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Challenges of Infrastructure Rehabilitation and Reconstruction In War-affected Economies

by

Anke Hoeffler
CSAE
Oxford University

The views and interpretations in this paper are those of the author
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RÉSUMÉ ET QUELQUES CONCLUSIONS

Dans ce document, nous avons examiné les défis qui se posent aux économies de douze pays africains touchés la guerre, dans le domaine de la réhabilitation et de la construction des infrastructures. Notre étude sur les secteurs de l'eau, des transports, de l'énergie et des télécommunications a révélé l'insuffisance des infrastructures dans les douze pays. En moyenne, 30 pour cent seulement de la population ont accès à l'eau potable et 20 pour cent environ à l'assainissement. En conséquence, il y a une forte incidence de maladies hydriques et d'origine hydrique. En raison de la fuite des réfugiés vers les grandes villes, les installations existantes d'adduction d'eau potable et d'assainissement sont utilisées actuellement par un plus grand nombre de personnes; en d'autres termes, l'une des conséquences des conflits a hé la détérioration de l'accès de la population urbaine à l'eau et à l'assainissement.

L'accès au transport est également difficile dans la plupart des pays. A l'exception de Djibouti, tous les pays se caractérisent par un pourcentage élevé de population rurale (70 pour cent en moyenne), la plupart pratiquant la culture de subsistance. Le transport routier est le mode de transport le plus important, mais seules quelques routes sont bitumées. Le réseau routier est, en grande partie, endommagé et/ou non entretenu par négligence pendant la guerre. Dans l'un ou l'autre cas, le réseau routier se trouve dans un piteux état dans nombre de pays. La plupart des routes sont actuellement impraticables, en particulier les pistes d'accès en milieu rural. L'accès au transport encouragera les paysans à avoir une production excédentaire commercialisable et à la transporter sur le marché. Ainsi donc, la réhabilitation du réseau routier, entre autres, offrira aux populations rurales la possibilité de gagner des revenus en espèces et par conséquent, d'améliorer leur niveau de vie.

L'accès à une énergie de haut rendement est aussi faible. Une grande partie de l'énergie consommée par la population rurale est générée par des biocombustibles, tels que les déjections animales, les résidus agricoles et le bois. Bien qu'en principe, les forêts, régions boisées et terres agricoles peuvent fournir de la biomasse sur une base durable; les régions très peuplées connaissent, en particulier, des dégâts écologiques considérables. Bien qu'il existe un certain nombre d'alternatives à l'extension du réseau électrique, par exemple l'installation de systèmes photovoltaiques, le coût d'acquisition est encore très élevé pour les ménages ruraux à faibles revenus. L'absence de facilités de crédit en particulier, constitue un obstacle majeur à l'adaptation générale des sources d'énergies renouvelables.

Bien que le nombre des principales lignes téléphoniques pour 100 habitants soit faible, dans certains pays les réseaux cellulaires fonctionnent déjà. Le secteur des télécommunications est le secteur de l'infrastructure ayant le plus de chances de tirer profit de l'investissement privé, en raison essentiellement du fait que les dépenses par ligne sont élevées et aussi de la forte demande et des recettes durant la période d'exploitation signifient que les délais de remboursement sont relativement courts. Compte tenu du bas niveau des revenus moyens, tout le monde ne peut pas posséder e téléphone. Toutefois, ce problème pourrait être résolu par l'accès partagé, et la disponibilité des téléphones publics est capitale pour la politique d'universalité d'accès.

Etant donné que les pays touchés par la guerre ont des économies très pauvres, la réhabilitation et la reconstruction de l'infrastructure dépassent la capacité financière des gouvernements. Le document présente donc l'investissement privé dans l'infrastructure, comme une alternative à l'investissement public. Toutefois, pour les investisseurs, les pays d'Afrique au sud du Sahara sont généralement considérés comme des pays à haut risque et d'après l'évaluation des risques, leurs économies sont classées parmi les plus risquées.

Aussi longtemps que ces pays ne connaitront pas la paix et que les activités de guérilla et le banditisme en feront des pays peu sûrs, les investisseurs seront réticents à investir dans les projets d'infrastructure. Dès que la paix sera rétablie dans ces pays, la reconstruction économique devra se faire parallèlement avec la réforme économique. En l'absence d'un cadre réglementaire et juridique adéquat, les pays ont peu de chances d'attirer l'investissement privé. Toutefois, malgré leur classement dans la catégorie des pays à haut risque, certaines économies touchées par la guerre ont

réussi à attirer des investisseurs privés pour les réseaux de téléphone cellulaire. Comme le montre le document, il existe une forte volonté de payer l'eau potable et l'énergie et ces deux secteurs pourraient donc, en principe, intéresser les investisseurs privés.

SUMMARY AND CONCLUSIONS

In this paper we considered the challenges of infrastructure rehabilitation and reconstruction in twelve war-affected economies in Africa. Our survey of the water, transport, energy and telecommunication sector showed that the standard of infrastructure provision is very low in all of the twelve countries. On average only about 30 per cent of the population have access to safe water and only about 20 per cent of the population have access to sanitation. As a result the incidence of water-borne and water-related diseases is high. Due to the influx of refugees to the major cities the existing water and sanitation facilities are now used by more people, i.e. one result of the conflicts was a deterioration of the water and sanitation access for the urban population.

Access to transport is also low in most countries. With the exception of Djibouti all countries are characterized by a high percentage of the population living in rural areas (about 70 per cent on average) and most practice subsistence agriculture. Road transport is the most important form of transport, but only a small proportion of the roads are paved. Much of the road network was either damaged and/or the maintenance was neglected during the war. In either case, the state of the road network is dilapidated in many countries. A large percentage of the roads are now intransitable, in particular rural feeder roads. Access to transport would encourage farmers to produce marketable surplus and to transport it to the market. Thus, among other things the rehabilitation of the road network would provide the rural population with opportunities to earn cash incomes and therefore improve their standard of living.

Access to efficient energy is low, too. A high proportion of the energy consumed by the rural population is generated by biofuels, such as animal dung, crop residues and wood. While in principle forests, woodlands and farmlands can supply biomass in a sustainable way; in particular densely populated areas are experiencing immense ecological damage. Although there are a number of alternatives to electricity grid extension, for example the installation of photovoltaic systems, the cost of acquiring the system is high for very low income rural households. The lack of credit facilities in particular constitutes a significant barrier to the widespread adaptation of renewable energy sources.

While the number of telephone main fines per 100 inhabitants is low, in a number of countries cellular networks are already in operation. The telecommunications sector is the most likely infrastructure sector to benefit from private investment, mainly because expenditures per fine are high and high demand and revenue during build-out mean that payback periods are relatively short. Due to the low average incomes widespread individual ownership of telephones i5 not feasible. However, universal access could be achieved by shared access and the availability of public telephones is the key to universal access policy.

Since war-affected countries are very poor economies the task of infrastructure rehabilitation and reconstruction is beyond the financial capacity of the governments. The paper therefore discussed private investment in infrastructure as an alternative to public investment. However, investors perceive countries in Sub-Saharan Africa on the whole as high risk countries and risk ratings show that investors rank the risk in war-affected economies as even higher.

As long as countries are not at peace and guerilla activities and banditry make the countries unsafe, private investors are unlikely to invest in infrastructure projects. Once the countries are at peace economic reconstruction has to be paralleled by economic reform. Without an adequate legal and regulatory framework countries are unlikely to attract private investment. However, despite their high risk rankings some war-affected economies have been able to attract private investors for cellular telephone networks. As the paper shows, the willingness to pay for safe water and energy is high and thus the water and energy could in principle be attractive to private investors.

Challenges of Infrastructure Rehabilitation and[1] Reconstruction in War-affected Economies

1. Introduction

This paper examines the state of infrastructure and the challenges of rehabilitation and reconstruction in war-affected economies in Africa. For the purpose of this study we concentrate on the following war-affected economies: Angola, Burundi, Democratic Republic of Congo (formerly Zaire), Djibouti, Eritrea, Ethiopia, Liberia, Mozambique, Rwanda, Sierra Leone, Somalia and Sudan.

Some wars were very protracted, like in Mozambique and Angola, who plunged into civil wars after their wars of independence. Thus, both countries emerge from war situations which lasted over 30 years. The Eritrean war of independence was also very long, it lasted over 20 years and left the economy in ruins. Although other wars were shorter, such as the conflicts in Rwanda and Burundi, the effects were nevertheless devastating. Due to the political violence in Burundi at least 100,000 people lost their lives[2] and about 1 million were displaced[3].

As of November 1998 conflict was still ongoing in Somalia and Sudan. The peace agreements in Liberia and Sierra Leone are fragile and the UNITA rebels control large parts of Northern Angola. There is also considerable tension between Eritrea and Ethiopia due to a border dispute which erupted in May 1998.

During the war both opponents, the government and the rebels, target physical infrastructure as a part of their strategy. The main targets are the enemy's communication and support lines, such as telecommunications, airports, ports, roads and bridges. In addition to this strategic destruction of

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1 A Background paper prepared for the African Development Report 1999.

2 The Stockholm International Peace Institute, SIPRI, (1998).

3 CIA Factbook.

key infrastructure, rebels and government soldiers looted and destroyed housing, schools and hospitals.

In some countries, like in Mozambique, fighting took place in all parts of the country and infrastructure was destroyed throughout the country. On the other hand, in some countries the war was relatively localized, such as in Sudan and Ethiopia. However, although some parts of the country may not be directly affected by war, maintenance of infrastructure is neglected due to the war, because capital expenditure is cut back in favour of increased military spending.

This paper is structured in the following way. First we give a brief overview of the economies of the war-affected countries. The third section provides a discussion of the link between infrastructure reconstruction and economic rehabilitation. In the fourth section we discuss the state of the infrastructure in the twelve countries and the challenges of reconstruction and rehabilitation. Section five presents a discussion of private investment in infrastructure. The last section provides a summary and some conclusions.

