A COST-BENEFIT ANALYSIS OF ELECTRICITY SUPPLY IN A DEVELOPING COUNTRY, WITH REFERENCE TO VENDA

THESIS

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by

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ABSTRACT

This study concentrates specifically on assessing those elements of private and external costs and benefits which need to be accounted for in analyzing the role of electricity supply in a developing region. To facilitate this aim, three interrelated questions are addressed. The first question examines the reasons why a critical need for electrification in developing areas exists. In this regard, a selective review of the literature on development economics is offered, illuminating the previous neglect of the rural dimension in development and the associated problems of poverty and inequality, a lack of infrastructure and the general inability to fulfill basic needs.

The second question is devoted exclusively to an economic analysis of the supply of electricity in developing areas. A broad theoretical review on whether an unregulated or regulated (private or public) sector should be responsible for the provision of electrification is presented. This evaluation highlights the various welfare implications and efficiency considerations that appear to be relevant in the present context.

The final question, which constitutes the central proposition of the thesis, establishes how electrification should be supplied in developing areas. To this end, the conditions specific to a region in Venda are discussed. An attempt is made to identify the private and external costs and benefits relating to electricity supply and the corresponding costs and benefits pertaining to alternative sources of energy. Since the incidence and nature of these costs and benefits could only be ascertained from individual households, it was deemed necessary to undertake a questionnaire study of residents in Makwarela township and its peri-urban settlement of Lufule-Tshisele.

A number of basic trends were evident from the research results. As far as the various benefits are concerned, respondents tended to place a much higher value on both the private and external benefits associated with electricity than its alternatives. At the same time, the survey found that although the private (or monetary) cost of electricity far exceeded the corresponding cost of alternative energy sources, the external costs were significant in the case of alternative energy sources, but virtually non-existent in the case of electricity.

On the whole, the Venda survey seems to suggest that an economic case can be made for involving the broader community in subsidising the supply of electricity in Makwarela, Lufule-Tshisele and other areas. While such a subsidy can perhaps be justified on distribution grounds alone, and more specifically in terms of the rapid and pronounced effect it is likely to have on the quality of life in the region, its real worth lies in the fact that it may confer certain external benefits on the community.

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CHAPTER 1

INTRODUCTION

Generally speaking, developing countries represent the largest and most urgent sphere of economic need in the world. The term 'developing countries' is used in the broad sense to include those countries where there is widespread absolute poverty and inequality. The general rule in conventional economic analysis is that significant economic development needs to be sustained in countries with these problems. In this study, emphasis is placed on the fact that infrastructural development may be viewed as a necessary though not sufficient condition for economic development. Usually infrastructural development has a strong influence on both social and economic upliftment and on the productivity of a country's population. For example, electricity supply - which forms an integral part of the infrastructure of a country - becomes an important part of development. It is an essential input in most industries and assists in the provision of services such as health care, water supply, transportation and communications. Electricity supply also absorbs a large proportion of total capital expenditure. When associated with mechanisation and industrialisation, electricity supply becomes important in that the resulting effects are high levels of output accompanied by lower unit costs. This is true in both the public and private sectors, in both rural and urban areas and across a wide spectrum of business activities. Thus, it must be appreciated that for economic development to occur, infrastructural development may be viewed as providing the inputs and services necessary to generate higher levels of national output.

In a less-developed region where a large proportion of the population lives, however, infrastructural development should be considered in the context of the related problems found in these areas.[1] While the above conclusion concerning infrastructural and economic development implies that the quantity and nature of electricity used by society is correlated to levels of social and economic development, the

1. The term "less developed" or "rural" region is used in this thesis in the broad sense to include all areas outside the metropolis and big towns in developing countries. Areas such as emerging urban centres, peri-urban areas, closer settlements, settlement schemes, villages, farm settlements as well as widely scattered rural dwellings are all included in this list of rural life. The term is not confined strictly to the conventional countryside conditions characterised by poorer rural people whom Chambers (1978, 209) defines as "... hard to reach, typically unorganized, inarticulate, often sick, seasonally hungry and quite frequently dependent on local patrons. They are less educated, less likely to use government services and less likely to visit outside their home areas than their better-off rural neighbours. They are often especially concentrated in regions remote from urban centres. Further, they are relatively invisible, especially the women and children".

relationship between electricity consumption and development is complex and is still inadequately understood. Many people believe that there is little basis for the assertion that a causative relationship between electricity consumption and development exists. Electricity use is regarded as only one element within wider social, economic and environmental factors that contribute to economic development.

In modern societies, electricity - in its non-natural state - is regarded as an essential and convenient form of energy despite its relatively high cost. It is one of many types of energy which can be easily converted for use in the provision of heat and light and in generating mechanical power in certain chemical processes (Crew and Kleindorfer 1979, 159).

The above outline of electricity usage contrasts with most alternative energy sources which, apart from petroleum for transport, are used solely as sources of heat. Electricity is also versatile insofar as the choice of fuels from which it can be generated is concerned (Cottrell 1955, 98). Though coal and oil are the most widely used fuels, electricity may be generated by use of peat, wood, industrial waste or domestic refuse. Electricity may also be obtained from the use of nuclear energy and from a range of renewable energy sources including hydro-electric schemes, wave power generators, tidal barrages, windmills and geothermal energy schemes.

Electricity is an efficient form of energy for providing power as required for water pumping, process machinery, electric transport and cooling/ventilation purposes. It also provides more flexibility than other heating sources, often offsetting the lower overall efficiencies. Furthermore, for lighting purposes, there are few alternatives to electricity. The growth of electricity networks has, according to Berrie (1978, 2) been consistently faster than the average for the economy in both developed and developing countries alike.

The advantages of electricity must, however, be viewed in the context of the fact that electrical energy must be supplied from the source at the exact moment that it is required by a consumer. Except for storage in other energy forms such as in pumped-hydro schemes, it is not yet feasible to store large quantities of electricity economically as can be done with diesel or other primary energy sources. Large scale storage at the point of consumption is practically impossible. As a result, the required distribution system for electricity is such that a supply facility suitable for each consumer's power requirements is necessary.

As an "indispensable" service, by reason of its pervasive role in production and consumption and by reason of the absence of close substitutes, electricity assumes a position of such ever-increasing importance in almost every facet of daily activities - in the home, commerce, entertainment and industry - that an interruption of supply for more than an hour or two in most highly developed communities can almost assume disaster dimensions (Shepherd and Gies 1966, 90). It is therefore often difficult to provide a

comprehensive account of the economic importance of electricity. In view of these factors, countries should consider the supply of electricity as one of their most important industries.

In most developed countries, the electricity supply industry is generally capable of meeting the demands placed upon it, and there is a close correlation between the size of the industry and the level of economic activity. By contrast, most developing countries lack the fundamental electricity supply necessary to allow rapid economic development. Frequently, only an inadequate electricity supply system exists with no supply at all in many areas. There is thus a severe shortage of houses, schools and other social infrastructural services that are adequately electrified.

Considering the contribution which electricity supply can make to the process of development and the size of the investment required, it is surprising that so little appears to have been written on the role of electricity in developing countries. In some cases, detailed targets are set in these countries for the number of jobs, factories, hospital beds, the intake of children into schools or the length of railroads that are to be built. However, there is seldom any discussion of the implications of these goals for the electricity supply industry. In general, development plans are specified in detail, but little or no attention is paid to the electrical requirements that are necessary to facilitate their realisation. Where reference is made to these needs, there is often little attention paid to the social and economic benefits and costs that could arise from electrification.

Given that electricity has a significant role to play in the process of development and is one of the largest and most influential industries in a developing country, the thesis itself addresses three interrelated questions. The first question examines the reasons why a critical need for electrification in developing areas exists. To this end, a literature review of rural development is offered, illuminating the previous neglect of the rural dimension in development and the problems of widespread and growing inequality, poverty, a lack of infrastructure and a general inability to fulfil basic needs.

The second question is devoted exclusively to an economic analysis of the supply of electricity in developing areas. A broad theoretical review on whether an unregulated or regulated sector (private or public) should be responsible for the provision of electrification is presented. This evaluation outlines the welfare implications and efficiency considerations that appear to be relevant for the purpose of this study.

The final question, which constitutes the central proposition of the thesis, establishes how electrification should be supplied in developing areas. To this end the conditions specific to a region in Venda are discussed, looking at the costs and benefits relating to electricity supply and the corresponding costs and benefits pertaining to alternative sources of energy. Since statistical data suitable for testing the conditions in question is limited in most of the existing studies, it was deemed necessary to conduct interviews with

relevant authorities as well as undertake a survey among residents in an emerging urban residential township, Makwarela, and its peri-urban settlement area, Lufule-Tshisele.

Against this background, the study will specifically concentrate on assessing those elements of private and external costs and benefits which need to be accounted for in analysing the role of electricity supply in the process of development in Venda. In order to avoid confusion, it is considered appropriate at this stage to define, quite specifically, what is meant by the terms 'private' and 'external' costs and benefits. This clarification is of much importance because of the fact that the same words may mean different things to different people, particularly with respect to a complex subject such as electrification.

In a conventional sense, private benefits are those benefits which accrue solely to the individual utilising the goods and services that are being provided by a given project or programme. Theoretically, the real value of these benefits is the maximum amount of money which the consumers are willing to pay for them. In electricity supply, the convenience, flexibility and adaptability of electricity compared to other forms of energy and its resultant influence on the quality of life, are of particular importance in the domain of private benefits. External benefits, on the contrary, refer to those gains which accrue not only to the individual or agency taking the decision to make use of the goods and services which can be provided by a given project or program, but to society as a whole. In electricity supply, external benefits include, inter alia, the contribution of electricity to the alleviation of slum conditions and crime as well as health improvement through the avoidance of exposure to poisonous gases.

While private costs are those borne by the beneficiaries of a given project or programme and which must be incurred in order to realise the full value of the benefits, external costs are the total costs incurred, including both the costs borne by the individual beneficiaries and society in general. In electricity supply, private costs include, inter alia, all financial expenses associated with the generation, transmission and distribution of electricity which are borne by the authorities involved in the construction and operation of the project. All monetary expenditure for the services of electricity made by consumers as well as the loss of and damage to private property and appliances as a result of the vulnerability of electricity to lightning and other disturbances may also be included in the list of private costs. Examples of external costs that are associated with electrification may include the threat to human and animal life (accidental and fire risk) and other environmental costs such as scarred and unproductive land, deterioration of the quality of air and water and aesthetic costs.

An important consideration arising from the above description is that certain costs and benefits, though recognised in a general way, cannot be measured in monetary terms. This illustrates the relevance of a qualitative cost-benefit analysis (CBA) which is generally regarded as a useful approach to addressing the problems of evaluation where market data is inadequate. Another reflection is that the above

characterization addresses both the supply and demand side of the electricity supply industry. While the supply side gives insight into the contribution that electricity may make towards economic and social development, the demand side addresses both the willingness of the population and their ability to purchase electricity at the going price. In economic theory, willingness alone is not effective in the market - it must be backed by the ability to pay for electricity services.

The thesis is structured in the following way:

Chapter 2 is devoted to a background of economic development and electricity supply in order to facilitate a better understanding of the conditions in the study areas. Chapter 3 gives some information on the important public utility aspects of electricity supply. Chapter 4 looks exclusively at the theoretical issues of the cost-benefit analysis (CBA) technique. Chapter 5 presents a brief discussion of the data collection and processing procedures employed in the survey, while Chapter 6 gives a detailed summary of the survey results. Chapter 7 contains the conclusions and several recommendations relating to the continued supply of electricity in Venda.

Appendix A contains a copy of the questionnaire used in the survey.

PART ONE: PRINCIPLES OF DEVELOPMENT AND ELECTRICITY SUPPLY

In this section, basic theoretical arguments on aspects of development economics and electricity supply are examined - with particular emphasis placed on the assertion that the supply of electricity has a significant role in the development of underdeveloped regions.

CHAPTER 2

ECONOMIC DEVELOPMENT AND ELECTRICITY SUPPLY

2.1 INTRODUCTION

In most of the current international theory and writing on questions of economic development, a strong emphasis is placed on the assertion that an improvement in the living standard or the quality of life of the poor should be afforded priority in developing countries. This implies that for most of these economies, emphasis should be directed to combating the widespread poverty and inequalities and shifting the distribution of resources in favour of the poor. As remarked earlier, electricity supply is an important part of development in those economies characterised by pervasive poverty and inequality. In order to fully appreciate this scenario, it is necessary to review the relevant theoretical work with particular emphasis on those that show how the less developed regions in most countries have been neglected. While the first sections of this chapter review the historical theories and conditions of economic underdevelopment, the concluding parts refer specifically to the basic needs approach (BNA) and the role of electricity in meeting these basic needs.

