomass interventions there is a need to explore indirect mechanisms to increase biomass availability, not direct intervention.

4.7 Environmental Impact

It is worth noting, in passing, the environmental impacts of hydropower and biomass interventions. Hydropower generation can come in three different forms, namely:

1. Run-of-river hydropower projects which make use of the energy potential for a reach of the river with a concentration of rapids. The discharge in the river for that reach will be significantly less for a substantial part of the year. The intake is normally a small reservoir or a pond only.
2. A single purpose hydropower development project, normally with a major dam and reservoir. The purpose of the reservoir is to provide water when needed for power generation to meet the varying power demand over the year. The environmental impact is very much connected to the reservoir and its operation.
3. Multipurpose or river management projects, including power generation, where the objectives may be flood control, irrigation, hydropower, water supply, recreation or other river use/river improvement objectives.

Some of the main environmental impacts of hydropower include deforestation, land use, river and reservoir biology, fluctuating discharge in rivers, health aspects related to impoundment and change in hydrological regimes, changes in the sediment transport regimes, and resettlement of people away from impounded areas and migration towards man-made reservoirs when completed. Although there are detailed ecological studies of multipurpose management projects, little evidence of environmental knowledge on small hydropower projects is available in the SADCC region.

Deforestation is the term commonly used to describe the process of vegetation disappearance, a disappearance that is frequently associated with the use of wood energy. It is important to bear in mind that the term covers a range of vegetation types including "proper" forests, woodlands, bush lands and all the types of woody vegetation cover. Quantitative data on the relative contribution to deforestation of the different factors is not readily available but it is now accepted that *clearing of land for agriculture is contributing more than fuelwood consumption to deforestation in Africa*. Woodfuel use in towns and cities has made a significant contribution to deforestation. Ecological damage due to deforestation can cause:

i) Gully erosion and losses of top soils to wind and rain.
ii) Greater surface evaporation and reduced soil moisture content as surface wind velocities increase.
iii) Greater surface run-off and adverse changes in water tables which puts the existing trees in greater stress and decline in water supply from wells.
iv) Removal of deep rooted trees reduce the recycling of nutrients.

Deforestation of the catchment forests can also seriously interfere with water conservation. Deforestation in Africa is not currently caused by cutting for fuelwood - the blame lies elsewhere and is therefore difficult to address as an energy problem.

4.8 Basic Needs

Bioenergy is the most important energy source in the SADCC region and will remain so in the foreseeable future. Traditional fuels will still contribute over 70 per cent of energy supply in the year 2000. Energy requirements for future basic needs have to consider a number of parameters of which population is the most important. The population of the SADCC region was 58 million in 1980 and approximately 75 million in 1990. The projected annual growth of the rural population is estimated at 2.6 per cent. Fuelwood demand in rural areas can be assumed to remain constant per capita but grow with population. The problem lies elsewhere - the projected rate of growth of urban population is about 5-6 per cent per year. With these rates of urban growth, pressure on biomass energy which has already caused acute shortages

in peri-urban environments and is expected to intensify. Basic need provision will be increasingly an urban, not a rural, problem.

4.9 Gender Issues

The manner in which women interact with their environment is characterised by a complex set of relationships. In rural areas across the SADCC region, they are the household members who have sole responsibility for domestic tasks and for the majority of subsistence agriculture. In the absence of developed infrastructure and in the face of limited resource base, they are heavily dependent on natural resources, including energy, which must be utilised in the agricultural and household tasks essential for daily life. Any threat to or depletion of these resources undermines women's ability to maintain the basic survival of their families. It is women, thus, who are most consistently faced with making decisions about trade-offs between conserving energy and other natural resources, and exploiting them.

Many energy development policies have made a fundamental error in assuming that because women utilise energy resources, they also have free access to and control over them. Only in relation to very specific resources, however, (for example, certain land areas which may be used for family vegetables) women typically have limited control over resources. Even where communal resources, such as forests, are equally accessible to them, for purposes of gathering forest products such as fuelwood, fruit, nuts, fibres for cloth and medicinal remedies, commercialisation of the produce has increasingly meant that the profits derived from sales accrue to men and not the women-gatherers.