2. The State of the Economies

Poverty and war are interdependent: poverty is a cause as well as a consequence of civil war. While poorer countries are more likely to experience civil wars (Collier and Hoeffler, 1998), conflicts also reduce countries' incomes through a variety of channels (see for example Collier 1999 and Humphrey, Lee and Stewart 1997).

Using the World Bank's four key economic development indicators - income per capita, life expectancy, access to safe water and gross primary enrolment, listed in Table 1 - we see that the war-affected countries are very poor. Indeed, all of the 12 war-affected economies are classified as least developed countries by the United Nations. Average GNP per capita was only $195, which was less than half the average of Sub-Saharan Africa[4] ($500).

In terms of human development the various civil wars also had devastating effects. For example life expectancy on average was only 49 years in war-affected countries in comparison with 52 years in Sub-Saharan Africa as a whole. On average only about 30 per cent of the population has access to safe water[5] while 44 per cent of Sub-Saharan Africa's population has access to safe water. Furthermore, on average only about 58 per cent of children of school age are enrolled at primary school, which is again much lower than the Sub-Saharan African average of about 75 per cent.

[4] Since all the war-affected economies are situated in Sub-Saharan Africa, we decided to compare these economies to the Sub-Saharan average and not to the African average. We use the World Bank's deninition which excludes Reunion, because it is a high income economy.

[5] Please refer to Section 4.1 for a definition of "access to safe water".

Table 1: Development Indicators 1997

	GNP per capita (US $)	life expectancy at birth (years)	access to safe water (% of the population)	gross primary enrolment (% of school age population)
Mozambique	90	45	32	60
Ethiopia	110	50	27	29
D. R. of Congo	110	53	27	72
Burundi	180	49	37	43
Rwanda	210	42	..	82
Eritrea	210	55	8	57
Sudan	280	55	50	54
Angola	370	46	32	88
Liberia	..	51	30	..
Somalia	..	49	..	..
Djibouti	..	50	24	38
Sierra Leone	..	38	34	..
Sub-Saharan Africa	500	52	44	75

Source: World Bank Website (country profiles)

To summarize, the 12 war-affected economies are very poor and the population has a low life expectancy, limited access to safe water and many children do not receive primary education. In order to achieve higher per capita incomes and improve welfare the main objectives of war-affected countries must be economic growth and poverty reduction: the next section provides a brief discussion of the link between these two objectives and infrastructure.

3. Infrastructure and Economic Reconstruction

For the purpose of this paper we define infrastructure as the services provided in the following sectors: water, transport, energy and telecommunications.

Transport is an input for every commodity and input-output matrices show that energy, water and telecommunications are used in the production process of nearly every sector. Furthermore, infrastructure services facilitate the diversification of production and the expansion of trade. Without infrastructure rehabilitation the prospect of economic growth will remain very limited. However, there is some argument about the direction of causation between infrastructure investment and growth, because an expansion of the economy also leads to greater demand for infrastructure. Canning (1998) presents some evidence that better infrastructure services, in particular telecommunications, cause growth. According to the World Development Report (1994), the average economic rates of return of World Bank-supported infrastructure projects is about 16 per cent, which is just slightly above the project average of 15 per cent. Given the importance of infrastructure for the economy, this seems relatively low. However, rates of return depend on project identification, design and implementation as well as the overall economic policy. For example good roads and port facilities alone do not guarantee an expansion of trade. Only if infrastructure improvements are coupled with good economic policies, such as low barriers to trade and an efficient and non-corrupt customs service, can the economy realize the full benefits of infrastructure improvements.

One consequence of non-existent or unreliable public infrastructure services is that production costs are much higher than for companies with access to reliable infrastructure services. For example companies often install individual power generation units to bridge periods of blackout or to avoid damage from power fluctuations. Independent power generation is far less efficient and substantially more expensive in terms of capital as well as operating costs compared than power supplied by large utilities. For example, the average generator installed by small- and medium-sized enterprises in Uganda costs about $25,000 new and needs another $10,000 annually for fuel and maintenance.[6]

[6] Donaldson, Sader and Wagle (1996) p. 10.

We now turn to the discussion of the second policy objective, poverty reduction. The World Development Report 1994 defines poverty in the following way: "To a large extent the poor can be identified as those who are unable to consume a basic quantity of clean water and who are subject to unsanitary surroundings, with extremely limited mobility or communications beyond their immediate settlement."[7]

There are numerous consumption benefits from access to infrastructure for the poor. Most obviously, access to clean water and sanitation reduces mortality and illnesses. Availability of alternative energy sources to animal dung and firewood or more efficient use of these energy sources can improve indoor pollution. Access to water and energy increases the productivity of the households, because less time and income is spent on their collection. A high proportion of the population in war-affected economies are living in rural areas and often their only basis for survival is subsistence agriculture. Irrigation can help to increase the yield and crop diversification. Access to transport encourages farm households to produce marketable surplus and to sell their produce in markets and thus create cash income. Provision of infrastructure also expands the non-farm employment opportunities in rural areas.
The rehabilitation of roads in war-affected economies is also important for famine prevention. Often food is available in some parts of the country, but poor transport infrastructure inhibits the relief efforts for famine regions.

To summarize, improved infrastrucure services encourage growth through the reduction of production costs. Furthermore, access to infrastructure increases the productive capacity of the poor, in particular of women who spent much time and income in order to obtain water and cooking fuels and in carrying crops to markets. However, in order to achieve the two policy objectives infrastrucure improvements have to be coupled with good policies.

So far the discussion of the links between growth, poverty reduction and infrastructure services

[7] World Development Report 1994 p. 20.

has assumed that the economy is at peace. For countries emerging from war the basic needs of the population have to be addressed first. During the transition period from war to peace food and safe water have to be provided for households, refugees and soldiers, many of whom may live in emergency shelter and camps. These emergency measures are coordinated and financed by international agencies such as the United Nations and by non-governmental organizations. Only urgent repairs on airports and ports are usually carried out in this immediate post-war phase.

The next pressing issue is the resettlement of displaced persons and the demobilization and re-integration of ex-combatants. Refugees and veterans are in need of transport services in order to return to their communities and they usually need help to erect some simple accommodation. In a number of countries the re-integration of refugees and veterans and the rehabilitation of infrastructure are linked. For example in Liberia "jobs for guns" persuaded the fighters to lay down their arms and provided labour for the infrastructure rehabilitation projects.[8] In Ethiopia "food for work" programmes support infrastructure rehabilitation.[9]

Once the country is at peace and normal economic activity can commence infrastructure rehabilitation can begin on a wider scale. There is little research on the sequencing of infrastructure reconstruction. Uganda, a country emerging from 15 years of civil strife and which has enjoyed high growth rates (about 7 per cent per annum during 1987-1997[10])first concentrated on roads rehabilitation, but at present Uganda's main production constraints are the supply shortages energy sector. Thus, since the production of most goods needs infrastructure inputs from different sectors, all sectors will need to be rehabilitated in the long run. Furthermore,

[8] European Commission (1997) Second Liberia Rehabilitation Programm.,

[9] GTZ (1997a, 1997b).

[10] World Bank Country Profile - Uganda.

infrastructure services are complementary: one sector cannot provide services without the others and infrastructure measures tend to be highly correlated (Canning 1998).

We now turn to a more detailed discussion of the state of the different infrastructure sectors in the twelve war-affected economies.

Uganda's economy was severely affected after about fifteen years of civil strife and prolonged guerrilla struggle. Over 36,000 soldiers were demobilized in three phases between 1992 and 1995. In order to enable the ex-combatants to return to their villages transport was provided and they were given a cash payment for their resettlement. This cash benefit, however, was not a severance payment, but was calculated on the basis of the soldier's basic needs such as food, clothing, medical care, agricultural tools and housing. One donor, USAID, contributed to the resettlement programme through commodity provisions. As a consequence the housing aid in the resettlement programme was mainly provided in the form of twenty galvanized corrugated iron sheets and five ridges per veteran. Ideally, the veterans would receive the in-kind housing benefit immediately after their return to their communities. However, the iron sheets and ridges arrived up to one year late, so that many veterans did not have adequate shelter for a prolonged period of time after arrival and many were not able to save the cash components of their allowance until the sheets arrived, mainly due to rent payments during this period. Source: Colletta, Kostner and Wiederhofer (1996).

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4. The State of Infrastructure and the Challenges Ahead

The World Bank provides a new data base of infrastructure stocks which is described in Canning (1998). In Table 2 we present the changes in the electricity-generating capacity and in the length of paved roads during the civil war. We calculated the per centage difference between the infrastructure measures as given in the last year of peace and in the year in which the war ended.[11] However, since the data was not available for all years we indicate in both columns for which periods the per centage changes were calculated.

According to this World Bank data none of the countries experienced any destruction of its infrastructure (this was also true for other infrastructure stocks provided by this data set, e.g. main telephone lines and the total length of the railways). This extraordinary result is probably due to the data quality and does not mean that no infrastructure was destroyed in any of the war-affected countries.[12] We therefore decided to consult different sources to obtain a better description of the state of infrastructure stocks and services.

This section is structured by infrastructure sector. We start with a description of access to safe water and sanitation, followed by transport, energy and telecommunications.

[11] Please refer to the appendix for a list of the durations of the twelve civil wars.

[12] There were also other obvious problems with this data set, e.g. railways data is provided for Burundi although Burundi has no railways.

Table 2: Change in Infrastructure During the War

	Change in Electricity-Generating Capacity (in %)	Change in the Length of Paved Roads (in %)
Angola	20 (1974-94)	15 (1974-91)
Burundi	0 (1992-94)	no data available after 1992
D. R. of Congo	no data available after 1995	no data available after 1991
Djibouti	124 (1989-94)	no data available after 1991
Eritrea	no data available	no data available
Ethiopia	45 (1976-91)	38 (1976-90)
Liberia	2 (1989-95)	9 (1989-93)
Mozambique	500 (1974-92)	45 (1974-92)
Rwanda	0 (1993-94)	no data available after 1991
Sierra Leone	0 (1990-95)	15 (1990-93)
Somalia	17 (1980-95)	39 (1980-90)
Sudan	60 (1982-95)	no data available after 1991

Source: Canning (1998).