2.2 DEVELOPMENT VERSUS GROWTH: A HISTORICAL REVIEW

The concept of economic development is not clearly defined and it sometimes causes confusion. This confusion arises from the various interpretations which have been attached to the concept as well as the misconception of what it means and what is involved in it. The concept of economic development is frequently confused with that of economic growth. This is so because since the early 1950s and 1960s, development activity has been directed at expanding per capita gross national product (GNP). The intention was to create more jobs and income and therefore place more spending power in the hands of the population. This attitude was widely held in development circles - with the consensus that economic growth should be the measure of success. Accordingly, Goldstein (1985, 596) points out that "... economic growth was the reigning fashion of political economy. It was simultaneously the hottest subject of economic theory and research, a slogan eagerly claimed by politicians of all stripes, and a serious objective of the policies of governments ...".

Furthermore, economic growth was viewed as the most effective way of eradicating poverty. The justification for this view was the belief that the gains from economic growth would automatically "tricle down" to the poor and their benefits would spread through market forces, raising demand for labour, raising its productivity and raising wages or lowering prices (Streeten 1979, 29; Coetzee 1983, 29). Countries were expected to attain a higher degree of industrialisation and urbanisation, with the society enjoying mass consumption of material goods. Pro-growth development economists such as Nurkse (1953), Lewis (1955) and Rosenstein-Rodan (1961), advocated that maximising the rate of growth of the industrialisation process through the concentration of investment in the urban industrial sector of the economy would both generate resources to expand the economy as a whole and distribute welfare throughout the population through the expansion of employment opportunities. The traditional sector, the latecomer to development, would, in the process, undergo gradual erosion and eventually 'catch-up' with the industrialised sector. This implies that development of rural areas was not of primary concern. The rural sector was generally viewed as a reservoir supplying food, raw materials and labour to industry (Lee 1980, 99). Agriculture was regarded as the traditional sector and was characterised by diminishing returns and a significant surplus of labour. This labour, in turn, was seen to contribute little or nothing to total output in the agricultural sector. As a consequence, growth maximisation and industrialisation were taken as the twin and mutually supportive objectives of development (Stewart 1985, 8).

Contrary to expectations, however, this evaluation of development in terms of GNP growth criteria did not lead to the expected increase in the welfare of the poor countries. The accumulated weight of empirical evidence pointed out that since the mid-1960s, economic growth was often accompanied by increasing dualism. Two economic sectors were identifiable. There was a large-scale manufacturing or capital-intensive sector which was generally the focus of modernisation and maintained links with the developed world, expanding alongside a traditional sector characterised by indigenous, labour-intensive methods and slow growth or stagnation. The only beneficiaries of industrialisation appeared to be the small urban elite who possessed scarce skills vital to the functioning of the modern sector. This implies that although rapid GNP growth through investment in capital-intensive industries was occurring, only a limited number of people were benefitting. The majority were still the victims of escalating unemployment and persistent rural poverty and inequality. These factors were exacerbated by unanticipated increases in the rates of population growth and migration. This rural-urban exodus, in turn, had far-reaching consequences - the prime one being a shortage of agricultural manpower which existed alongside urban unemployment. Not only are the benefits of growth being viewed as having failed to trickle-down to the poverty groups of the population, but economic growth is seen as having led to their absolute impoverishment (Ghai 1977, 2; Keeton 1984, 2). This implies that a 'trickle-up' instead of a 'trickle-down' effect may have resulted.

By the late-1960s, policy emphasis had changed to a structuralist approach of redistribution-with-growth as well as employment-oriented approaches which had more than GNP growth as goals. While the redistribution-with-growth approach suggested that intervention through government policy was deemed necessary to boost the provision and distribute the benefits of economic growth more equitably throughout society, the major focus of employment-oriented approaches' was to reduce the capital intensity of modern-sector activities. In the early 1970s, these broadly redistributive or anti-poverty ideologies came under attack from several quarters. More precisely, evidence suggested that they tended to be aimed at specific target groups, with the familiar lack of widespread success (Stewart 1985, 11). As a result, the poor continued to be impoverished and the gap between rich and poor became increasingly marked.

Today, however, a major rethink concerning the question of economic development in developing countries has taken place. Economic development is no longer exclusively linked to economic growth. Most economists now define economic development in terms of the reduction of poverty within a growing economy. Nattrass (1980, 58) contends that as a process, economic development should focus not only on improving the distribution of income (i.e. the elimination of poverty in a relative sense) but also on the elimination of poverty in the absolute sense. Likewise Meier (1976, 9) and Streeten (1979, 30) regard economic development as an attack on the chief evils of the world today: malnutrition, disease, illiteracy, slums, unemployment and inequality. This is an important attack because of the far-reaching consequences of these evils. In particular, severe and widespread malnutrition may seriously and permanently damage intellectual and creative abilities with concomitant effects on productivity, technological progress and overall growth (Bequele and Freedman 1979, 327). Furthermore evidence suggests that income, wealth and consumption inequalities disrupt a community and may be a major source of political instability (Diwan and Livingstone 1979, 72; Coetzee 1983, 30). Along similar lines, the existence of large-scale poverty is likely to impede growth and development through its impact on the accumulation of human capital, on the level of domestic saving as well as on the size and rate of growth of the local market for goods and services and on average levels and rates of growth in labour productivity.

Economic development is thus associated with a process of "... growth with a change in production techniques, consumer behaviour, consumption patterns and in the distribution of resources through the economy" (Erskine 1985, 369). This means that it is seen as a process of economic and social transformation within countries. On a more comprehensive basis, Thirlwall (1974, 23) and Laker (1980, 99) maintain that economic development should encompass progressive changes which embrace both horizontal and vertical dimensions: more hectares under production and higher production per hectare, more people educated and more education per individual, more factories and better quality products, more and better roads and more and better teachers.

Little purpose can be served by presenting yet another proposed list of views on the definition of economic development. These views will undeniably include many of the points made above. However, one important conclusion which emerges from the above views is that attention is now increasingly being focussed on the rural sector. Development thinking now effectively challenges the persistence of widespread inequality and poverty as well as the inability to fulfil basic needs. Consequently the main thrust of a successful economic development strategy is today seen to be one that includes within its framework, policies that would alleviate these conditions as quickly as possible, whilst at the same time providing an overall foundation for a healthy economic future.

Essentially the definition of economic development has been discussed in this section with the intention of presenting a framework for examining the role of electricity supply in development in a developing country. To do so, the general characteristics of developing countries must be identified before the role of electricity supply in their development can be considered.

2.3 CHARACTERISTICS OF DEVELOPING COUNTRIES AND THE NATURE OF UNDERDEVELOPMENT

The concept of underdevelopment is relative or more accurately, relational. In a conventional sense, it is a state of societal well-being which in relation to conditions elsewhere, is far from satisfactory. In developing countries, the production sector is generally still dominated by agriculture. These countries are in the process of building up industrial capacity. In addition the flow of goods and services are so small that the problem becomes one of allocation of existing scarce resources so as to achieve rapid and widespread improvements in the standard of living. Frequently, secondary industry and service sectors are immature and incomplete while an inadequate electricity supply system exists, with many areas having no supply at all. Similar shortages are found in transport, communications and public services as well as in the entire physical, social and administrative infrastructure. Even where these services do exist, the poor often do not have access to them because organisation is inadequate and the cost is high. In a comparative study covering four selected countries (two developed and two developing) in 1981, Cole (1981, 36) discovered that in relation to developed countries, both the generation and production capacities of electricity were very little or nothing in developing countries (see Table 2.1).

Contrary to the above scenario, developed countries include those which have achieved substantial manufacturing and service capability in addition to advanced techniques in agriculture and raw material extraction. A large stock of capital is normally available, and this is applied mostly for investment, industrialisation and physical infrastructure, as well as for the administrative and legal machinery necessary to operate an economy. Furthermore, in these countries electricity supply has developed to the point where economic requirements can be served as they arise.

TABLE 2.1: ELECTRICITY PRODUCTION AND GENERATION IN FOUR SELECTED COUNTRIES, 1981

	Developed countries		Developing countries	
	USA	Italy	Thailand	Bangladesh
Electricity generating capacity (%)	100	32	2	(0)*
Electricity production capacity (%)	100	28	2	(0)

*(0) = Under 0,50%

Source: Cole J.P. (1981): The Development gap: a spatial analysis of world poverty and Inequality. New York: John Wiley.

2.3.1 The rural-urban divide

The rural-urban division that is characteristic of the development process in most developing countries can be explained by the theory of cumulative causation and the theory of rural-urban migration.

The theory of cumulative causation spells out the conditions that cause and accelerate regional growth and the concentration of economic activity in specific regions within a national economy and/or in specific centres within regions. In this regard, Myrdal (1963, 26) suggests that if left unchecked, market forces would result in a concentration not only of industrial production, commerce, banking, insurance, shipping and almost all economic activities, but also of cultural heritage in fields such as science, art, literature, education and higher culture.

The process of cumulative causation evolves through the working of labour migration, capital movement and trade. These aspects are regarded as the media through which the process causes some areas to grow cumulatively richer whilst others fall even further behind in relative terms (Thirlwall 1983, 136; Williamson 1965, 6). As an example, it is argued that due to internal and external economies associated with the mass concentration of capital projects in the developed urban regions, capital emigrates from the less developed (rest of the country) to the developed areas, thereby accelerating interregional inequality and widening the imbalance.

The increased attractiveness of existing growth centres, sets in motion a chain of the so-called "backwash" effects which operate to the detriment of the less developed regions. For example, Truu (1973, 100) points out that the first effects of labour migration would be a reduction in the demand for final output in the depressed non-industrial and non-urban region with a concomitant increase in the prosperous region. This initiates a negative employment-output multiplier process in the depressed region with the opposite occurring in the prosperous one.

The negative influence of these "backwash" effects is countered to a degree by the so-called "spread" or "trickle-down" effects which emerge from the growth centres. These consist mainly of increased demand for less developed regions' products and the diffusion of technology and knowledge.

Whether the "spread" effects are sufficient to neutralise the "backwash" effects seems to depend to a large extent upon the level of economic development of the country. In Myrdal's view, the higher the level of economic development attained, the stronger the spread effects will usually be. However, he argues that the "spread" effects are weaker than the "backwash" effects and this implies that as a rule, the free play of the market forces in a poor country will work more powerfully to create regional inequalities and to widen those which already exist (Myrdal 1963, 32). This is likely to occur because in poor areas, poverty and the inefficient utilisation of resources which it implies, will limit the area's potential for economic growth, while in rich areas, a fuller utilisation of resources and a greater capacity for economic growth will be possible.

An important policy measure whereby the "spread" effects can be strengthened and help to neutralise the "backwash" effects is perhaps the use of rural development programmes. These should focus, inter alia on infrastructural development of electricity, water supply, roads and other services. Such infrastructural developments naturally give rise to enhanced agricultural production, encourages the development of rural, small-scale industries as well as the extension of job opportunities and the provision of basic needs. The development of these programmes, however, depends heavily on overall government policy.

Addressing the same fundamentals, the theory of rural-urban migration explains the increased migration of people from less developed rural to higher developed urban areas, thereby perpetuating what Lipton (1977, 16) calls "urban bias" in the overall development process. This continual migration is considered by many economists (e.g. Amin 1974; Todaro 1969; Portes 1978; Rogers and Williamson 1982; Peak 1982 and Shrestha 1987) to exacerbate urban unemployment problems and to deplete the rural countryside of valuable human capital. In particular, Little et al. (1970, 85) point out that migration into cities "... creates a great need for infrastructure investment: urban housing, drainage, electricity, transport, schools and various other public utilities. Attempts to meet this need have (often) diverted a part of the limited investable funds from investment in productive capacity where it would have created more employment opportunities".

The underlying assumption is that migrants are an economic liability in the urban setting because of the heavy burdens they impose on public, social and economic services as well as their posing a political threat.