The impact of energy development projects on women has thus been limited.

As noted earlier, improved stoves may have benefits for women in that they are cleaner and more rapid in cooking but, where cash outlays are required to purchase the stove, construction inputs or new pots, women are usually dependent on male household members to make any financial decisions involved. The latter frequently see no advantages in investing

in kitchen equipment as it is women's domain. Women's role in forestry projects have been limited by land tenure issues.

The focus of a gender-orientated approach must be predicated upon a clear understanding of the multiple ways in which women interact with the environment. Interventions must be identified which do not create an imbalance in the interrelated systems of basic needs provision within the household. But the overall challenge lies not just in addressing women's basic needs, in respect to their improved use of energy resources; their strategic needs, in respect of obtaining more direct access to and control over such resources, must also be addressed.

4.10 Summary

There are ample energy resources in SADCC. Where energy provision is difficult, there are usually two problems. Firstly, it is difficult to access financial resources for commercial energy development thus slowing the energy transition. Secondly, at the household level, there are increasing problems of meeting basic needs in urban and some semi-arid areas from traditional biomass supplies. It is, however, difficult to generalise this problem as an energy crisis.

In looking at technology choice, there is the possibility of redefining interventions by not over-specifying technological interventions in the commercial sector and determining indirect interventions in the traditional fuel sector. Both these redefinitions would go far to support the creation of a basic needs strategy for energy. While there are environmental impacts from current energy use and new energy projects, these are difficult to determine in general as they are site specific in nature. Gender issues are difficult issues to address in commercial energy development and, to date, have not been substantially addressed in the biomass sector because of the mis-specification of project design.

For Norwegian aid there is a need to continue support for commercial energy development, especially assistance that can accelerate the transition of the urban energy to a modern fuel-

technology mix. In investing in a sustainable energy and environmental future, the more rapidly that household consumption in urban centres is moved from biomass to modern fuels, the more rapidly a secure energy future is established. Furthermore, this investment in the urban energy transition will take off pressure on the diminishing biomass resources in peri-urban and rural areas. Urban energy provision is a key area to explore.

While it is difficult to generalise, the crisis of energy provision at household level, problems of biomass production and consumption remain difficult to address. This is largely because the issues have been professionally over-determined with energy and forestry planners attempting to take a lead role although neither body of professionals has much experience of biomass provision at local level. The provision of biomass fuels must be seen as part of a broader landuse policy which will require other professional input, particularly from agricultural and rural development professionals. Many of the solutions that will provide additional woodfuel will come from the establishment of woody biomass for non-fuel purposes. Establishing models of best practice for indirect solutions is difficult for both professional development workers and administrators. It is, however, these models of best practice which have demonstrated substantial success.

Over-specification of biomass projects, particularly by establishing limited species choice and setting physical production targets, is paralleled by over-specification of technology in electricity projects. In hydro-electricity projects, in particular, schemes which do not provide annual base load but can generate electricity for a large part of the year, should be openly considered. This is particularly the case when the cost of dams or barrages, and channelisation, would make a local generation scheme prohibitively expensive in conventional project analysis. Increasing attention should be paid to the possibility of establishing a mix of generation technologies to meet local electricity demand.

It is difficult to comment substantially on the issue of gender and energy. In both the commercial and non-commercial energy sector, the role of gender is rarely addressed. The reasons for this are:

* That in formal project planning, setting of project incentives and monitoring of project performance, the gender issue is rarely articulated. The shortage of professionally

documented material which can address the issue gender and energy is an obstacle to the learning process. There is little experience of this learning curve, and, therefore, few models of best practice.