4.1 **Access to Safe Water and Sanitation**

The World Bank defines access to safe water as the share of the population with reasonable access to an adequate amount of safe water. Safe water includes treated surface water and untreated but uncontaminated water, such as from springs, sanitary wells, and protected boreholes. In urban areas the water source may be a public fountain or standpost located not more than 200 metres away. In rural areas the definition implies that members of the household do not have to spend a disproportionate part of the day fetching water. An adequate amount of water is that needed to satisfy metabolic, hygienic, and domestic requirements, usually about 20 litres of safe water per person per day.

Access to sanitation is defined by the World Bank as the share of the population with at least adequate excreta disposal facilities that can effectively prevent human, animal, and insect contact with excreta. Suitable facilities range from simple but protected pit latrines to flush toilets with

sewerage. To be effective, all facilities must be correctly constructed and properly maintained.

Access to safe water is a basic human need and with food security it receives top priority by aid agencies in humanitarian emergencies such as civil wars. Inadequate access to safe water and sanitation results in a sharp increase in water-borne and water-related diseases. Throughout the conflicts the population in the major cities increased through the influx of refugees, and the existing water and sanitation facilities had to serve more people than before the war. Water and sanitation problems are also critical in refugee camps. As stressed in the Second Liberia Rehabilitation Programme unconditional relief aid should be phased out once the conflict is over and emphasis be given to operations which strengthen the delivery of basic services at community level and stimulate local population capacity for self-help. Within this programme it is planned to strengthen the Liberian Water and Sewer Corporation's management capacity and to put in place a new management and revenue collection system which is both accountable and transparent. Household and commercial water tariffs have been set for Monrovia in order to start raising sufficient income to maintain the service and a study for a more comprehensive investment programme is planned. Water is still provided free of charge for humanitarian reasons to the displaced in Monrovia.[13]

[13] European Commission (1997) Second Liberia Rehabilitation Programme.

Access to safe water in the war-affected economies is low: on average only 30 per cent of the population have access to safe water.[14] Access to sanitation is also low: on average only about 20 per cent of the population have access to sanitation which is slightly above the Sub-Saharan African average of 16 per cent.[15] In nearly all countries the per centage of people who have access to safe water and sanitation is higher in urban than in rural areas. In Ethiopia about 70 per cent of the urban and 11 per cent of the rural population have access to safe water.[16] In Djibouti 86 per cent of the population in Djibouti town have access to potable water, but in rural areas only 42 per cent of the population have access to safe water. Sixty-six per cent of the urban population have access to sanitation facilities, while only 24 per cent of the population has access to sanitation in rural areas. Djibouti has problems with its sewage systems, unevacuated waste waters and household rubbish, and parts of Djibouti town are flooded during the rainy season. The combination of these problems causes a number of health problems for the population and malaria, cholera, poliomyelitis and hepatitis A are common in Djibouti.[17]

As a result of the civil wars the water supply network was either directly damaged or maintenance was neglected. A major problem is leakages: about 30 to 50 per cent of the total water distributed leaks from the distribution system in Eritrea[18] and an estimated 60 per cent of the water supply leaks away in Mozambique.[19] In most of the civil war countries the water services were parastatals which were overmanned and the management was inefficient. Extremely low tariffs were charged and there was inadequate financial and human resources management. In most cases the water companies' autonomy was limited, which made it impossible for the water services to operate and maintain the infrastructures at their disposal in an efficient and sustainable manner. The challenge ahead is, first, to repair the leakages in the water supply system to reduce the losses, because the water which leaks away is produced but

[14] Please refer to Table 1 for data on access to safe water.

[15] Please refer to Table 5 in the appendix for data on access to sanitation.

[16] African Development Bank: Ethiopia - Country Strategy Paper 1996-98.

[17] African Development Bank: Republic of Djibouti - Country Strategy Paper 1996-98.

[18] African Development Bank: Eritrea - Country Strategy Paper 1996-98.

[19] XI Consultative Group Meeting - Water, 1998, Mozambique.

not charged for. Secondly, tariffs have to be increased in order to cover the costs of water supplies and revenue collection systems have to be improved. For example it is estimated that the uncollected amount of water charges is nearly 40 per cent of the invoiced volume in Mozambique.[20] In the longer run total cost recovery should be achieved so that the water companies can invest in the extension of the existing water supply network.

[20] Ibid.

In order to tackle these challenges Mozambique plans to privatize the management of the water systems of its five major cities (Maputo, Beira, Quelimane, Nampula and Pemba). The institutional framework will be reformed in order to allow partnerships between the government and private sector companies. In addition an investment and asset fund and a regulatory body will be created. The new management system will then consecutively be introduced in the remaining cities and villages in the country. Differentiated tariffs will be introduced initially in order to cover the costs of operation and maintenance and then contribute to the recovery of the investment costs. In the medium run total cost recovery should be achieved.[21]

The water sector in many poor countries is characterized by a relatively high level of private entrepreneurship. The majority of households are not directly connected to a piped system and many buy their water from water vendors. This is very common in peri-urban areas and in smaller towns. Private water vendors either deliver water in containers to households or fill household containers from their vehicle tanks or water kiosks. There are two main disadvantages for consumers who buy water from vendors. In general there are higher health risks than from piped water, and the distribution of water by vendors is expensive. In Maputo for example the water bought from vendors is five to ten times more expensive than the official water rates.[22] In inner city Luanda the water price was only $0.0015 per cubic metre for households with a pipe connection, while in the outskirts where the population buys water from private trucks a cubic metre costs almost $17.[23] This would suggest that the willingness to pay is quite high in these countries.

This is similar to the findings by Whittington et al (1994) who carried out a detailed water

[22] Ibid.

[22] Ibid.

[23] Donaldson, Sader and Wagle (1996) p. 10.

vendor analysis for the Kenyan town of Ukunda. They found that water from the vendors was relatively expensive: households were spending about nine per cent of their income on water. However, the vending market was found to be competitive and while the vendors were making a fair return on their labour and capital investment, they were not extracting large monopoly rents. The price for water was high, because hauling water manually is expensive.

The existing water supply can for example be extended by supplying more wells with hand-pumps in order to achieve financial and/or time savings for the local population. A further option is the extension of the piped water system. On the basis of their Ukunda study Whittington et al (1994) argue for a detailed analysis in order to establish whether the cost of additional hand-pumps is greater than their benefits. It is a dynamic analysis in which it needs to be considered whether extending the water supply by additional hand-pumps will provide sufficient benefits over an extended period to justify its initial capital costs. If the piped system is extended, the pumps will become obsolete. In a number of situations water vending may be the appropriate technology, because it does not entail significant capital cost and is much more flexible and adaptable than the policy of installing additional hand-pumps. The Ukunda study showed that the water vending system permitted households to adjust their water purchases to fit their cash flow situation. Unlike being connected to a piped water system the households are not locked into fixed monthly commitments which they may find difficult to pay for. Water vendors gave regular customers credit and kept the price of water relatively constant over the dry and rainy seasons. Lastly, Whittington et al (1994) also found that households were paying much more for vended water than would be necessary to provide and sustain a piped distribution system with yard taps. This is important information for water companies planning to expand the piped water system. Thus, a survey of vending practices can be a useful indicator of a community's ability and willingness to pay for a piped system.

4.2 **Transport**

This aim of this section is to give an overview of the present state of the transport infrastructure and the challenges which lie ahead in its rehabilitation. We concentrate our discussion on roads, railways, ports and airports.

Roads

Paved roads are defined as concrete or bitumen surfaced roads. The definition excludes stone, gravel, water-bound gravel, oil-bound gravel and earth roads.[24] In many countries most roads are unpaved and very often a large proportion of these unpaved roads are intransitable, in particular during the rainy season. During the war roads and bridges were damaged by direct hits and they were also damaged by heavy military convoys using the roads system extensively. However, a large amount of damage is also due to the neglect of routine maintenance during the war. For example in the Democratic Republic of Congo the dilapidated state of the roads system is almost entirely due to the neglect of maintenance and not due to the civil strife.

Many of the war-affected economies, like their neighbours, have a poorly developed road system which is in a way often a reflection of the demographic features of these countries, such as low population densities, very scattered settlement structures and relatively low urbanization rates.[25] In some cases the existing road system still reflects the colonial transport system which was established to provide a link to the sea ports for the landlocked countries in central and southern Africa. For example Angola and Mozambique had traditionally relatively well developed East-West road connections. The long-lasting civil wars resulted in severe damage and neglect of the roads system. These major road connections (corridors) usually receive priority in the reconstruction process, but there is also a need to construct better North-South connections which would among other things allow for a better distribution of food from food abundant areas to areas of food shortages.

Road rehabilitation has been given a key role in the Ugandan rehabilitation programme. First, the main road connections and the urban road network in Kampala were rehabilitated. In addition, the rural feeder roads are an important part of the rehabilitation strategy. Adequate transport

[24] Canning (1998) p. 12.

[25] Platteau (1994) p. 23.

links encourage farmers to increase their marketable surplus and to use land more intensively, and in the longer run they will adopt more efficient techniques and modern inputs.

The environments farmers face in most of the war-affected countries are characterized by severely limited transport and communication facilities. The extremely poor state of both road and off-road transport has the effect of severely reducing the timeliness and quantities of agricultural inputs and outputs that are moved from and to the farming communities. Thus, rural feeder road rehabilitation is a necessary condition for an improvement in the agricultural sector in which the majority of the population works. For example in the early 1990s it was found that in the Democratic Republic of Congo agricultural production was thriving on the periphery of Kinshasa and in the well-connected Bandundu region, which was in sharp contrast to the agricultural stagnation observed in many other areas.[26]

Furthermore, there are two specific problems for road transport resulting from the civil wars, namely the large number of land mines which are not yet removed and the number of weapons available. Land mines still impede road transport in Angola and Mozambique and the large arsenals of weapons are used by bandits who make overland travel dangerous in a number of countries, for example in Angola and in the Democratic Republic of Congo.