In order to limit the flow of rural-urban migration, thereby reducing unemployment and other associated problems, it is suggested by many observers that a reorientation of economic activity and social investments towards the rural sector should be afforded priority. From a policy viewpoint, the main objective of this approach is to decentralise development activities and directly attack the presumed source of poverty which

generates migration streams to the cities. Presumably these development activities would discourage migration by providing incentives for potential migrants in villages, thereby making villages more economically attractive.

2.3.2 Bias against agriculture

In addition to the reasons for urban bias and rural underdevelopment previously outlined, it is essential to recognise that, in most developing countries, there are several inappropriate economic policies which promote a bias against the agricultural sector. This bias is prevalent in spite of the fact that governments in these countries do attempt to provide the poor with an adequate diet and promote a more productive and efficient agricultural sector. As a result of this bias, the sector remains largely underutilised and contributes only to a limited extent to further economic development. To this end, the World Bank (1986, 85) maintains, for example, that in most developing countries, consumers are subsidised in order to help the poor, but these policies end up in reducing the incomes of farmers, who are sometimes poorer than many of the urban consumers who benefit from the subsidies. Furthermore, taxes imposed on agricultural exports tend to decrease commodity prices in the farm sector. As a consequence, the growth of agricultural production is limited and the efforts towards reducing rural poverty are hampered. The main source of this discrimination against agriculture lies in the developing countries' policy of promoting domestic industries through a shift in resources out of agriculture toward the industrial sector.

This is in direct contrast with the objectives of agricultural policies in industrial countries, which are aimed at stabilising and increasing farmers' incomes and slowing the migration of people out of this sector.

2.3.3 The state of electricity supply

Turvey and Anderson (1977, 155) have described four coordinated phases of electrification schemes. The initial phase is one in which private generation is of prime importance. There are a few scattered and isolated businesses that need electricity, as well as being able to afford it. Electricity is, at this stage, obtainable by installation of generators and it finds use in such purposes as refrigeration, lighting and heating on farms, refrigeration and lighting in shops, refrigeration on a large scale in slaughter houses as well as meeting the machinery power needs of large agro-industries such as sugar processing. The power needs of small farms and businesses are, in this phase, generally provided directly by animals or by small diesel engines.

The development of electricity needs is introduced in phase two, where the collective demand of several households and businesses needs to be met. Electricity use may be extended to such areas as public and private lighting. In addition, large and small businesses and farms may make further demands. During this

phase, small local networks or "microgrids" are usually drawn from local autogenerators (isolated generators powered by diesel engines, small steam turbines or microhydro turbines) installed through public or private initiative.

Phase three, which involves fully-fledged electrification using the main grid system, arises when collective demand becomes large enough and offers economies of scale.[1] The microgrids are taken over and extended, with subtransmission links being introduced in place of old autogenerators. The latter may either be scrapped or find alternative uses. During this phase, businesses can turn to electricity as a source of machine power in preference to animals or diesel engines and may, as a consequence, even introduce some new processes. A number of major demand centres can be identified in a region resulting from the demands of larger villages, farms and industries that lie outside of them. To minimise the significant cost of subtransmission and distribution lines which may emanate from such demand centres, a need arises for a design to route the electricity network.

In the fourth and final phase, low demand centres may be connected to adjacent main networks already established in the region. This could possibly be carried out at very low marginal cost.

Against this background, Turvey and Anderson (1977, 158) contend that most African developing countries are largely in the first phase of private generators and are only gradually beginning both the second and third phases. Furthermore, while Asian Middle Eastern and North African developing countries are mostly in the midst of the third phase, most Latin American developing countries are in the fourth and final phase.

The most important conclusion that can be drawn from the study by Turvey and Anderson is that electrification is inadequate in most developing countries. This is especially true since electrification comprises a comparatively new field of investment in most of these countries. This inadequacy affects and retards the pace and pattern of development of both industrial and rural areas, and is compounded by the fact that most developing countries face an "energy crisis" situation - one in which people in the rural areas depend overwhelmingly on diminishing fuelwood resources and other traditional, non-commercial fuels such as animal dung, leaves and crop residues. These materials are used as the principal source of energy for cooking, space and water heating, lighting and other rural households needs. For many people, it is a problem of survival illustrated by the fact that these resources are almost exclusively used for life-sustaining activities. The World Bank (1981, 40) reports that in many of these developing countries, industries also rely heavily on fuelwood and in some countries - Mali, Tanzania, Nepal, Ethiopia and Haiti being notable examples - traditional fuels represent over 90% of total energy consumption. Eden et al. (1981, 354) adds

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1. The main or national grid system is the network of power lines from the power stations to the cities, towns, rural and residential areas where electricity is used (ESCOM Databank, July 1986).

that in India, fuelwood, cow dung and other farm waste provide 80% of the energy used for cooking and other domestic purposes, while in China the figure is probably similar. Although statistical evidence is not available, straw is a very important component of the fuel used for domestic heating and cooking in the rural areas of China, while coal is used extensively in towns.

Furthermore, poorer urban and peri-urban households in developing countries generally do not have electricity. These households rely on inconvenient and expensive fuels such as paraffin, gas, candles, batteries and fuelwood has recently become increasingly expensive. This places a heavy burden on the population, both in terms of the direct private costs and external costs such as pollution. In particular, fuelwood is no longer a free resource to which everyone has a traditional right. Abundant resources of wood in the form of indigenous forests no longer exist. Wood from commercial forests is expensive, both in terms of cost and transportation, and collecting of dung is an extremely time-consuming task. To cite some cases, Eberhard (1983, 2) discovered that receding woodland has meant longer trips for fuelwood collection - a task which has become increasingly arduous for women and children. In the Herschel district in Transkei, it has been observed that the average journey to fetch bundles of wood weighing up to 54 kg each lasted 4 hours and that approximately 15 hours a week could be spent on this task. In addition, Gandar (1984, 3) reports that in the Mahlabathini district in KwaZulu, the average time spent collecting wood varies between 9 hours 5 minutes and 6 hours 45 minutes per household per week in the high grassland areas and in the valley lowveld areas respectively. The average distance walked to collect one headload varies between 8,3 km and 3,6 km. In one extreme case, Gandar reports that a group of women were observed to have walked a round trip of 19 km, spending 9,5 hours in gathering a 40 kg headload each.

These problems are prevalent in most developing countries, and South Africa is no exception. In South Africa, where much of the population live in conditions similar to those found in the Third World, it is therefore to be expected that households in the rural and peri-urban areas would rely heavily on fuelwood and other inconvenient fuels to meet their domestic energy requirements. For example, a nationwide study on the quality of life undertaken in 1983 by the Centre for Applied Social Sciences at the University of Natal in conjunction with the Human Sciences Research Council indicates that a high percentage of the population living in black townships place a heavy reliance on candles for lighting purposes (77%) and paraffin for cooking (71%) and heating (52%) purposes (see Table 2.2). Similar trends were recorded in the peri-urban and rural areas as well as for blacks residing on white farms. For the latter two areas, however, fuelwood is preferred to paraffin for cooking and heating purposes. Particularly striking in all four areas of the study was the low percentage of electricity use - the highest percentage recorded being 29% for lighting purposes in the townships. This state of affairs in South Africa is worsened by disparities in the availability of modern energy.

TABLE 2.2: FUEL CONSUMPTION IN A DEVELOPING ECONOMY: SOUTH AFRICA, 1983

Area	Percentage using different types of fuel for purposes of Lighting (%)	Cooking (%)	Heating (%)
RURAL[a]			
Electricity	3	2	2
Wood	2	88	81
Dung	1	32	30
Coal	1	52	51
Candles	94	-	-
Paraffin/Petroleum	74	70	48
Gas	4	6	4
WHITE FARMS[b]			
Electricity	10	2	1
Wood	5	93	83
Dung	0	37	31
Coal	0	19	16
Candles	90	-	-
Paraffin/Petroleum	67	52	33
Gas	2	2	1
TOWNSHIP[c]			
Electricity	29	24	19
Wood	2	38	26
Dung	0	2	1
Coal	3	47	38
Candles	77	-	-
Paraffin/Petroleum	53	71	52
Gas	8	14	8
PERI-URBAN[d]			
Electricity	1	1	1
Wood	4	30	28
Dung	0	1	1
Coal	0	9	8
Candles	93	-	-
Paraffin/Petroleum	70	88	75
Gas	5	7	5

Source: Moller V. (1985): Rural Blacks' Perception of Basic Needs Fulfilment: South African National Scientific Programmes Report No. 116. Pretoria.

a Blacks living in the rural areas. This category comprises roughly equal numbers of persons residing in the remoter country districts. Such as traditional, planned and resettlement areas and on mission land in KwaZulu and Lebowa.

b A spatial category of rural blacks consisting of persons living and working on white farms in the Pietersburg district and Natal.

c Urban township blacks living in Soweto and townships in the Bloemfontein, Cape Town, Port Elizabeth and Durban areas, as well as towns in the Eastern Transvaal and KwaZulu.

d Peri-urban blacks living in shack areas to the north and south of Durban.

Recent figures presented by the Escom Databank News (1987, 6) indicate that of South Africa's total population (about 31,4 million in 1984), about 22 million do not have access to electricity and have to use coal, gas, paraffin, batteries and fast diminishing supplies of wood to meet their basic energy requirements. The implication is that although approximately 60% of the total electricity supply in Africa is generated by South Africa, and Escom today still ranks amongst the top seven electricity producers in the world, the majority of South Africans do not have access to its benefits. The provision of electricity seems to be confined, in the main, to white urban areas and farms, with the majority of the people remaining dependent on traditional fuels.

The costs involved in using traditional and relatively inefficient forms of energy technology in developing countries are extensive, chiefly in terms of detrimental effects on the environment and lifestyles of the populace, particularly in health, welfare and comfort levels. Most academic analysts of energy use agree that in urban areas, fire hazards, smoke pollution and bad reading light have become major problems. In the rural areas, bad reading light is accompanied by the more serious problem of deforestation. The depletion of forests caused by increasing wood fuel consumption and the use of substitutes such as dung and other wastes, seriously threaten soil fertility, water retention, crop yields and the availability of livestock feed in regions that depend for their survival on the agricultural sector.

The success with which these costs can be minimised and eventually eliminated depends on the acceptability of electricity amongst the poor in developing countries and the realisation that it can make an important contribution to agricultural, industrial and social development. This would occur by way of its application in irrigation projects, agricultural processing and sawmills. Further, it can significantly influence leisure activities at community centres such as municipalities and missions. In this regard, it is difficult to envisage any satisfactory development pattern for the less-developed countries which would not involve a very substantial increase in electricity consumption.

The characteristics presented thus far indicate that most developing countries face a significant lack of electricity supply. At the same time, evidence suggests that where supply is available, it is often made in the modern urban regions with little or no supply at all in the less developed areas. The provision of an adequate supply network in rural areas is thus of the utmost importance.

2.4 THE ROLE OF ELECTRICITY AND THE BASIC NEEDS APPROACH

The basic needs approach (BNA) to development arose from dissatisfaction with the results of past development efforts and was greatly influenced by the continuing absolute poverty of millions in developing countries. This goal was founded in the belief that as long as the poor remain deprived of the essentials required for an economically productive life, development would be impossible. As a result, the approach is viewed in many current development circles as a broadening of the concept of development in the sense that it aims at eliminating absolute poverty on a permanent and sustainable basis, thereby promoting the development of underprivileged areas and enabling even the lowest income groups to enjoy a minimum standard of living.

The major strength of the BNA is that it is viewed as providing a key to the solution of a number of separate, but related problems. In particular, Streeten (1979, 30) and Slabbert (1984, 22) assert that the aspects of urbanisation, protection of the environment, equality, the relation between rural development and industrialisation, rural-urban migration, domination and dependence, appear in a new light once the meeting of basic needs becomes the central concern in economic development. Likewise, Nattrass (1980, 58) points out that the BNA allows developing countries to attack the problems of poverty, growing inequality and economic dependence through the creation of jobs since the BNA is both labour intensive and import replacing. Of major importance is that jobs reduce the developing economies' need to rely on the migrant labour system.

The BNA defines basic needs in terms of material commodities such as primary health care, a minimum level of food consumption and a reasonable level of nutritional intake, a minimum level of education, access to safe drinking water and sanitation, basic clothing and shelter, transport and simple household goods. Certain non-material needs such as public participation, change in attitude, equality and self-reliance could also be provided for. While there is much controversy as to the exact criteria for defining these components of BNA, the argument has found widespread acceptance from a large spectrum of writers (e.g. Burki 1980; Hicks 1980; Ul Hug 1980; Stewart 1985). This consensus is ratified by success so far recorded by the International Labour Organisation (ILO) in developing countries such as Kenya, India, Sri Lanka and Colombia.