* That energy projects are written in such a manner that women, lacking technical expertise, have little opportunity to comment on such activities. Where they are actively involved, in such things as stove programmes, the emphasis is usually broader than a single sector focus on energy. Ironically, such projects call for a wider range of inputs and intervention than that usually associated with a single sector approach. Such projects usually are successful when income generation opportunities exist for local women, but defining such income generation opportunities in energy projects is difficult.

5. EMERGING ISSUES FOR NORWEGIAN ASSISTANCE

From the inception report to this final report has taken some three years. In that period, there have been substantial changes in the way that the aid debate is conducted. Firstly, the increasing documentation of Eastern Europe has called for a redirection of assistance, particularly large scale infrastructural investment that includes energy projects, from the Third World to the Second World. Secondly, the redefinition of Third World economies by the World Bank, particularly but not only in Africa, has led to an emphasis on financial efficiency rather than new investment. Thirdly, there has been a rush from institutions particularly in areas such as energy planning where policy makers have little direct impact on what occurs on the ground. Against all this, is the rising consciousness of environmental problems which has particularly focused into a debate of energy futures because of the threat of global warming. In this context, this final chapter attempts to establish what is likely to be the implication of all these changes for future Norwegian energy assistance.

It is impossible to define future Norwegian assistance without shaping a Norwegian energy policy for developing countries. The global energy future is largely unknown and unknowable. Not surprisingly, the environmental impact of this is equally uncertain. Developing policy under conditions of uncertainty will require an emphasis on prevention rather than cure, on proactive not reactive development. The principles that underlie such an energy policy will be a commitment to a sustainable energy economy and a commitment to energy security. Such a commitment is not only a "Brundtland Commitment" (minimising ecological risk while enhancing development opportunity). It is also a commitment to *long term* cooperation with development partners. Increasingly, in this partnership, the environmental conditionality implied by the development of a sustainable and secure energy economy will require *environmental additionality* from Norway. This environmental additionality will be used to encourage the rapid spread of models of best practice for energy provision.

Models of best practice imply an accumulative awareness of what seems to work best. Rather like medical professionals who accept that perfect diagnosis and intervention is rarely possible, energy professionals must drop their assumption that they can dominate people and nature and accept that they must work with people and nature. Energy professionals must realise that there is not one simple solution because there is not one simple problem.

Energy is not a goal in itself but an input required to maintain basic needs and to provide development services. *Enduse demand analysis* is the cornerstone for planning a sustainable energy economy. Such a sustainable energy economy is also obtainable when a *real cost analysis* of meeting energy needs is undertaken.

To date, the real costs, *including the environmental externalities* of current energy use, have not been fully analysed. Without real cost analysis, it is impossible to choose models of best practice.

In meeting the demands of a sustainable and secure energy future, support must emphasise *institutional development* and enhanced planning capacity at international, national and local levels. Within the planning framework the emphasis on an enduse and real cost approach drives assistance towards *investment in energy efficiency*. This emphasis on efficiency, together with and emphasis on *renewable sources of energy*, should be the essential technical thrust of future proposals.

In supporting an improvement in basic provision, the *household energy sector* will remain to the fore, particularly the specific challenge offered by the *urban* household energy sector. An emphasis on households explicitly recognises the central role of *women* in managing the household energy economy and, as producers, managing the local environment.

Major components of future energy assistance could include

- Ensuring that regional and country allocations are made only when environmental conditionality has been agreed with partners.
- Creating a policy awareness of the interlinkage of energy and environmental issues.
- Implementing environmental assessments of energy projects and energy assessments of other projects.

Such assistance moves away from hardware investment, which can essentially be handled by markets, and places emphasis on a policy framework to develop a sustainable and secure energy future. This does not preclude financing at national and local level of energy efficiency, NARSE, household energy, rural electrification and energy planning projects.

What it does mean, however, is that *bilateral* forms of assistance will continue to dominate energy investment. Quite simply, there is no single multilateral institution that carries forward the debate on a sustainable and secure energy future nor is there capacity in the non-governmental organisations to address such a critical issue.

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