Rail

Railways are defined as the railways open to the public[27] and the importance of railways varies tremendously across the twelve countries studied. While Burundi and Rwanda do not have any railways, transport by rail was very important in Mozambique during the civil war. Addis Ababa and Djibouti are linked by railway and road, but over time the importance of the railway link has declined. However, due to the recent border dispute with Eritrea, the majority of landlocked Ethiopia's external trade is now shipped via Djibouti and the railway link could increase in importance if the border dispute is not resolved.

[26] Platteau (1994) p. 21.

[27] Canning (1998) p. 14.

Ports

Sea ports and the ports along Lake Tanganyika are very important for all of the countries studied, because the majority of the external trade goes through these ports, since air transport only plays a very minor role. Some ports, such as Monrovia, the largest port in Liberia, suffered major damage during the first few months of the civil war in mid-1990 when all major infrastructures were damaged and looted.[28] Not all ports were damaged directly in the war, but underinvestment, inefficient management and interference by the governments led to a deterioration of the ports' facilities. Cargo handling and storage facilities need to be rehabilitated and extended.

Air

Only a very small proportion of international freight is airlifted, but because of the dilapidated state of the roads and ongoing security problems air travel is important in countries such as for example Angola, the Democratic Republic of Congo and Ethiopia. However, international airports are important for business travellers and for the revival or development of tourism, which could become a major earner of foreign exchange in some countries.

To summarize, the transport sector is in a very dilapidated state in many countries. Because of conflict with neighbours or conflicts in neighbouring countries the transport situation is difficult for a number of countries, for example Ethiopia, Burundi and the Democratic Republic of Congo. In order to obtain a more detailed picture of the state of the transport sector and the challenges ahead we present a number of country overviews.

In 1994 **Angola**[29] had a road network of 75,000 km of which about 8,000 km were paved. Millions of land mines remain in the country,[30] but most main roads have been restored and cleared of mines. However, the sporadic laying of new mines and banditry make travelling by

[28] European Union (1997) Second Liberia Rehabilitation Programme.

[29] The discussion of Angola's transport infrastructure is mainly based on the Economist Intelligence Unit Country Profile - Angola.

[30] CIA Factbook.

road unsafe.

Three main railways link Angola's hinterland to the main non-oil ports, Luanda, Lobito and Namibe. In 1973 9.3 million tonnes of freight were transported by railway. The war-affected the northern and central railway links more than the southern railway link which was able to operate a limited service despite the war. In 1994 only about 135,000 tonnes were transported by railway. In 1997 an Italian company won the contract to rebuild the Benguela railway which links the port of Lobito to the mines in the Shaba region of the Democratic Republic of Congo. Due to continued fighting in Angola the rehabilitation of this link has not yet begun. Parts of the Luanda rail-link had been restored by 1997.

Export volumes from Angola's ports were 15.8 million tonnes in 1973 compared with only about 94,000 tonnes in 1994. Imports experienced a less sharp decline, from 2.07 million tonnes in 1973 to 1.24 million tonnes in 1994.

Due to the dangers of overland travel air travel is important: the state airline services most of the main cities and several foreign destinations. Low air fares have plunged the state airline into debt and the line has periodically been suspended from the International Air Transport Association. A number of private and mixed companies operate on domestic routes.

Burundi has no railways but about 5,200 km of roads of which 370 km are all-weather routes.[31] The road infrastructure has not been extensively damaged by the civil war. There are three main foreign trade routes for landlocked Burundi.[32] The road link from Burundi through Rwanda and Uganda to the port of Mombasa in Kenya is commonly referred to as the Northern Corridor. The link from the port of Bujumbura to Kigoma and then by railway to the Tanzanian port of Dar-es-Salaam is known as the Central Corridor. A third transport link, the Southern Corridor, links the port of Bujumbura to the Zambian port of Mpulungu at the southern end of lake Tanganyika and from there by railway to the Southern African countries. Most of Burundi's external trade is

[31] Economist Intelligence Unit Country Profile - Burundi.

[32] The discussion of Burundi's transport infrastructure is mainly based on Nkurunziza (1997) and on discussions with Mr J.-D. Nkurunziza.

transported via these three links; only about 2 per cent is airlifted. Until recently the Central Corridor was the most widely used route due to its relatively low costs. The cost of transporting one ton varies from $70 to $100 compared with a cost of $200 to $250 for the Northern Corridor. The main disadvantage of the Central Corridor is that it is slower and more uncertain. It takes between 1.5 and 6 months to move goods from Bujumbura to Dar-es-Salaam. The round trip from Bujumbura to Mombasa only takes about one month and traffic on this route, though more expensive has increased over the past years. Traditionally the Southern Corridor has been used for cement and sugar imports from Southern African countries.

Mainly due to its landlocked location transport costs are high for Burundi; about one third of the country's export earnings are spent on transport and associated costs. Since Burundi is landlocked and the vast majority of its external trade is transported on land it is heavily dependent on its neighbours. On different occasions Burundi has suffered from interruptions in its external trade due to internal problems in the countries of transit. Following the coup on 25 July 1996 in which former president Ntibantunganya was overthrown by the current president Pierre Buyoya, Burundi's neighbours put the country under a total economic blockade on 31 July 1996, which further increased Burundi's transport costs. Some trade has been diverted from the Northern and Central Corridors to the Southern Corridor.

About two thirds of the population in **Djibouti** live in the capital city and most food must be imported. The economy is dominated by the tertiary sector. The sea port, railway line and the trade banks and telecommunications have developed around the French military base and the service industry accounted for about 76 per cent in 1997.[33] Road transport is poorly developed: Djibouti has about 2,905 km of roads of which 281 km are paved. The paved road which links Djibouti town with the Ethiopian border makes up most of Djibouti's paved roads (217 km). With the help of donors, including Saudi Arabia and the African Development Fund (ADF), the

[33] Word Bank Country Profile - Djibouti.

government is currently making an effort to improve the condition of the roads.[34]

[34] African Development Bank: Djibouti - Country Strategy Paper 1996-98.

Air traffic declined sharply during the civil unrest and in 1995 air traffic was only 46 per cent of that recorded in 1991.[35] In 1997 Air Djibouti was relaunched as a private company, financed by Arab Djiboutians and Saudi Arabians. In 1998 a Boeing 737-200 was leased and regional flights began. During 1998 it was announced that a second-hand A310-200 Airbus will be leased in order to re-introduce regular services between Paris and Djibouti.[36]

Addis Ababa is linked to Djibouti by rail and by road. The *Chemin de Fer Djibouto-Ethiopien* is jointly owned by both countries and 97 km of this railway link are situated in Djibouti. The railway link was completed in 1917 and the railway is ageing. It has sharp curves, steep gradients and deficient ballast which results in restrictions of speed and capacity. Less than five per cent of **Ethiopia**'s domestic and international passenger and freight traffic is accounted for by rail. Most of the freight from Addis Ababa to Djibouti is handled by road. However, the recent border dispute between Ethiopia and Eritrea makes Djibouti the main port for Ethiopia and this may provide impetus to improve the railway link.

Road maintenance has been neglected throughout the prolonged civil war in Ethiopia. Improvements in the transportation system are a major focus of Ethiopia's economic reform programme. A major road sector investment programme has been endorsed by the World Bank, the European Union and a number of bilateral donors.[37]

Ethiopia has an extensive air transport network of both domestic and international routes. Although Ethiopian Airlines is one of the most efficient in Africa, the infrastructural facilities at

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[35] Ibid.

[36] Economist Intelligence Unit Country Profile - Djibouti 1998-99.

[37] African Development Bank: Ethiopia - Country Strategy Paper 1996-98.

Addis Ababa airport are in a poor state and require urgent attention.[38]

[38] Ibid.

In **Sierra Leone** the road system is in a very poor state. The country has about 11,300 km of roads of which about 900 km are paved, 3,200 km are gravelled trunk roads and 7,200 km are feeder and village access roads. Even before the war a considerable proportion of the entire road network was in disrepair: about 30 per cent of the paved roads, 55 per cent of the gravel and 70 per cent of earth roads were in very poor condition. A rehabilitation programme had to be halted when the rebels completely destroyed equipment at a major construction site. During the war about 1400 km of road were rendered unusable and it is estimated that the rehabilitation of the feeder roads alone will cost $20 million.[39]

In **Eritrea**[40] the transport infrastructure is completely in ruins due to the protracted war and past neglect. Bridges and roads were severely damaged, railway lines have been completely dismantled and sea ports and airports need repairs and extensions. The country has about 592 km of paved roads: 375 of all-weather gravel roads and about 4,500 km of rural earth roads. The rehabilitation of the main road from Asmara to Massawa and then to Sbdarat at the border with Sudan is a top priority. Furthermore, a new trunk road connecting the port of Massawa to the Western lowlands in the Sudan and Ethiopian borders is also considered.

The port of Massawa was devastated by the civil war but due to some rehabilitation works some parts of the port are again operational. Asmara has an international airport and one further airport at Assab. Several international airlines fly to Eritrea (including Lufthansa, Egypt Air, Sudan Airways). However, Asmara airport needs to upgrade its runways, telecommunications and navigational aid facilities in order to be able to handle projected traffic.

During the war all basic fisheries infrastructure has been destroyed. Marine fisheries has been an

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[39] African Development Bank: Sierra Leone - Country Strategy Paper 1996-98.

[40] The discussion of Eritrea's infrastructure is mainly based on African Development Bank: Eritrea - Country Strategy Paper 1996-98.

important activity in Eritrea since the 1950s. In 1954 the fish production reached 54,000 tonnes, but by the mid 1970s production had virtually ceased and in 1996 the production was only about 2,000 tonnes. As part of the agricultural policy aimed at promoting food security, the coastal infrastructure such as ports and roads as well as storage and processing facilities are given high priority.