An important conclusion is that in a nutshell, the BNA has a number of distinctive features which can be summarised as follows (Dewar and Watson 1981):

- High priority is given to satisfying the specific needs of the poorest people, not only in order to raise productivity, but as an end in itself. Put differently, the approach recognises the urgent need to tackle problems at the grassroots level and to decentralise

the planning and implementation of programmes aimed at ensuring greater satisfaction of the basic needs of the local people. These people should, in turn, be involved at every stage of the process. Specifically, the approach recognises that without schools, hospitals, sanitation and the like, the poor will either be less productive or migrate to towns and cities. The latter scenario naturally creates a huge waste of human resources.

- The reduction of absolute deprivation is stressed. This policy is laudable in that it indicates an awareness that conditions which condemn the poor to lifelong misery and frustration in the rural areas, constitutes a basic denial of human rights.

- Government control of supply management, particularly in the transitional periods, is regarded as fundamental. This interference is commendable since it ensures that increases in the incomes of the poor are not neutralised by price increases.

- The approach stresses access to and delivery of services to the poor through making maximum use of local resources for the production and distribution of essential goods and services. From the point of view of costs, mobilisation of public support and contribution to local employment, institutional design is called for.

While the foregoing outline stresses that the provision of basic goods and services may enable the poor to compete more efficiently in the market place, it is, at the same time, essential to realise that electricity is an important input that determines both the quantity and quality of these goods and services. It particularly helps to provide the drive for better education, a flourishing employment market, improved housing, more time for recreation, greater security and greater personal fulfilment, thereby improving the individual's quality of life and ensuring continued economic growth. This is true because there is a surprisingly wide range of uses of electricity in developing countries for both household and productive needs. These uses are, in turn, usually intended to serve both economic and social aims.

While it is advocated that quantitative and qualitative deficiencies in education in developing countries may be minimised by, among others, building more schools, increasing participation through offering of incentives such as bursaries and free education, providing in-service training to teachers as well as designing appropriate curriculae (Burki 1980, 19; Van Wyk 1982, 149), it should also be recognised that improved equipment and better training facilities contribute greatly in both the quantity and quality of educational opportunities. The supply of electricity finds its role in education in its use for purposes such as visual aids and lighting for reading and studying in the evenings. Adult education classes are most conveniently held in

the evenings and given the structure of rural societies, this is arguably the most crucial and neglected aspect of education for underdeveloped areas. The availability of electricity could also enable training in technical courses such as welding, carpentry and panel beating to be undertaken.

Similarly, one of the solutions proposed for better health care is the introduction of a simple community based system which aims at preventive health and focusses on the needs of rural populations (Ghai et al. 1980). Without the availability of hospitals, clinics, health centres, adequate staff and other amenities, such programmes are not possible. Electricity is required in hospitals and health centres to fulfil their curative and preventive functions such as the sterilisation of drinking water and refrigeration for storing vaccines.

Furthermore, an adequate supply of clean water for a wide variety of uses in every aspect of life such as agriculture, industry, recreation and household activities is seen as an essential requirement (Streeten 1981). Electricity provides the power required for water pumping and processing machinery. While pumps for wells and town pipes may be operated either by hand or diesel engine, neither of these techniques is suitable for ensuring a significant and efficient supply of water. Electricity supply has to be taken into account in the processing and fabrication of materials needed in construction, domestic and agricultural implements, tools and clothes.

In some urban areas, electricity consumption, though dominated by its use for cooking and heating is still growing through increasing ownership of appliances such as television, refrigerators, freezers, washing machines, electric kettles and irons.

The availability of electricity is also a baseline for the establishment of industry, commerce or specialised services in rural areas. If as a result, industries do relocate, people can enter paid employment and be able to afford consumer goods. Although there is, in fact, little hard evidence as to the effect of electricity availability on migration, to the extent that people and businesses are attracted to and remain in rural areas because of it, migration from rural areas to cities may be stemmed or reduced.

The main conclusion drawn from the preceding discussion is that electricity provides the means by which the most important basic needs can be fulfilled. This implies that in economic development, electricity supply and the provision of basic needs should be pursued side by side. However, the successful implementation of this strategy depends, among others, on the institutional structure and objectives of the supply authorities of electricity. These issues are addressed in the next chapter.

CHAPTER 3

ELECTRICITY AS A PUBLIC UTILITY[1]

This chapter is intended to provide a background to some of the theoretical welfare aspects that are deemed to be of crucial importance in the supply of public utility services. Most of the issues to be discussed have a direct bearing on the supply of electricity. Of course, no attempt will be made to provide a complete exposition and only those propositions relevant to the present study shall be set out. Indeed, a discussion and understanding of concepts such as public versus private goods, the economic characteristics of public utilities and the need for regulation by the state, are necessary in order to meaningfully interpret the contents of the later chapters.

3.1 PUBLIC UTILITIES AND PUBLIC GOODS THEORY

The economic nature of public utilities is frequently appreciated by considering the conventional distinction between three different kinds of goods and services, namely private, public and merit goods. While all three enter into the utility functions of consumers, there are at the same time, several differences that exist between them (Musgrave 1958, 13; Truu 1988, 253).

The private good is perfectly divisible in that it can be allocated to different individuals, priced and subsequently sold through the market system. Given a fixed amount of such a good, increased consumption by one community member reduces the quantity available to other members by an equivalent amount. As a result of the private good's property of perfect divisibility, potential consumers can be excluded from consuming the good unless they are willing to pay the stipulated price to the owner.

The outstanding property of a pure public good is that upon its production, it is equally consumed by all members of the community. Formally, a public good has the following characteristics:

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1. Public utilities are easily recognised. The term "public utility" is applied today in a restricted sense to certain specific industries such as water supply, rail transport, electricity, gas and telephone services, although Batson (1933, 458) argues that numerous other activities that could be claimed to be "useful" to the public such as the clothing and baking industries and house construction "... are of at least as much public utility as electricity, tram rides and grain storage".

(a) The consumption of such a good is 'non-rival' i.e. one person's consumption does not diminish the amount available to any other person.

(b) It is not feasible, and sometimes not even possible, to exclude any individual from consuming the good once it is provided.

An example of a public good is a street light because it is non-rival and non-excludable. It is not feasible or desirable to levy a charge on this public good "... either because to assess a charge on each occasion of use would be excessively cumbersome or because use is not voluntary or even definable" (Dorfman 1973, 4). Other examples of public goods are national defence, fire services and radio transmission.

Since it is not feasible, at a reasonable cost, to exclude any person from consuming a public good, it follows that no authority or firm is likely to find it profitable to supply public goods to the market. Such a firm or authority would have to rely on voluntary contributions for its revenues. Payments for private, non-public goods are not voluntary in so far as one must pay in order to receive the good. In the case of public goods, however, one receives the good whether or not payment is made. In such situations, governments undertake to provide the good and finance its provision through taxes. The implication of all this is that there is no meaningful per unit 'price' which may be levied on the individual for the consumption of public goods. This lack of price means a lack of an objective yardstick of value for public goods (Mansfield 1979, 472; DeSerpa 1985, 290).

In reality, however, most economic goods and services are neither purely public nor purely private. In fact the vast majority of goods and services fall somewhere between these two extremes and thus exhibit properties of both 'publicness' and 'privateness'. Such goods are called merit goods. Since merit goods and services differ from each other in more than one respect, it is thus not really possible to rank them systematically according to comparative degrees of publicness or privateness. What is of major importance, however, is that they are all partially divisible and/or partially nonappropriable. As a result, merit goods are supplied partly by the market and partly through the state Budget.

Most public utility services are merit goods in the sense that they exhibit properties of both publicness and privateness. A clear distinction can be made between the electric utilities in Britain, France, the USA and Western Germany. The first two have state-owned electricity industries while the other two have a large proportion of privately owned suppliers. Furthermore, the consumption of most public utility services is liable to partial excludability and/or rivalry. For instance, the provision of street lighting may exhibit properties of publicness while the consumption of electricity in the house may indicate the features of privateness in that potential consumers can be excluded from consuming the services unless they are willing to pay the stipulated price to the owner or supply authorities.

3.2 ECONOMIC CHARACTERISTICS OF PUBLIC UTITLITIES

3.2.1 General features

The most prominent economic characteristic of public utilities is that they do not experience pure or approximately pure competition, but commonly produce and sell their services under monopolistic or only nominally competitive conditions. In other words, public utilities are located in the upper part of the rivalry spectrum where the seller has a large measure of price control and knows it.

However, features common to monopolies do not quite cover all possible characteristics of public utility services. A number of other distinctive attributes of public utility services can be briefly described as follows (Wallis 1983, 3):

i) They are used on a continuous or repeated basis in a multiplicity of activities throughout the economy. This property makes them major industries of considerable interest and importance, particulary in countries aspiring to industrialisation.

ii) Their services are usually not consumed directly, but are used as primary inputs in the direct production of other goods and services. Electricity, for instance, can be used as an input in the growing and subsequent processing of raw materials into foodstuffs in most agro-industries.

iii) Except for the limited day-to-day storage of gas and reservoir storage of water, public utility services are non-storable. Indeed they must be produced at the precise moment they are required for use. Specifically, electricity must be consumed as it is demanded for use in the operation of machinery and household implements. Delays in use do not mean deferred consumption, but rather reduced demand at the time. Thus, since these public utility services are non-storable, the companies have much unused plant capacity when consumer demand is not at a peak. As a result of this attribute and to ensure security of supply, extra plant capacity is provided for unforseeable changes in the peak demands at various times of the day, year or business cycle.

iv) Public utility services cannot for practical purposes be transferred from one consumer to another due to the technical conditions of service distribution. Electricity, gas, water and telephone services are, for instance, consumed on the premises of the buyers, and the lines to one buyer are not readily extended to the homes and establishments of other buyers. Indeed, these services are almost as non-transferable as medical and dental

services. In addition, even where such transfers may be possible as between neighbours, they may be contrary to legislation. This property of non-transferability of service is one of the basic conditions of price discrimination in public utility services.

v) A further property of public utility services which is unusual, but not unique, is that it is not possible for a consumer to use them without having first purchased suitable equipment or appliances. Using electricity as a specific example, the expenditure may consist of the wiring of a house for electric lighting, the purchase of a refrigerator or electric stove, etc. The demand of any consumer without such equipment or facilities is zero at any price, but having invested in the equipment, his demand is very inelastic until the equipment purchased is fully utilised, whereafter the marginal demand is zero unless and until other equipment is in use.

The above list, indeed, implies that the economic characteristic of public utility services can be viewed from both a demand and a supply perspective. In particular, the view that public utility services are "indispensable" because of their use on a continuous basis and in many diverse ways throughout the economy, implies that their position in society is firmly established. As a result of this "essential" nature, the demand[2] for public utility services becomes highly inelastic, both in regard to price and income (Troxell 1947, 31; Wallis 1983, 3). In addition, the upward trend of consumption is not greatly affected by fluctuations in the level of economic activity. With electricity supply, for instance, a typical low price elasticity of demand is clearly observed in the industrial sector.

The industrial consumer uses electricity almost entirely for lighting and mechanical power. As a result, electrical consumption for these purposes is quite inelastic and insensitive to tariff form or level, although electricity used for thermal and chemical processes may often be very price sensitive (Clay 1961, 1012). In the same way, the income elasticity of demand for public utility services is generally low. Berrie (1967, 425) attributes this to the fact that in modern developed societies, families apparently consider utility services as a basic part of their lives - something akin to a subsistence quantity of food. As a consequence, consumers are generally unwilling to forego consumption of utility services as incomes decline. Rather, an expenditure on non-essentials may be eliminated and that on other essentials cut down to finance demand for public utitlity services.

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2. Utility company managers have a special term which they use to describe the demand for services; they frequently speak of the "load" of utility service. The "load", a term that shows an engineering influence in public utility pricing generally means the prevailing scales of service of the day, or month or at times the potential purchases of the existing buyers. However, the notion of the load, like other business concepts of demand, appartenly is not treated as a function of prices, increasing as prices decline or decreasing as prices rise.