In **Mozambique** the national road network system consists of approximately 29,000 km of roads of which only 5,000 are paved. According to a 1992 survey 28 per cent of all roads were intransitable, 48 per cent were in poor condition, 14 per cent were in a reasonable condition and only 10 per cent were in good condition. The critical road situation is primarily due to the war, which devastated the road network in the rural areas. A lack of maintenance also contributed to the deterioration of the road network. The government prepared a five year plan for roads with an emphasis on the rehabilitation of primary, secondary and feeder roads and intensification of the road maintenance. The programme was submitted to the international community for funding. The objective is that 70 per cent of roads should be in the good or reasonable categories and that about 19,000 km of roads will be transitable. The government plans to stimulate the participation of national road contractors for routine and periodic maintenance which has so far been carried out by state road companies. The road rehabilitation programme has received a particular focus since 1992 and currently the road programme absorbs about 30 per cent of total government budget expenditures. However, it is estimated that the roads programme needs $406 million finance for the next three years.[41]

Mozambique is strongly integrated with the infrastructure of neighbouring states. The routes from Malawi and Zimbabwe to the ports of Maputo and Beira are adequate. However, North-South links have traditionally been weak. The reconstruction of the North-South links could increase food security in the country, because it would enable the transport of food from surplus areas (mainly Napula and Zambézia provinces) to food deficit areas (mainly Maputo, Gaza and Inhambane provinces). A further option of a better North-South economic integration would be by coastal shipping. One advantage would be that lower fixed costs are incurred if this mode of transport is encouraged.[42]

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[41] XI Consultative Group Meeting, Mozambique, 1998, Transport.

[42] Based on discussions with Tilman Bruck.

While the road network was neglected during the war, the rail corridors absorbed the bulk of investment and international assistance, in particular the Beira and Nacala corridors.

Mozambique has privatized several port terminals under concession agreements of 10 to 15 years. However, in a number of cases the operation of these terminals has been contracted out to the previous main user of the facilities, resulting in vertical integration rather than the introduction of private competition.[43]

The Maputo corridor development initiative was launched by the governments of South Africa and Mozambique in 1996. This corridor links Gauteng and Mpumalanga provinces in South Africa with the port of Maputo and the governments agreed to provide up to 10 per cent of the funding for the corridor. The rest is to be undertaken by private investors who will invest in and operate the rail and port infrastructure under long-term concessions. Trans-African Concessions, a French-led international consortium, started with the construction of a 460 km toll road between Maputo and Witbank in April 1998; it should be completed in 1999. The consortium will build and operate the road for 30 years, after which it will be handed over to the state. Other components of the project are the rehabilitation and management of the port of Maputo and the upgrade of the existing railway between Gauteng and Maputo and of Maputo's container terminal.[44]

A tender for the privatization of the national airline LAM (Linhas Aereas de Moçambique) in 1997 did not result in offers acceptable to the government. The airline made profits in 1997 and the airline is currently trying to secure a strategic partner by the end of this year. The government

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[43] Donaldson, Sader and Wagle (1997) p. 8.

[44] Economist Intelligence Unit, Country Profile - Mozambique 1998/99.

intends to complete the restructuring process by transforming LAM into a limited-liability company, in preparation for the possible sale of shares on the forthcoming stock market. The government is committed to improving LAM's financial and operational performance.[45]

[45] Policy Framework Paper for 1998-2000. Republic of Mozambique.

4.3 **Energy**

All of the twelve war-affected countries studied are characterized by a low per capita electricity consumption. The capital cities and some larger cities are the main consumers of electricity; in rural areas where the majority of the population lives, the electricity grid is underdeveloped or non-existent. For example in Burundi about 93 per cent of energy consumption is of wood, charcoal and peat, 6 per cent of petrol products and 1 per cent of electricity. Only 1.5 per cent of the population have electricity in their households and 90 per cent of the electricity is consumed in Bujumbura.[46] In Eritrea the main sources of energy are wood fuel (70 per cent), oil products (16 per cent) animal dung (8 per cent), crop residue (4 per cent), charcoal (1 per cent) and electricity (1 per cent).[47] Thus, this section is structured in two parts. In the first part we present a discussion of the electricity-generating capacities and in the second part we focus on the energy problems in rural areas.

In a number of countries much of the electricity-generating capacity and the distribution system have been destroyed by direct attacks. For example during the civil war most of the electricity-generating capacity of the Liberian Electricity Corporation has been destroyed and looting has removed much of the distribution and transmission systems. A rehabilitation project has been finalized and will be financed by EDF and DANIDA. Main aims of the project are to rehabilitate the power generation, strengthening the institutional capacity of the Liberia Electricity Corporation with a particular emphasis on revenue collection and management capacity. The funding agencies are also keen to obtain a commitment from the government to abstain from "undue political" interference in the management of public utilities.[48]

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[46] Economist Intelligence Unit, Country Profile - Burundi 1998/99.

[47] African Development Bank: Eritrea - Country Strategy Paper 1996-98.

[48] European Commission (1997) Second Liberia Rehabilitation Programme.

In **Mozambique** the electricity distribution and transmission system was destroyed, but has already been rehabilitated and extended. As a result Mozambique is now an exporter of electricity. Mozambique's main domestic energy generator is the Cahora Bassa hydroelectric dam which was finished in 1973 and is jointly owned by the Portuguese (82%) and the Mozambican (18%) governments.[49] During the war RENAMO (the Mozambique National Resistance) attacks brought down many of the 4,000 pylons and forced the power line to close. The line was restored and was again operational in December 1997. The output of the dam is 2,075 mw per year while Mozambique's consumption is only 200 mw per year. Depending on a price agreement with the South African grid it is expected that energy exports to South Africa will be resumed shortly. In 1997 a second line from the dam to Zimbabwe was completed and Mozambique now exports 500 mw of electricity per year. A further line from the dam to Malawi is planned. While the northern cities of Nampula and Quelimane are connected to the Cahora Bassa dam the capital city Maputo is not and electricity is currently imported from South Africa. In July 1997 the Mozambican electricity market was liberalized, allowing privately owned electricity generators. The central city of Beira is currently served by two small privately owned hydroelectric plants situated in Manica province. In June 1998 the Prime Minister announced that two gas-fired power stations in the districts of Vilankulo and Inhassoro will be privatized.[50] Currently the state electricity company, Electricidade de Moçambique, is extending the poorly integrated national grid to the rural areas.

Mozambique also has considerable coal reserves, but mining at the Moatize colliery in Tete province stopped in 1994 when after years of neglect equipment failed and the mine was flooded. The largest single cost of resuming mining is the rehabilitation of the 550 km Sena railway line from Moatize to the port of Beira. In addition there are abundant reserves of natural gas and there are plans to exploit the large reserves at Pande in Inhambane province and transport the gas via pipeline to Maputo. The main customer for the gas will be the planned steel factory in the Maputo area. The start of the construction of the $2 billion investment project is scheduled for

[49] The discussion of Mozambique's energy sector is mainly based on Economist Intelligence Unit Country Profile - Mozambique 1998/99.

[50] Mozambique news agency http://www.poptel.or.uk/mozambique-news.

2000 and commercial operation could begin in 2003.[51]

[51] Ibid.

The electricity supply in **Angola** has also been severely disrupted by the war.[52] Angola is an energy-rich country which has huge reserves of oil, gas and has hydroelectric potential. The north of the country is mainly served by the Cambambe dam (Kwanza river) and the Mabubas dam (Dande river) and by diesel generators in Luanda. During the war UNITA attacks have frequently disrupted supplies. In 1998 the electricity supply in Luanda has been improved as a result of better management of supply and demand from local generators. The hydroelectric plant at Lomaum on the Catumbela river has been closed since an attack in 1983.

In contrast to for example Angola and Mozambique **Djibouti** is not energy-rich; the country depends on petroleum imports for energy production and electricity is mainly produced by thermal power stations. There are electricity shortages and power cuts are common. The main challenge for Djibouti is to increase electricity supply as well as to reduce the dependence of petroleum imports and to cut the cost of electricity generation. With the help from several donors the government hopes to develop geothermal and solar energy.[53]

Ethiopia has poorly developed energy resources; its greatest potential for energy generation is hydroelectric power along the Awash and Nile valleys, but it remains largely untapped. Currently feasibility studies are being carried out for hydroelectric installations along the Blue Nile; however, these plans are controversial with Sudan and Egypt. Electricity generated in the Blue Nile valley could be sufficient for the north of the country and could potentially allow for exports to Sudan and Eritrea.[54] The Ethiopian government recently decided to increase average tariffs by 60 per cent over the next five years. Even so, tariffs will still be no more than 72 per

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[52] Economist Intelligence Unit Country Profile - Angola 1998/99.

[53] African Development Bank: Eritrea - Country Strategy Paper 1996-98.

[54] Economist Intelligence Unit Country Profile - Ethiopia 1998/99.

cent of long run marginal costs.[55]

[55] Donaldson, Sader and Wagle (1997) p. 3.

The majority of the population lives in rural areas where the electricity grid is underdeveloped or non-existent. For areas in which the population is widely dispersed and the load density is low extension of the electricity grid is likely to be too expensive. However, as the World Bank report "Rural Energy and Development"[56] makes clear there are a number of alternatives to grid extension.

Micro-grids can provide an alternative to grid extension. The primary source of energy can be diesel, hydro, solar or wind. In a number of countries (for example Ghana) the extension of the national grid has been predated by the installation of micro-grids which are supplied by diesel generators. The costs of such systems are typically between $0.2 and $0.6 per kWh. The number of households is sometimes very small, about 50. However, maintenance is often difficult in remote locations, because spare parts have to be imported. The cost of spare parts and fuel has also tended to make them unreliable.

A further alternative are micro-hydro schemes. In Peru for example the Inter-American Development Bank established a fund to make loans available to rural communities and enterprises wishing to install micro-hydro schemes. The communities provide the labour to construct the channel, install the pipe and build the powerhouse. Technical assistance is provided by the Intermediate Technology Development Group. Costs can vary significantly depending on the site and the terrain, but the costs of electricity in these schemes can be as low as $0.12 per kWh.

A further primary source of energy in micro-grids can be solar energy. Costs have decreased dramatically over the past years and today photo-voltaic (PV) systems are used in many developing countries. Typically a solar PV panel is installed on the roof of a rural home, shop or clinic. The panel charges an automobile-type battery which can be used to run up to four light bulbs, a black-and-white television or a radio for four to five hours a day (approximately

[56] The following discussion is based on the World Bank (1996) report on Rural Energy and Development.

equivalent to 0.5 kWh of grid electricity a day). One main advantage for rural homes is that the quality and quantity of electric light is much superior to the commonly used kerosene lamps which also cause indoor pollution and fire hazards. However, there are many more possible uses in rural areas such as for telephones (please refer to Section 4.4 for an example of the use of PV panels as energy supplies for payphones in South Africa), vaccine refrigeration in health clinics, village water pumps, irrigation pumping and public lighting. In Kenya about 20,000 households in rural areas had purchased PV systems by 1994. There was no government programme and the panels were not subsidized. In contrast, the rural electrification programme had only reached 17,000 households. However, the average income in the war-affected economies is much smaller than in Kenya and the purchase of PV systems is a very large expenditure for rural households. Expenditure is lumpy, the cost of acquiring the system is high, while the maintenance cost is low. The life span of PV systems is long, given regular cleaning of the panel and not running down the batteries too much. Because of the lack of credit facilities most households will not be able to afford a PV system in poor war-affected economies. Thus, the initial cost of acquiring the equipment constitutes a significant barrier to the widespread adoption of renewable energy sources.

However, many countries subsidize electricity consumption. These subsidies are harmful in a number of ways. Often, revenues from electricity supply fall short of the costs; this impedes the maintenance or rehabilitation of the existing grid and the utilities are unable to finance grid extensions. In some remote rural areas diesel engines or PV systems may provide electricity at a lower cost than grid supplies. However, no investor will come forward with least cost options and consumers will not opt for them if grid supplies are subsidized.

Much of rural energy consumption is for cooking. However, households in rural areas (and lower income urban households) rarely use electricity for cooking. The most common cooking fuels are biofuels, i.e. wood, crop residues and animal dung. Charcoal, kerosene and liquid petroleum gas (LPG) are more expensive and are more commonly used in higher income urban households. In principle forests, woodlands and farmlands can supply biomass in a sustainable way. However, in many countries the ecological damage is immense. Increased deforestation, soil erosion and reduced soil fertility can be the result of the use of biomass fuels. A further disadvantage of biomass fuels is the high level of indoor pollution. Women and children are

exposed to high levels of suspended particulate matter when cooking. This causes an irritation of the bronchioles which makes these women and children much more susceptible to acute respiratory infections. In adults illnesses such as chronic bronchitis and emphysema are common. These respiratory diseases can eventually lead to heart failure. According to recent studies carried out in India and Pakistan non-smoking women who are exposed to biomass smoke have mortality rates which are comparable to those of male heavy smokers.

A further disadvantage of biomass fuels is that their energy efficiency is lower than that of kerosene or LPG. For example one kilogram of wood delivers about 3 megajoules to the cooking pan, whereas kerosene delivers 15 megajoules. However, the energy efficiency of biomass fuels can be significantly improved if biogas is used. Digesters of dung and farm residues can be used to derive biogas. About 18 megajoules can be delivered to the cooking pan by using biogas and the use of biogas has been encouraged in rural regions in India and China.

One of the advantages of biomass fuel is that it is available at no cash costs to the population in rural areas; however, often several hours per day are spent in collecting cooking fuels. As incomes rise bimomass fuels are less and less used in favour of modern cooking fuels. However, the transition to modern cooking is likely to take some time for rural low income households and they will continue to use biomass as cooking fuels in the future. Improving the efficiency of biomass fuels can have several positive effects, such as reducing the time spent collecting biomass, reducing the indoor pollution levels and reduce the pressure on scarce wood resources. In a number of countries improved biomass stoves have helped to increase the energy efficiency of biomass fuels. Modern wood stoves can achieve a 25 per cent reduction in wood consumption.

In **Rwanda** an improved charcoal stove was marketed in the late 1980s which achieved fuel savings in the order of 35 per cent. Based on a Kenyan model and adapted to local household preferences the “Rondereza” charcoal stove was developed in a government initiative. Private entrepreneurs produced, distributed and retailed the stoves without government subsidies. After just three years of its introduction 25 per cent of rural households had the stove. User surveys showed a high level of user satisfaction. Advantages quoted were not just the fuel efficiency, but

the cleanliness and ease of use of the "Rondereza".[57]

In Ethiopia the vast majority of energy needs are met from natural sources, and firewood cutting has denuded vast tracts of highland woodlands and greatly exacerbated soil erosion. For example in Ethiopia's Jarso region about one billion tons of fertile topsoil per year is washed into the Blue Nile Valley. Land is scarce in this densely populated area: there is not even one hectare per family living in the Nile Gorge. Many of the fields in the Ethiopian highlands are situated on steep mountain slopes. One important part of the "Participatory Integrated Rural Development Programme" supported by the German Development Agency (GTZ) and Canadian Physicians for Aid and Relief (CPAR) is therefore afforestation and agro-forestry which will protect the fields from erosion. Agro-forestry includes planting trees, shrubs and sometimes grasses on farmlands in alternating patterns with traditional crops. This intercropping has been traditionally practised in many areas; however, poverty, population pressure and ill-defined property rights have led to a neglect of these practices. Planting trees and bushes above the fields will slow down the heavy rain waters and thus bring the water into the soil. Below these tree and bush lines crop-farming terraces are created by erecting stone walls. The soil gathers behind the stone walls and once the space is filled up, the wall can be raised. Then more soil is piled onto the lower layer and so on. Under the stone walls there is a potential exit of the water as a stream which can be used for irrigation. Source: GTZ, 1997a and 1997b.

[57] World Development Report 1998 p. 39.

4.4 **Telecommunication**s

Table 3 lists some basic telecommunications indicators.[58] Main lines are the number of lines connected to local telephone exchanges; they are a more suitable measure of the capacity of the telephone system than the total number of telephone sets. However, as Canning (1998) shows the number of telephones and the number of telephone main lines tend to be highly correlated. Since mobile telephones do not require a main line we have listed them separately. Teledensity, the average number of main lines per 100 inhabitants, is about 0.4, which is lower than the Sub-Saharan African average of 0.52. These numbers are national averages, which include urban and rural regions. Teledensity for rural areas is considerably lower, because most of the telephone main lines are concentrated in the urban areas. For example in Burundi and Sierra Leone 88 per cent of all main lines are located in their capital cities, Bujumbura and Freetown.

[58] The discussion of the telecommunications infrastructure is mainly based on ITU (1998).

Table 3: Telecommunications Indicators

	Main Telephone Lines (per 100 inhabitants) 1997	Cellular Mobile Subscribers 1997 (per 100 inhabitants)	Cellular Mobile Subscribers 1996 (as % of total telephone subscribers)	Public Pay Telephones 1996 (as % of total telephone subscribers)
Mozambique	0.36	0.01	0.27	0.47
Ethiopia	0.26	..	..	1.04
D. R. of Congo	0.08*	0.02	16.7	1.39
Burundi	0.25*	0.01*	3.3	0.70
Rwanda	0.28*	..	..	..
Eritrea	0.51*	..	..	0.69
Sudan	0.54	0.01	2.2	1.55
Angola	0.48	0.06	5.9	..
Liberia	0.16*	..	..	..
Somalia	0.15*	..	..	..
Djibouti	1.32*	0.02*	1.3	0.77
Sierra Leone	0.39	..	..	1.25

Source: ITU (1998) African Telecommunication Indicators 1998
* measured in 1996

During the conflicts either much of the fixed telephone network was destroyed or maintenance was neglected. One option for the national telephone operators is to rebuild and extend the fixed line network. However, due to recent technological advances, scale of procurement and international competition, other possibilities now exist. Currently only part of Djibouti's international operator is privatized; in all other countries the telephone operators are state-owned. However, in Sub-Saharan Africa expenditure per line is high, about US$ 1,175 in 1996 (source: ITU 1998, figures were not available for individual countries). This is the result of intensive usage of the limited number of lines and of a high proportion of international telephone calls. The high expenditure per line should make the African market attractive for private investors, because they will get quick return on their capital.

In Angola, Burundi, Djibouti, the Democratic Republic of Congo, Mozambique and Sudan cellular networks are already in operation. Burundi, Mozambique and Sudan have opted for joint

ventures between the state-owned operator and private companies to provide mobile cellular telephone services. So far there is no competition in the national cellular markets. Although mobile cellular phone services are relatively expensive, they can help to boost access by substituting for fixed lines. In the Democratic Republic of Congo nearly 17 per cent of all telephone subscribers use mobile cellular telephones.

One important issue is the question of universal access to telecommunication services. As a consequence of the civil wars all twelve countries are poor and the individual ownership of telephones in most cases is confined to the urban elite. The majority of the population live in rural areas (on average about 70 per cent), and in these very low income countries widespread individual ownership is currently not feasible. However, for poor countries universal access could be achieved by shared access. The availability of public telephones is the key to universal access policy. As recent developments in South Africa show, public telephones can be provided by private operators as part of their privatization conditions (Box 3).

As part of the privatization conditions the fixed operator Telkom must install 120,000 payphones between 1997 and 2002. In addition South Africa licensed two operators to provide mobile cellular services; the operators are owned by South African companies and foreign strategic investors. One of the conditions imposed on the new cellular operators was that they install 29,500 payphones within five years in under-served areas. The most convenient locations were established by testing demand for the payphones in various regions. Subsequently the payphones were installed in small centres or shops where the shopkeeper is allowed to keep a per centage of the call revenue. The installation of payphones in payphone centres or shops prevents damage of the phones by vandalism. The installation of the payphones will create about 5,000 jobs in local communities. In order to keep the service affordable subsidized pre-paid telephone cards were introduced.