3.2.2 Decreasing costs/increasing returns to scale

The production (supply) of public utility services is characterised by technical efficiency features that give rise to economies of scale over the entire output range of the market. In the standard theory of the firm, economies of scale exist when expansion of the scale of productive capacity of a firm or industry causes total production costs to increase less than proportionately with output.[3] As a result of this technical efficiency in production and distribution, public utilities tend to be classed as "natural monopolies" in the sense that competition within the industry will result in inefficiency and waste. The term "natural monopoly" is described in economic theory to imply that the control of a public utility service in a market is somehow "naturally" or inherently monopolistic so that the rivalry between unregulated companies is inevitably eliminated and one company ultimately dominates the market which several companies once occupied. Standard economic theory provides a powerful justification for the creation of natural monopolies. This is illustrated in Figure 3.1 below which portrays a situation in which the public utility experiences increasing returns to scale over the entire output range in the market where it operates.

Increasing returns to scale mean that the long-run average cost curve (LAC) falls as output increases. As a result, the long-run marginal cost (LMC) curve lies below the LAC over the entire output range. The condition for profit maximisation in a perfectly competitive market is that all firms set their marginal cost (MC) equal to the market price, i.e. when market price P_1 or P_2 in Figure 3.1 is set equal to LMC. In an industry where there are increasing returns to scale, this will lead to individual firms incurring long-run losses and closing down until eventually a natural monopoly emerges (Koutsoyiannis 1979, 547).

On the basis of the above arguments, it would be appropriate to ascertain whether the electricity supply utility is in fact properly classed as a natural monopoly. The suggestion is made from time to time that the expression "natural monopoly" is misleading and unjustified when applied to electric utilities in view of the intense competition between suppliers of electricity and suppliers of various alternative sources of energy such as gas, fuel, oil and coal, which adequately curtail the monopoly power of the electricity supplier. Contrary to the foregoing suggestion, it should be noted that the essential foundation of the concept of a natural monopoly is not so much the absence of alternatives or substitutes, but the fact that efficiency is increased in the absence of competition between two or more suppliers of the same product (Kahn 1971, 49). Within any area, competition is seldom found between electricity utilities. The increase in efficiency in electricity supply results in lower unit costs and is a consequence of avoiding duplication of underground

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3. Koutsoyiannis (1979, 126) distinguishes between pecuniary and real economies of scale. Pecuniary economies are those associated with a reduction in the prices for the factors used in the production and distribution of the product due to bulk-buying as the size of the enterprise increases. On the other hand, real economies are those realised from a reduction in the physical quantity of inputs used in the production and distribution of the product due to technological efficiency.

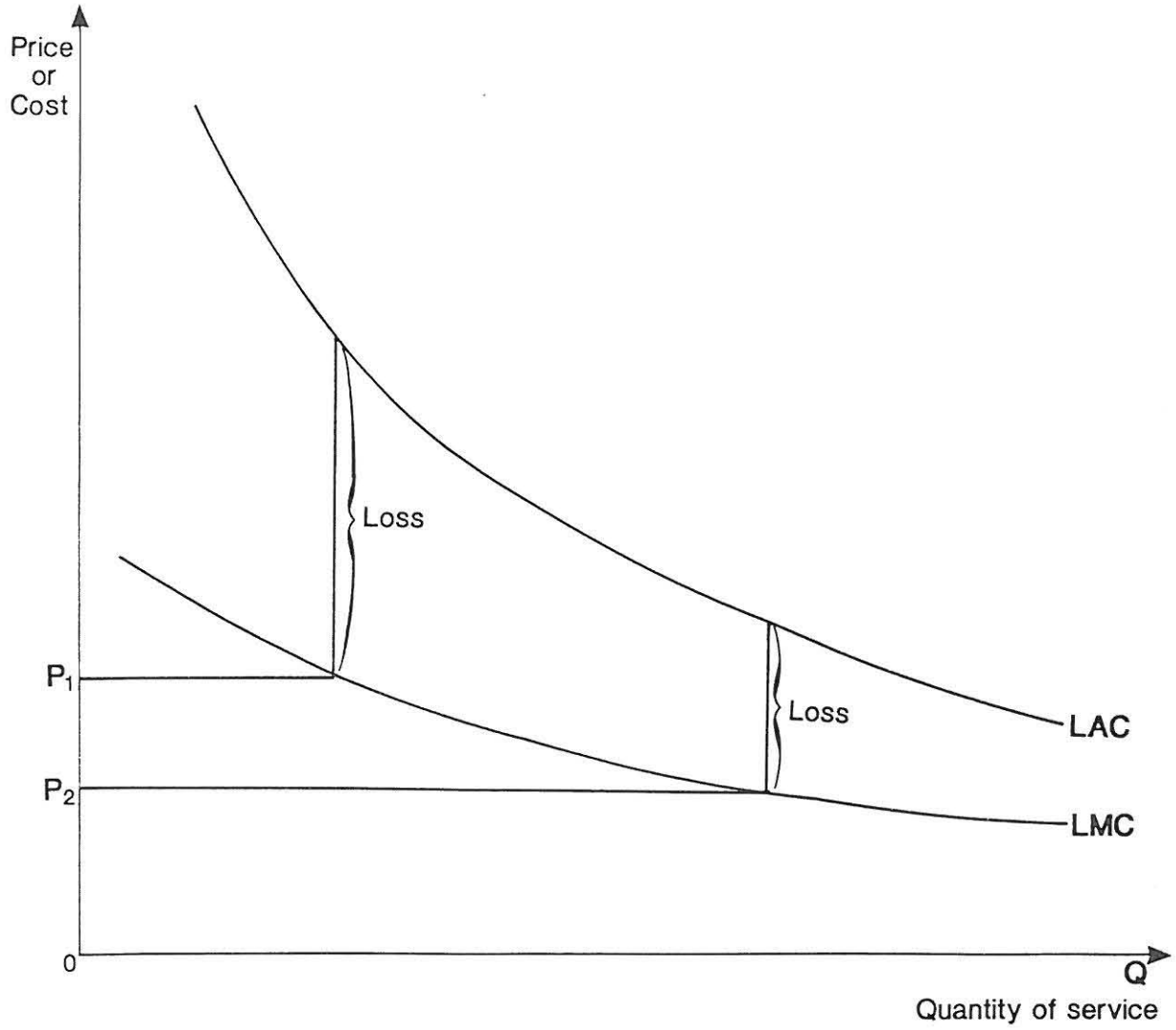

Figure 3.1 : NATURAL MONOPOLY : INCREASING RETURNS TO SCALE

cables, overhead lines, substations, connections, maintenance personnel and other equipment. In addition, the electricity supply industry has become a classic example of a decreasing cost industry in which average unit costs have fallen consistently as a result of technological improvements and economies of scale.

From both these points of view, it is clear that electricity supply can certainly be regarded as a "natural monopoly" and in regard to competing energy sources, the question might well be asked whether it is not possible to achieve further economies by having a single distributing monopoly responsible for all or several public utility services.

3.3 UNREGULATED PUBLIC UTILITY

The issues of inefficiency and waste associated with competition within a public utility industry put forth above are obvious. To this end, Crew and Kleindorfer (1979, 3) contend that "... there are definite cost savings in having only one water main in the street and similarly with the other utilities". What this amounts to is that it would be prohibitively expensive to have two or more competing public utilities constructing alternative networks so that each consumer would have a choice of supplier. As an example, the most likely and significant results of having two sources of electricity supply in competition may include costly effects on the continuity and reliability of service as well as failure to take full advantage of economies of scale in power generation. A single network is thus taken to imply a single seller in order to avoid unnecessary duplication of service.

Notwithstanding the above contention, economic theory predicts that if such a natural monopoly is unregulated and profit-maximising, the price will be raised above marginal cost and output of the service will be restricted below its optimal level. In welfare economics such practices are considered to provide a reason for a misallocation of productive resources and unemployment in the economy (Reder 1948, 47; Rees 1984, 3). Figure 3.2 shows a typical unregulated public utility that maximises profits by producing where marginal revenue (MR) equals marginal cost (LMC), i.e. MR = LMC at Q_m and pricing above LMC at P_m. In this instance, profit is AP_m per unit and total profits to the industry are measured by the rectangle AP_mBC.

However, it is not so much monopoly profits which have been a cause for complaints against an unregulated monopoly; rather it is the deadweight loss which results from a divergence of price and marginal cost. At output Q_m in Figure 3.2, the social marginal benefit P_m exceeds the social marginal cost at E. The monopolist produces too little. Social marginal cost and marginal benefit are equal at the output Q_c and the efficient point for society is F. This point is ensured under competition where P = MC, but under monopoly, price exceeds MC and so output is lower than is socially desirable. The unregulated

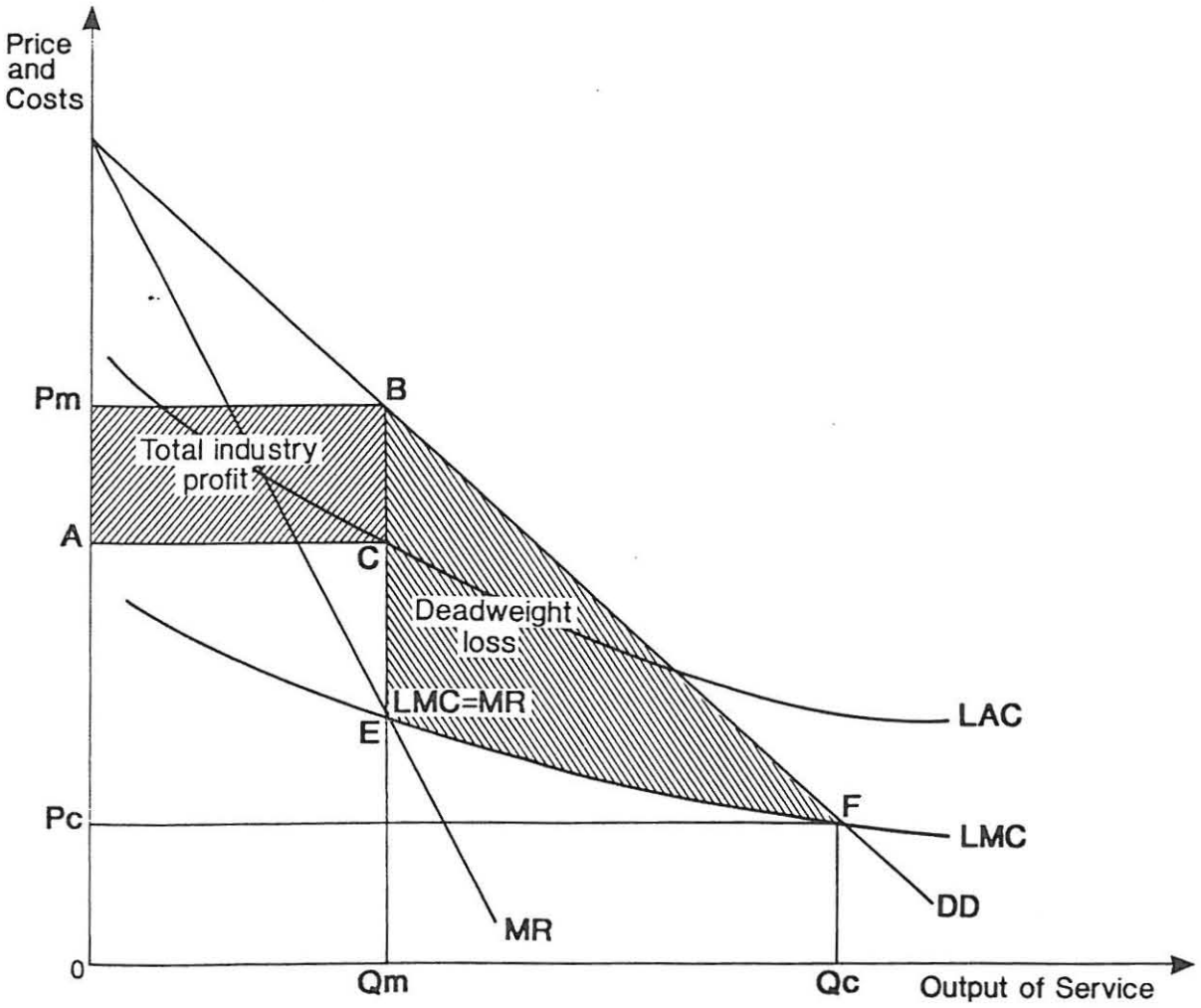

Figure 3.2 : UNREGULATED PUBLIC UTILITY.

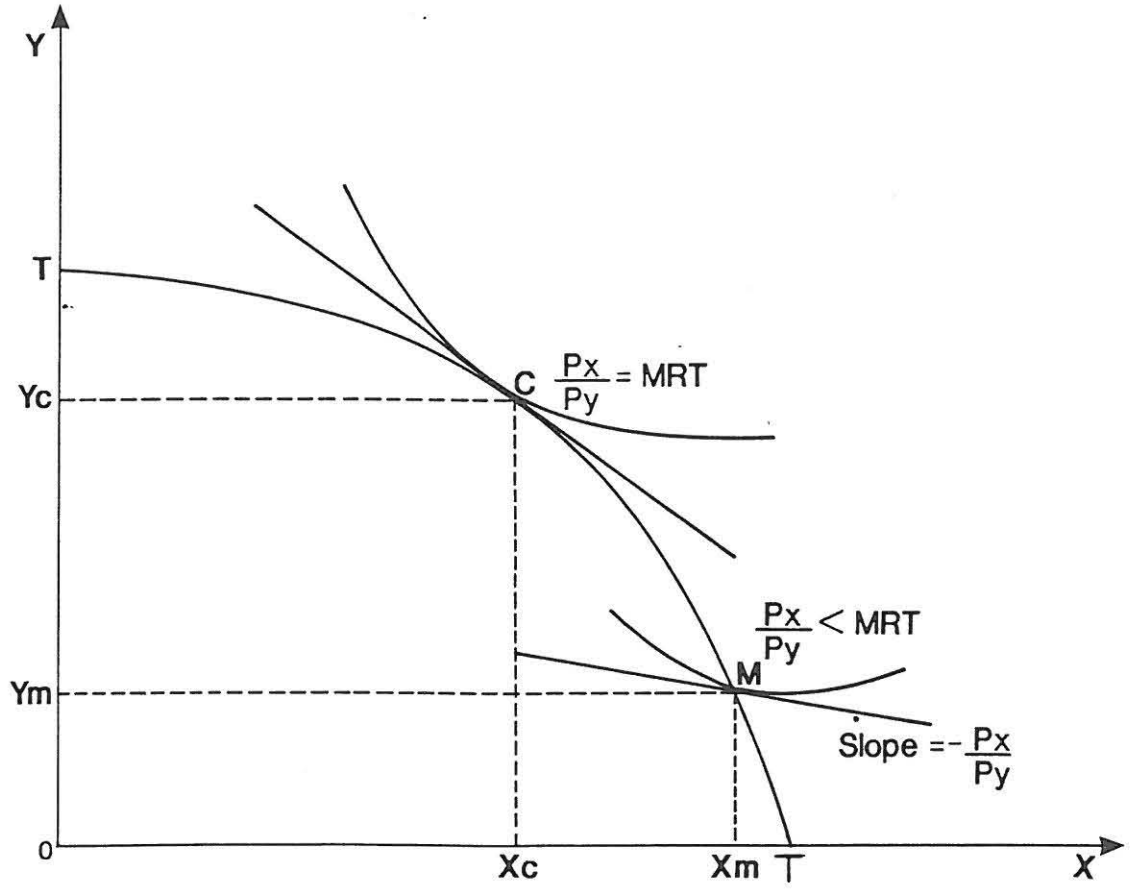

Figure 3.3 : WELFARE IMPLICATIONS OF UNREGULATED MONOPOLY.

monopoly thus creates a deadweight loss equal to the shaded area EBF. In theory, this situation implies that the unregulated monopoly leads to a less than Pareto optimal allocation of resources.[4]

The partial equilibrium conclusion presented above may be reinforced by examining the effect of monopoly in a general equilibrium context. The essential elements of this equilibrium are illustrated in Figure 3.3.

Assume for expositional purposes that the economy consists of two commodities, one of which (x) is supplied by a competitive industry while the other (y) is supplied by a monopolist. Customarily the Pareto optimality requires resources to be allocated efficiently in production such that the marginal rates of technical substitution (MRTS) between inputs are equal for all commodities, i.e. $MRTS_x = MRTS_y$. In the same way, equilibrium in the purely competitive industry requires that $P_x = MC_x$ for all producers. It follows that only one

price ratio $\frac{P_x}{P_y}$ for the two commodities is possible, namely

$$\frac{P_x}{P_y} = \frac{MC_x}{MC_y} = MRT$$

where marginal rate of transformation (MRT) is the slope of the transformation curve, TT. In the above figure, the competitive equilibrium is attained at point C.

By contrast, the monopolist maximises profit by equating marginal revenue and marginal cost, i.e. MR = MC. Since, in this instance, MR < P, P_y must be greater than MC and therefore

$$\frac{P_x}{P_y} < \frac{MC_x}{MC_y} = MRT$$

As a result, the reallocation of resources move the equilibrium to a point such as M, resulting in less y relative to x. At this point on the transformation curve, MRT exceeds P_x/P_y because the monopoly price exceeds marginal cost.

The outstanding feature to be drawn from the above discussion is that in the absence of regulation, the monopolist possesses the ability to exploit the situation of imperfect competition. In the real world, this property permits the seller to adopt special pricing policies which, in turn, depend on such factors as the

4. The Paretian approach requires that it must not be possible to change the existing resource allocation in such a way that someone is made better off and no one worse off, since, if this is possible, the existing resource allocation must involve a 'welfare waste'. This criterion of allocative efficiency was put forward by the Italian economist Vilfredo Pareto who is credited with having first proposed this tradition in his book "Manuel 'd Economic Politique" (1909) and so is known as the 'Pareto criterion'.

price elasticity of demand for his product, the extent to which he is able to control the supply of the product to the market, the desire to obtain the maximum profit or income and other economic and non-economic considerations.

3.4 REGULATED PUBLIC UTILITY

The economic attributes of unregulated public utilities outlined in the previous section, provide good reason for the regulation of their activities by the state. The institutional arrangements for regulating these industries, however, differ from country to country. While public utilities in the United States are privately-owned enterprises controlled by various utility commissions, such control has been traditionally effected through state ownership in countries such as Britain and South Africa. For this reason it will be assumed for simplicity in the remainder of this chapter that public utilities in South Africa are state-owned enterprises.

In a conventional sense, there is the recognition that the evils of regulation of public utilities are far outweighed by the evils of leaving them unregulated. Arguing in support of this assertion, Wallis (1983, 4) has pointed out that an unregulated public utility may use its monopolistic power to 'exploit' its customers either by restricting the volume of its services or by appropriating their consumers' surplus through the practice of first and third degree price discrimination.[5] As a result of these deficiencies, the State often imposes output controls alongside price controls to enable these industries to achieve maximum economic efficiency.

The criterion of 'efficiency' is a fundamental principle in the determination of tariff structures and price levels, but one that occasionally has to be modified in the light of special circumstances. As Batson (1933, 467) contends, this principle of efficiency is, as far as public utilities are concerned, "... a purely political judgement depending on whether the evils of regulation are less or more than the evils of laissez faire".

Economic principles must, however, be taken into account. In recognition of this view, Crew and Kleindorfer (1979, 122) have indicated that in the operation of regulation and public enterprises, economic principles have often been in the background of these activities.

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5. DeSerpa (1985, 319) defines first degree price discrimination to occur where a monopolist can charge different rates to each individual consumer and third degree price discrimination to occur where different rates are charged to different classes of consumers.

The two fundamental economic criteria which have been applied by governments in regulating the process of price determination by public utilities have been, according to Wallis (1983, 6), those of "fairness" (equity) and "financial viability". The most crucial concern is that the tariff structure for public utility services should be "fair" in the sense that no group of consumers should be discriminated against by being charged more than the cost incurred in supplying them. The notion of equity is extended to include the provision of services to the largest possible number of consumers at the lowest possible cost, and adequate safeguards should be built in to protect the public from possible exploitation by monopolist suppliers.

In addition to the above, public utilities are required to achieve and maintain financial viability. Formulation of financial objectives in terms of long-term viability and the need to cover immediate costs are thus necessary. The programme should incorporate capital and operating expenditure forecasts, loan and equity financing, tariff formulation and the acceptable rate of return on assets. The basic objective is that the utility should, in the long-term, remain financially viable without the need for state subsidisation.

The above criteria clearly point to the government's concern in making public utilities operate in a socially acceptable and economically efficient way. In a conventional theoretical sense, the 'efficiency' criterion is facilitated by getting the unregulated natural monopoly as close as possible to the socially efficient allocation of resources in the economy. Figure 3.4 illustrates this scenario.

In Figure 3.4, the economic conditions leading to natural monopoly are, as in Figure 3.2, described by the conventional demand and marginal revenue curves and the long-run average and marginal cost curves. In the absence of any regulatory activity, the monopolist would maximise profits, producing at an output rate of Q_m and charging a price of P_m. The regulatory alternatives may embrace three solutions (Hirshleifer 1980, 350; Begg et al. 1984, 382).

To begin with, the regulatory authorities may impose the average cost price of P_2. At this price, the monopoly would produce at a rate of output of Q_2 where price equals average cost. This type of regulated natural monopoly reflects a reduction in the social cost of the deadweight burden from EBF to HGF. Some welfare losses (area HGF) are incurred but the monopolist earns a normal profit.

Secondly, the monopolist may be ordered to produce at the socially efficient point F where price equals marginal cost, but a government subsidy equal to rectangle P_5P_3FI must be provided in order to cover the losses that this will inevitably imply. However, to subsidise the already regulated monopolist would create additional problems. In particular, the regulatory authorities will need to levy taxes elsewhere to raise the revenue to pay the subsidy. Such action creates welfare losses and is usually not justified on income distribution grounds. Furthermore, subsidies create administrative difficulties and may be politically infeasible and unpopular.

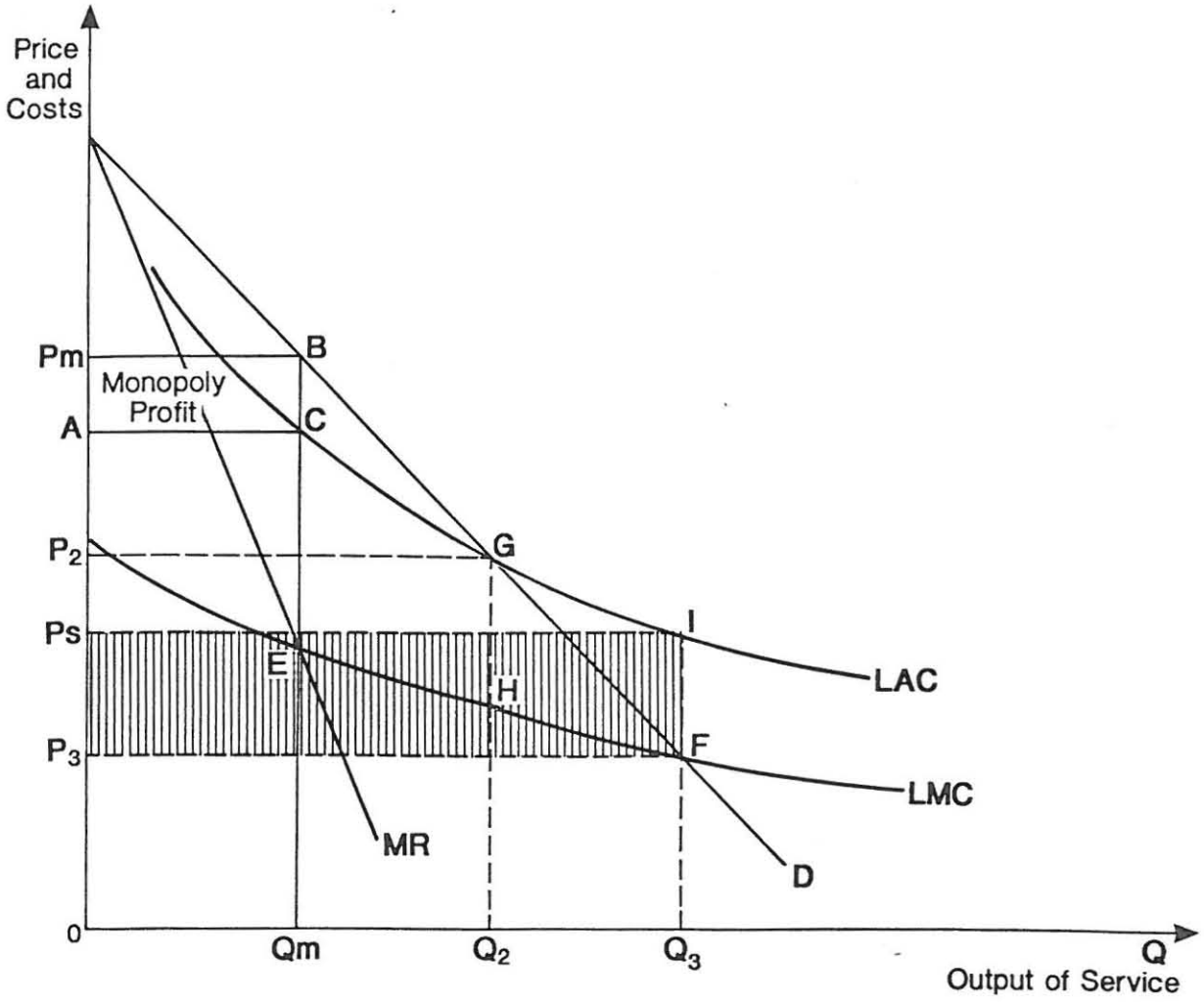

Figure 3.4 : REGULATION OF NATURAL MONOPOLY

Finally the monopolist may be allowed to charge a two-part tariff. A two-part tariff is a pricing policy which requires users to pay a fixed sum for access to the service and then pay a price per unit which reflects the marginal cost of production (DeSerpa 1985, 324). In Figure 3.4, the authorities may instruct the monopolist to charge P_3 for each unit of the service and then allow it to levy the minimum fixed charge necessary to ensure that the monopolist breaks even after allowing for all relevant economic costs. This pricing system is, however, not always a feasible solution because it may induce people to abandon the consumption of the service altogether if the fixed charge has to be very high.