The South African example is innovative in a number of ways. First, it is one of the first instances where cellular operators were required to install payphones. Second, they were the world's first GSM payphones (Global System for Mobile which is the most popular standard for cellular networks in Europe), i.e. fixed payphones are using a mobile network. Third, in some areas without access to the electricity grid the payphones are powered by car batteries and solar energy.

Other African countries such as Senegal allow the private provision of public telephones in "Télécentres privés". Private provision of public telephones is also common in Sudan and Burundi; in fact according to the ITU in Sudan two thirds of the payphones were private telephones used as public phones.[59]

[59] ITU (1998) p. 17.

A further important issue in the African telecommunications sector is international traffic. African subscribers make a higher per centage of international calls against domestic calls (238 minutes per year) than subscribers in other parts of the world (100 minutes per year).[60] African countries receive much more traffic than they send out, which makes them net recipients of settlement payments.[61] The origin of these settlement payments is that an international call used to be a service jointly provided by the telephone company in the country where the call originated and by the company in the country receiving the call. The originating company compensates the company at the receiving end for each call. The settlement payment is generally half the wholesale price for international calls, which is usually higher than the actual cost of the call. African countries receive more incoming calls than they originate and thus receive net settlement payments. For some countries these payments can be a substantial part of total telecommunications revenue. For example in 1996 Ethiopia and Sierra Leone received net settlement payments from the United States alone which were 20 per cent and 33 per cent of total telecommunications revenue, respectively.[62] Net settlement payments have increased during recent years. One reason is that due to increased competition in the US market and technological advances such as callback services more African callers use American callback services. In 1997 the US telecoms regulator suggested benchmarks for international settlements; if these benchmarks were adopted this would lead to a substantial shortfall in total telecommunications revenues for African countries, including the twelve war-affected countries. While no new arrangements have been agreed upon, it is unlikely that the current system of international settlements will continue in the same form. Telecommunications operators have to find other sources of finance to make up for this loss in revenue.

One last interesting issue within the telecommunications sector is the internet. According to the International Telecommunication Union "The internet is today one of the most dynamic telecommunications markets in Africa".[63] The basic obstacle to rapid internet growth is the lack

[60] Ibid p. 10.

[61] The explanation of settlement charges follows World Development Report 1998 p. 66.

[62] ITU (1998) p. 11.

[63] Ibid p. 14.

of telecommunications infrastructure, in particular in the war-affected economies. It is thus unrealistic to expect widespread internet usage in these countries. However, some limited use in urban areas could address and help to overcome other infrastructure problems such as the lack of teaching and research facilities in the universities. The African Virtual University, based in Nairobi, was founded in 1995 to make study courses available on the internet. Students receive study material through the internet and have access to a digital library of scientific journals.[64] In Mozambique the principal constraint to the expansion of primary education is the availability of teachers,[65] thus distance learning supported through the Internet could perhaps provide an opportunity to train a large number of new teachers. Internet access could be made available through Personal Computers in public places such as schools, libraries and payphone centres.

[64] For more information about the African Virtual University please refer to the World Development Report 1998, p. 55.

[65] XI Consultative Group Meeting. Republic of Mozambique - Education.

5. Private Investment in Infrastructure

As discussed in the previous section infrastructure in all sectors is in great need of rehabilitation and reconstruction in the twelve countries. However, war-affected economies are poor and the infrastructure investment required is beyond the capacity of the public purse. An alternative is the involvement of private investors and in this section we concentrate on the scope of improvements in infrastructure through private investment.

In war-affected economies inadequate infrastructure provision is typically the result of direct destruction and/or policy failure. State participation has typically dominated the provision of infrastructure services in Sub-Saharan African countries and governments often imposed a multiplicity of social goals on infrastructure provision. For example the creation of employment and the subsidization of prices to consumers have been given priority over commercial objectives. Thus, even without any direct destruction of infrastructure during the war public utilities have tended to run into severe financial difficulties, preventing them from undertaking the necessary maintenance or expansion of their facilities.[66] Therefore, reconstruction and rehabilitation of infrastructure has to be paralleled by economic reform and a number of post conflict countries are engaged in reconstruction as well as in changing their development strategies. Addison (1998) provides a detailed discussion on how it can be ensured that economic reform is compatible with reconstruction.

Many different ownership structures are possible in private infrastructure investment. The literature distinguishes between:

- Management Contracts;
- Build Operate Transfer;
- Build Own Operate; and
- Divestiture.

[66] Donaldson, Sader and Wagle (1996) p. vi.

The extent of private participation is relatively limited for management contracts and increases in Build Operate Transfer (BOT) and Build Own Operate (BOO) projects and is greatest in divestiture, which is defined as the devolution of the full responsibility for long-term investment and operation of existing assets.

In Eastern and Southern Africa for example management contracts have been the most common form of private involvement in infrastructure. However, they have not resulted in large amounts of new investment.[67] The difference between build-operate-transfer and build-own-operate is largely political. Transfer has been preferred where governments are concerned about the political implications of ceding control to private or foreign owners. In practice, if private firms operate the assets efficiently, these concessions may be re-bid at expiry.[68]

[67] Ibid p. 7.

[68] IFC (1996) p. 45.

There is a multitude of impediments and constraints for private provision of infrastructure in the twelve war-affected economies.[69] War and civil strife are a major impediment. Investors are unlikely to invest in civil war countries, or in post conflict countries if a renewal of the civil war is perceived as likely, or in countries which are plagued by civil strife and banditry. One exception is Angola where foreign investment in the oil sector is increasing in spite of the continuing civil unrest in the north of Angola. However, all the oil investments are in off-shore oilfields which so far have not been attacked by the rebels. Lack of government commitment and the high transaction costs and uncertainty in dealing with governments are a further impediment. In addition negotiations are often not transparent which raises the possibility of irregularities occurring. Investors will tend to stay away from countries where selection is perceived to be based more on the strength of political ties and non-transparent criteria than on technical and financial merits. For example licences for cellular phone operators should be awarded in a single criterion auction. The selection criterion can be either price, number of connections, or tariffs, but should not involve a ranking based on all three criteria, because then the selection procedure loses transparency.[70] Very often there are also concerns about the adequacy of the legal framework. Contracts must be enforceable and effective dispute settlement procedures must exist and be adhered to. A regulatory framework for each sector must be developed and ideally an regulatory agency which is independent of the ministry should be created. The convertibility and transferability of project revenues for foreign investors must be ensured. Furthermore, subsidized tariffs also constitute an obstacle to private investment. If prices are artificially low competitive entry based on the cost of the delivered service is much more difficult. Thus, many investors prefer sectoral price reform before entry.[71]

Most private investors do not consider the twelve war-affected economies as attractive locations for infrastructural investment at this time. All countries have low average income which means that the effective demand for infrastructure services from these consumers is lower than demand estimated on the basis of notional customer "needs". The fragmentation and the small size of

[69] The IFC (1996) report and Donaldson, Sader and Wagle (1997) provide lists of the main impediments to private investments.

[70] Based on discussions with James Douglas.

[71] IFC (1996) p. 51.

markets would almost certainly impose economies-of-scale constraints sufficient to affect the viability of some types of ventures.[72]

Furthermore, commonly used country risk indicators show that private investors perceive the war-affected countries (for which data is available) as a high risk environment. Two country risk indicators are presented in Table 4.

[72] Donaldson, Sader and Wagle (1996) p. 9.

Table 4: Country Risk

	ICRG Risk Rating (June 1998)	Institutional Investor Credit Rating (March 1998)	Military Expenditure 1995 (% of GDP)
Angola	45.3	12.5	19.9
Burundi	..	..	4.4
D. R. of Congo	45.8	..	0.3
Djibouti	..	..	..
Eritrea	..	..	..
Ethiopia	64.5	17.5	2.2
Liberia	..	..	..
Mozambique	57.5	16.1	5.4
Rwanda	..	..	5.2
Sierra Leone	36.3	5.7	6.1
Somalia	..	..	..
Sudan	..	..	..
Sub-Saharan Africa	61.1	18.9	..

Source: World Development Report 1998.

The ICRG risk rating presented in column 1 is a composite index taken from the International Country Risk Guide (ICRG). The ICRG collects information on 22 components of risk, groups these components into three major categories (political, financial and economic), and calculates a single risk assessment index ranging from 0 to 100. Ratings below 50 indicate very high risk and those above 80 very low risk. Ratings are updated every month. The average ICRG rating for the five war-affected economies for which data is available is 49.9, below the average for Sub-Saharan Africa (61.1). Thus, the war-affected economies are perceived as very high risk countries.

The Institutional Investor credit rating presented in column 2 ranks the probability of a country's default on external obligations. It ranges from 0 to 100 and a high number indicates a low probability of default. Institutional Investor country credit ratings are based on information provided by leading international banks. Responses are weighted using a formula that gives more

importance to responses from banks with greater worldwide exposure and a more sophisticated country analysis system. The average for the four war-affected economies for which data was available is about 13, which is below the average for Sub-Saharan Africa (18.9).

As stressed in the World Development Report 1998[73] risk ratings may be highly subjective, reflecting external perceptions that do not always capture a country's actual situation. For Sub-Saharan Africa the ratings are likely to overstate the risk of default. For example Haque, Mark and Mathieson (1998) show that although the Institutional Investor index is explicable on economic fundamentals, there is a large and significant Sub-Saharan African dummy: Sub-SaharanAfrica is regarded as more risky than is warranted by the fundamentals.

In spite of their high risk some countries have been able to attract private investment in the past. For example in Zaire (now Democratic Republic of Congo), Uganda and Tanzania the Institutional Investor country risk scores were extremely low at the time of the investment (between 9.5 and 15.2). However, in all three countries private investors focused on cellular networks where high demand and revenue during build-out mean that payback periods are relatively short.[74]

In addition to the perceived high risk in war-affected countries, mobilizing finance is difficult for a number of reasons. Domestic markets cannot mobilize large volumes of long-term debt; sponsors must turn to foreign lenders. This requires mitigating extra risks that the government controls, such as the availability of foreign exchange. According to the IFC fewer than fifty banks worldwide have a strong tradition of project finance in developing countries, so the pool of

[73] World Development Report 1998, p. 244.