Evidently, two problems emerge in an attempt to adopt any of the above solutions. Firstly, these measures presume considerable knowledge on the part of the regulating authority. The authority must know the demand function and marginal costs, which may be difficult to uncover from the accounts of the monopolist. Secondly, the socially efficient point F in Figure 3.4 is a first-best solution, which can only be attained if there are no other distortions elsewhere in the economy.[6]

In response to the above problems, second-best policies may be introduced into the analysis.[7] These policies require the regulatory authority to expand the output of the natural monopoly up to the point at which the marginal reduction in the deadweight burden equals the marginal increase in the deadweight burden elsewhere as a result of extra distortionary taxes (Begg et al. 1984, 383). To this end, the authority may generally wish to regulate natural monopolites so that they produce at an output a little lower than Q_3 at prices between marginal cost and average cost. By pricing above marginal cost, losses are partly reduced and there is, as a result, less need for distortionary taxation elsewhere.

The above suggestion may be illustrated in a general equilibrium framework in Figure 3.5. In the exposition, an economy is assumed to consist of two commodities, one of which (x) is supplied by a competitive industry and the other (y) by an unregulated natural monopoly i.e. point M in Figure 3.5. Introducing second-best policies (and lump sum taxes if these seem justified on income distribution grounds) to enforce marginal cost pricing might take one to point C.[8] However, negative supply side effects resulting from higher taxes required for subsidisation are more likely to move the economy to point S. This point indicates that resources are not being used fully or efficienctly since it is possible to have more of both

6. The first-best allocation is attainable only within what is termed a 'first-best' economy. In the first-best economy, all markets are assumed to be perfectly competitive (Rees 1984).

7. The second-best optimum refers to the Pareto optimum which can be achieved in the presence of constraints (Tisdell 1972, 299).

8. A suggestion has been made by Hotelling (1938) that this marginal cost pricing would be optimal even where a natural monopoly incurs continual losses if these losses were financed by raising lump sum taxes. It is, however, generally accepted that there are no feasible taxes which are of a truly lump sum character. Any feasible tax is thus likely to distort the Pareto optimum. This is, for example, particularly true of indirect taxes.

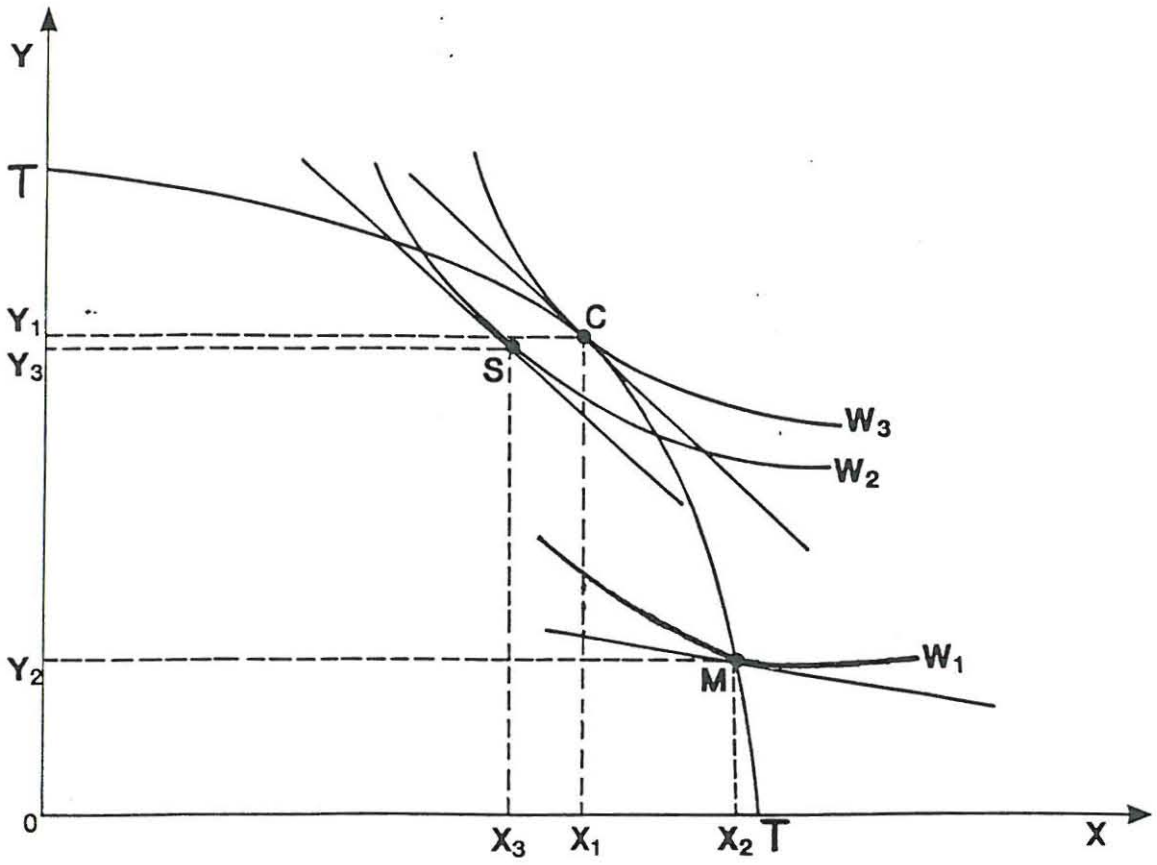

Figure 3.5: SECOND-BEST POLICIES IN REGULATION OF NATURAL MONOPOLY

commodities by being on the transformation curve TT. Nevertheless it is possible that welfare may be higher at point S than at point M, where the latter reflects the unregulated natural monopoly equilibrium.

3.5 COSTS OF REGULATING PUBLIC UTILITIES

Government intervention to control the activities of 'natural monopolies' such as electricity utilities or other public utilities as outlined above represents the standard point of departure for discussion of regulation in the textbook literature. From the point of view of the economist, such regulation entails no more than introducing taxes, subsidies or other policies to neutralise various monopoly distortions that would otherwise exist. In many respects, this broad approach has provided the rationale for the extension of government in an attempt to improve upon the allocation of resources attained in unregulated markets, particularly in mixed economies during the post-war era.

Contrary to the above scenario, recent developments in economic science and elsewhere have revealed a growing scepticism as regards both the usefulness and effectiveness of state intervention in unregulated markets. In particular, public choice theorists such as Posner (1975), Bohm (1973), Tullock (1978), Buchanan (1978), Stigler and Friedland (1982) and Peacock (1984) have increasingly come to acknowledge that the myriad of regulatory activities characteristic of modern government may severely undermine economic efficiency and distort the equity outcomes of market activity. On the basis of these deficiencies, the growth of state intervention is thus viewed as constituting a departure from the essentially normative purpose of welfare economics.

Apart from the various costs associated with marginal cost pricing outlined in the previous section, there are several other factors that can be attributed to the perceived inability of state regulation to secure optimal outcomes. The following two appear to be pertinent to the regulation of public utilities.

In the first place, state regulation may provide the regulatory authority with a strong incentive to engage in activities that may result in an excess supply of the public utility service. The basic argument in this context is that regulation may induce authorities to indulge in empire building, discrimination against unpopular demographic groups, and acts of giving favours to friends and relatives. Customarily, these activities might, to a certain extent, be intended to generate favourable public notice. As a result, the welfare loss emanating from these activities may be large. Assuming constant costs for expositional purposes, the issue of oversupply may be illustrated as in Figure 3.6.

Under constant costs conditions, conventional regulatory measures will cause the price of the service to drop from P_u to P_{r1} and the output of the service to increase from $0Q_u$ to $0Q_{r1}$. However, due to the vigorous pursuit of favourable public notice by regulatory authorities, public utilities might be instructed to

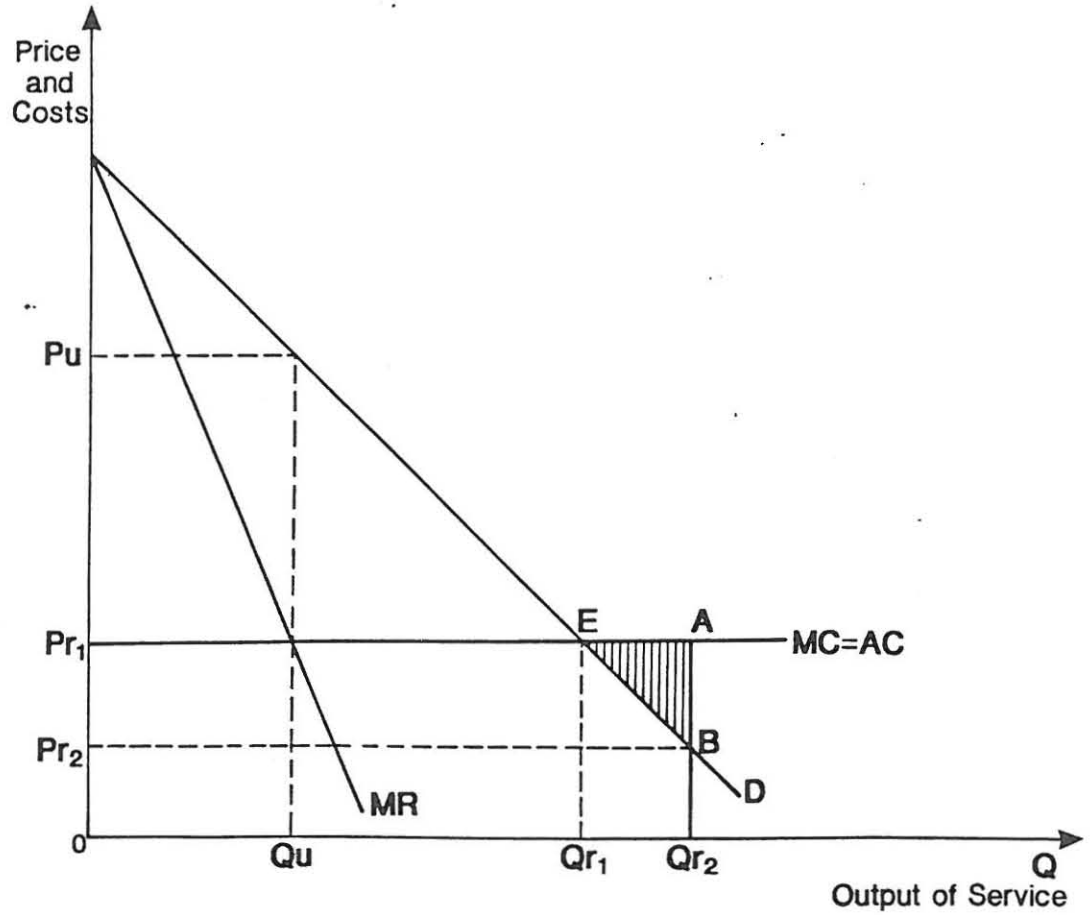

Figure 3.6 : OVER-SUPPLY OF PUBLIC UTILITY SERVICES.

produce at Q_{r2} and charge a lower price P_{r2}. If indeed Q_{r2} is actually produced at P_{r2}, the (additional) cost is $P_{r1}ABP_{r2}$ which exceeds the increase in consumer surplus $P_{r1}EBP_{r2}$ by the shaded triangle EAB. This triangle reflects the additional net cost of oversupply due to state regulation.