[74] IFC (1996) p. 21.

financing sources is limited.[75] Organizing syndications of lenders is time consuming and complex.

[75] Ibid p. 58.

As a result of the difficulties discussed above much of the funding of private participation in infrastructure projects in high risk countries comes from other official financing agencies. Private participation in infrastructure projects in Sub-Saharan Africa have included very little purely private debt.[76] Donaldson, Sader and Wagle (1997 p. 13) for example stress that with the exception of certain projects in South Africa, no project in Southern and Eastern Africa has yet managed to include commercial lenders.

However, the approval rate for infrastructure project in Sub-Saharan African countries from international funding agencies is low, too. The IFC only approved 5 infrastructure projects in Africa (of a total of 148 worldwide).[77]

Abstracting from risk and other economic constraints, the scope for private involvement in infrastructure projects generally depends on the private good characteristics of infrastructure goods. Public goods are goods which are non-rival (consumption by one additional user does not reduce the supply available for other users) and non-excludable (users cannot be prevented from consumption). Very few goods are pure public goods. Most of the infrastructure services are excludable; their use depends on gaining access to a facility or network, for example by connection to the piped water or gas system and the use may be metered and charged for. For other infrastructures access to the entire network can be restricted, for example for railways, ports, and airports. According to the main characteristics, rivalry and excludability, the literature distinguishes four categories of goods.[78]

- Private goods (e.g. road and rail transport, telecommunications) (rival and excludable)

[76] Ibid p. 22.

[77] Ibid p. 91.

[78] See for example the World Development Report 1994 and Israel (1992).

- Club or Toll goods (e.g. toll roads, airports, ports) (non-rival, excludable)
- Common Property (e.g. ground water, urban roads) (rival, non-excludable)
- Public Goods (e.g. rural roads) (non-rival, non-excludable)

With regard to the private good characteristics it is not surprising that privatization and increased competition have occurred most rapidly in the telecommunications sector. These developments have been encouraged by deregulation in industrial countries, technical change, and investor interest.[79]

Indications in the telecommunications sector are encouraging. In several of the cellular telecoms projects financed by IFC the initial market size has been underestimated. One example is Uganda where the subscriber base to the new cellular network has grown faster than anticipated. By early 1996, after a few months of operation, the network had 1,700 customers, versus a target of 1,000 by that date.[80]

To summarize, private investment has been limited because war-affected economies are very high risk countries. Once a peace agreement is achieved countries clearly need to improve their policy environment through policy reforms with a strong emphasis on institutional and regulatory capacity building if they want to attract private infrastructure investment. However, there are potentially a number of positive externalities generated by successful privately financed infrastructure projects. As stressed in the IFC (1996) report and by Donaldson, Sader and Wagle (1997) the development impact of successful private participation in infrastructure projects goes beyond improved service and increased capacity. Successful projects have a demonstration effect, give policy makers experience, strengthen capital markets, improve access to international finance and expertise and thus attract more investors and build constituencies for further reforms.

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[79] IFC (1996) p. 14.

[80] Ibid p. 29.

6. Summary and Some Conclusions

In this paper we considered the challenges of infrastructure rehabilitation and reconstruction in twelve war-affected economies in Africa. Our survey of the water, transport, energy and telecommunication sector showed that the standard of infrastructure provision is very low in all of the twelve countries. On average only about 30 per cent of the population have access to safe water and only about 20 per cent of the population have access to sanitation. As a result the incidence of water-borne and water-related diseases is high. Due to the influx of refugees to the major cities the existing water and sanitation facilities are now used by more people, i.e. one result of the conflicts was a deterioration of the water and sanitation access for the urban population.

Access to transport is also low in most countries. With the exception of Djibouti all countries are characterized by a high per centage of the population living in rural areas (about 70 per cent on average) and most practise subsistence agriculture. Road transport is the most important form of transport, but only a small proportion of the roads are paved. Much of the road network was either damaged and/or the maintenance was neglected during the war. In either case, the state of the road network is dilapidated in many countries. A large per centage of the roads are now intransitable, in particular rural feeder roads. Access to transport would encourage farmers to produce marketable surplus and to transport it to the market. Thus, among other things the rehabilitation of the road network would provide the rural population with opportunities to earn cash incomes and therefore improve their standard of living.

Access to efficient energy is low, too. A high proportion of the energy consumed by the rural population is generated by biofuels, such as animal dung, crop residues and wood. While in principle forests, woodlands and farmlands can supply biomass in a sustainable way; in particular densely populated areas are experiencing immense ecological damage. Although there are a number of alternatives to electricity grid extension, for example the installation of photo-voltaic systems, the cost of acquiring the system is high for very low income rural households. The lack of credit facilities in particular constitutes a significant barrier to the widespread adaptation of renewable energy sources.

While the number of telephone main lines per 100 inhabitants is low, in a number of countries

cellular networks are already in operation. The telecommunications sector is the most likely infrastructure sector to benefit from private investment, mainly because expenditures per line are high and high demand and revenue during build-out mean that payback periods are relatively short. Due to the low average incomes widespread individual ownership of telephones is not feasible. However, universal access could be achieved by shared access and the availability of public telephones is the key to universal access policy.

Since war-affected countries are very poor economies the task of infrastructure rehabilitation and reconstruction is beyond the financial capacity of the governments. The paper therefore discussed private investment in infrastructure as an alternative to public investment. However, investors perceive countries in Sub-Saharan Africa on the whole as high risk countries and risk ratings show that investors rank the risk in war-affected economies as even higher.

As long as countries are not at peace and guerilla activities and banditry make the countries unsafe, private investors are unlikely to invest in infrastructure projects. Once the countries are at peace economic reconstruction has to be paralleled by economic reform. Without an adequate legal and regulatory framework countries are unlikely to attract private investment. However, despite their high risk rankings some war-affected economies have been able to attract private investors for cellular telephone networks. As the paper shows, the willingness to pay for safe water and energy is high and thus the water and energy could in principle be attractive to private investors.

7. **Appendix**

Table 5: Country Characteristics

	GDP (current US $ billions)	annual growth rate	Agriculture (% of GDP)	population density (people per km^2)	Rural Population (% of total population)	Sanitation (% of population with access)*
Angola	7.7	7.6	9	9	68	16
Burundi	1.2	0.7	46	250	93	51
D.R. of Congo	6.1	-5.7	58	20	71	9
Djibouti	0.5	0.5	4	27	18	..
Eritrea	0.65	7.9	9	37	83	..
Ethiopia	6.4	5.6	56	58	84	10
Liberia	..	..	..	29	54	18
Mozamb.	2.8	12.4	31	23	65	21
Rwanda	1.9	10.9	38	273	94	..
Sierra Leone	0.76	-21.1	52.9	65	66	11
Somalia	..	..	..	16	74	..
Sudan	..	4.6	..	11	68	22
Sub-Saharan Africa	-	4.56	24	25	68	16

Sources: Columns 1-3 World Bank Web Site (Country Profiles)
Columns 4-6 World Development Indicators 1998

* latest year available 1991-97

The Duration of the Civil Wars Examined in this Study

The information about war-affected countries was obtained from various SIPRI yearbooks, the 1998 CIA Factbook and recent newspaper articles.

Angola
Angola obtained independence in 1975 and immediately plunged into a civil war. A cease fire lasted from June 1991 to October 1992 when the insurgent National Union for the Total Independence of Angola (UNITA) did not accept its defeat in the elections and fighting resumed throughout much of the countryside. The Lusaka peace accord was signed in November 1994 and a Government of National Unity and Reconciliation was formed in April 1997. The political situation remains volatile and banditry is increasing, especially in the north of the country.

Burundi
Burundi experienced a number of ethnically motivated massacres in 1972, 1988, 1990 and 1991. The assassination of the democratically elected president in October 1993 triggered extensive civil unrest which continued in 1994. Since the coup in 1996 the country has remained relatively stable.

Democratic Republic of Congo
In 1996/97 Zaire experienced civil unrest which ended in May 1997 when the Alliance des Forces Démocratique pour la Libération du Congo (AFDL) seized power.

Djibouti
Armed conflict erupted in 1990. A peace accord was signed in December 1994.

Ethiopia
The Ogaden war took place from 1976 to 1977 and the Tigrean war lasted from 1978 to 1991 when the Ethiopian People's Revolutionary Democratic Front gained control of the country. In 1994 a new constitution was introduced and elections were held in 1995.
In May 1998 a border conflict between Ethiopia and Eritrea erupted and as of November 1998 the fighting has subsided; however, heightened tension between the two countries remains.

Eritrea
The Eritrean war of independence lasted from about 1974 to 1991 (source: Singer and Small 1994). A referendum on independence from Ethiopia in April 1993 resulted in a landslide vote for independence which was proclaimed on 27 April 1993.

Liberia
Civil order ended in 1990 when the president was killed by rebel forces. In August 1996 the Abuja II peace accord was signed and elections were held in July 1997.

Mozambique
Mozambique's civil war started almost immediately after gaining independence from Portugal in 1975. Large-scale military destabilization of Mozambique began in 1981. In 1992 the Rome Peace Agreement was signed and in 1994 elections were held.
Rwanda
Following the death of the president in April 1994 genocidal strife broke out. Although there is

decreasing support for the rebels they continue to fight the Rwandan authorities from the eastern region of the Democratic Republic of Congo and inside Rwanda.

Sierra Leone
The rebel incursion began in about 1991.The civilian government was overthrown in May 1997 by the armed forces. A peace plan was negotiated in October 1997 and the democratically elected president returned to Sierra Leone in April 1998.

Somalia
The civil war started in 1981 and is still ongoing. The northern region of the country proclaimed its independence as “Somaliland Republic”.

Sudan
The civil war in Sudan commenced in 1983 and is still ongoing.

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