Secondly, even if an optimal level of public utility service provision could be attained, another cost is likely to arise from government regulation. Introduced into the economics literature by Leibenstein (1966, 395) as X-inefficiency, this notion suggests that industries producing in the absence of strong competitive pressures may lack sufficient incentive to maintain full internal efficiency and instead may allow their unit costs to rise perhaps substantially above the level that would be obtained under competitive conditions. An outstanding example in this regard is that of regulating public utilities through nationalisation (i.e. taking over the entire running of the industry so that all operations can be carefully monitored), such as in the case of rail transport in South Africa. This type of regulation may result in organisational or "intellectual" slack (Curwen 1979, 132), which can arise from a lack of knowledge regarding the optimum combinations of factor inputs as well as an inclination on the part labourers at all levels in the hierarchy to work at less than their full capacity. The effects of X-inefficiency are illustrated in Figure 3.7 below where it is again assumed for simplicity that costs are constant.

In Figure 3.7 P_u, Q_u and P_{r1}, Q_{r1} reflect unregulated and regulated prices and output levels, respectively. Now due to the perceived organisational slack in the nationalised utility, costs may rise from $MC_1 = AC_1$ to $MC_2 = AC_2$ thereby resulting in a drop in output from $0Q_{r1}$ to $0Q_{r2}$. The increase in costs also results in a deadweight gain from regulation, ABC, which is smaller than the previous gain of AFE.

On the basis of the above comments, some radical suggestions have been made by several public choice theorists. In particular, Demsetz (1968, 56) argues that public utilities should not be regulated at all. To this end, he suggests that a competitive bidding process conducted at suitable intervals should instead take the place of regulation. In his opinion, the winner of this bidding process may then be franchised to operate a monopoly at the "bid" price over the agreed time interval until the next competitive bid. Clearly, however, and as Crew and Kleindorfer (1979, 127) have pointed out, for public utitlities like electricity with highly expensive and immobile capital, such a scheme is impractical.

In essence, the criticism levelled thus far against corrective state intervention does not imply either that a public utility service should not be provided at all or that it should not be provided publicly. As Dollery and Wallis (1987, 4) have pointed out, "... any normative evaluation of state intervention must weigh potential welfare gains from correcting market failure against the welfare losses attendant upon intervention itself." It follows that when the welfare loss due to state intervention is less than the welfare loss due to leaving public utitlities unregulated, corrective state intervention would be justified. In the supply of public utitlity services for instance, without state intervention to control the activities of these industries, destructive competition

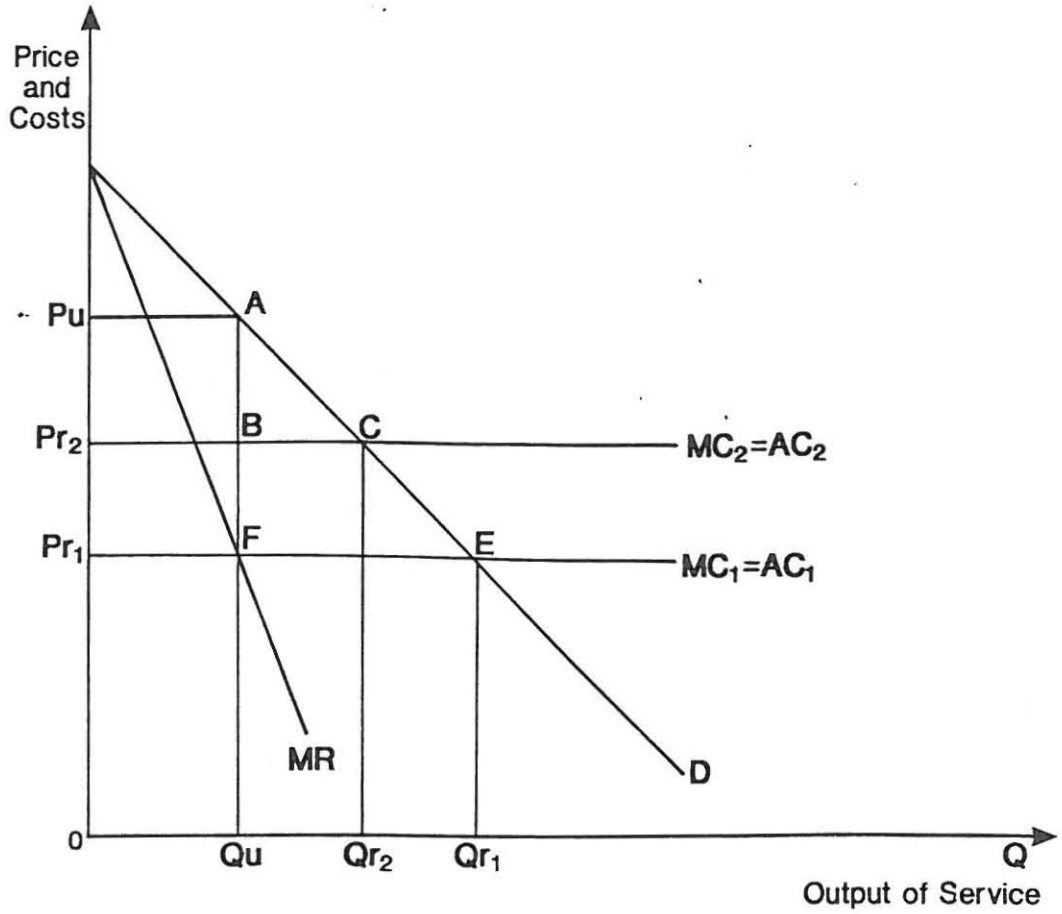

Figure 3.7 : X-INEFFICIENCY IN A REGULATED PUBLIC UTILITY

with resultant unnecessary duplication of services may arise, thereby contributing to inefficiencies and great welfare losses. On this basis an argument is presented by Herrmann (1974, 3-19) concerning the supply of electricity. In his opinion, there are various factors that justify corrective state intervention in the supply of electricity services. These are briefly set out below:

i) Electricity is today an essential element in the whole of our social and economic system with a powerful influence on social amenities, educational opportunities, transport and the cost of most items in daily use. As a result it is undesirable that the decision as to who should or should not receive electrical service and at what price should be left entirely to a rate engineer or Town Clerk without some disinterested form of control.

ii) The structure of costs and tariffs in the electricity supply industry is of such complexity that the man in the street would be unable to present an effective argument in the event of a legitimate complaint and is therefore in need of some body to whom he can appeal and that will look after his interests.

iii) As long as the utility's profit limitation is related to its total revenue, there must be some means of protecting those consumer groups with relatively inelastic demands from discrimination in favour of those with more elastic demands.

In conclusion, it is largely on the grounds of the above arguments that regulation of electricity supply activities, particularly tariffs, is not only desirable but may also be viewed as one of the most effective methods of averting social welfare losses. However, Herrmann (1974, 3-20) cautions that the regulating body must be fully aware of its responsibilities and of the principles on which such regulation should be based in order to avoid the danger of creating welfare losses that are economically and socially undesirable.

PART TWO: PRINCIPLES OF COST-BENEFIT ANALYSIS

An outline of the main objectives of the present study was presented in Chapter 1. It was pointed out there that an attempt will be made along lines suggested by the framework of cost-benefit analysis to identify relevant private and external benefits and costs of electrification. Toward this end, a general account of theoretical issues within the broad area of the theory of CBA will be given in the following chapter. We shall focus on the major CBA concepts that seem to bear relevance to the purpose of the study, particularly those that could be utilised when evaluating the role of electricity supply in a developing region like Venda. Essentially it is hoped that some of the sections in these chapters will provide a direct linkage with the nature of benefits and costs of electrification that will be outlined in Part Three.

CHAPTER 4

THE STATE OF COST-BENEFIT ANALYSIS IN ECONOMIC THEORY

4.1 THE ORIGINS OF CBA

Although the subject of CBA has come into prominence among economists only in recent years, it has been around a long time, according to Prest and Turvey (1965, 681). Its inception formally appeared in 1844 with the publication of an essay: "On the measurement of the utility of Public Works" by Jules Dupuit, a nineteenth-century French engineer.[1] Dupuit developed the concept of consumers' surplus, and proposed that the benefits to the community of public enterprises like bridges and roads are not the revenues received by the public treasury or the actual payments made by the public, but the public's willingness to pay, i.e. the sum of actual payments and consumers' surplus. Dupuit's idea is today "... a cornerstone of CBA, particularly in the analysis of, among other things, road investments" (Little and Mirrlees 1974, 28).

However, Dupuit's ideas lay dormant until the passage of the US Flood Control Act of 1936 which prescribed that flood control projects should pass the test that 'the benefits to whomsoever they may accrue are in excess of the estimated costs'. Unfortunately, this legal requirement gave no specific guidance on how to define benefits and costs. In evaluating this shortcoming, Eckstein (1971, 48) pointed out that

> "(al)though the Act has moulded the development of CBA, measuring all benefits and costs to 'whomsoever they may accrue' is not only beyond the present ability of economic science, but presents conceptual difficulties which by their very nature can never be overcome except by making very specific assumptions on matters about which the Act does not prescribe".

Despite this deficiency, the Act actually stimulated work in both the theory and application of CBA, first only in the area of water resources, but by the 1950s in defence analysis and since the 1960s in virtually all areas of public expenditure. Other examples of early use of a rudimentary form of CBA are found in the programme budgeting systems of the Tennessee Valley Authority and US Department of Agriculture (Gramlich 1981, 7; Steiner 1974, 331).

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1. Translated in International Economic Papers 2 (1952, 83-100). English translation by Barback R.H. from "De la Mesure del'utilite des Travaux Publics", Annales des Ponts et Chaussees, 2d series vol. 8 1844. Reprinted by courtesy of International Economic papers in Readings in Welfare Economics edited by Arrow K.J. and Scitovsky T. (1969). London: George Allen and Unwin Ltd. pp. 235-283.

Today, cost-benefit analyses are routinely conducted throughout both developed and developing countries in irrigation, hydro-electricity and transport investments, to mention but a few. In the field of electricity supply, it is no accident that the most interesting contemporary ideas on the subject of CBA should be those put forward in the late 1950s and early 1960s by economists in countries like France, USSR, Britain and Scotland. This part of the process is, according to Meek (1963, 38), symbolised by events such as the establishment of electricity authorities, for example the Electricite de France and the Central Electricity Generating Board in Britain. More recently, Turvey and Anderson (1977) have made an important contribution by their detailed analysis of CBA to electricity supply.

4.2 THE CONCEPT AND OBJECTIVES OF CBA

Cost-benefit analysis is generally considered to be an economic technique or a practical method used to

> "... assess the desirability of projects where it is important to take a long view (in the sense of looking at repercussions in the further as well as the nearer future) and a wide view (in the sense of allowing for side effects of many kinds on many persons, industries, regions, etc.) i.e. it implies the enumeration and evaluation of all the relevant costs and benefits" (Prest and Turvey 1965, 681).

Stated simply and clearly, this planning technique has a specific meaning in economics in that it attempts to set out and evaluate the costs and benefits of investment projects and may be used in deciding whether or not the projects should be undertaken. Numerous authorities, both in industry and government circles, have found it to be an excellent tool for the evaluation of alternative projects or programmes, their ultimate purpose being the selection of the one which would be the most suitable.[2] Some examples of public projects which may be suited to CBA are the building of a motorway, the construction of a new reservoir and building a nuclear-powered electricity generating station. In addition, social programmes of a wide ranging nature can be reviewed with the aid of this technique.

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2. Since the publication of the Organisation for Economic Cooperation and Development manual in 1968 (Little and Mirrlees) the idea has become accepted that CBA should be used to appraise projects in both developed and developing countries (Bohm 1973; Brown and Jackson 1978; Tisdell 1985; De Wet 1975).

   A project is defined in this context to imply "... an undertaking whose benefits and costs are identifiable, and whose feasibility can be determined in technical terms" Sewell et al. (1961, 5). In the same way, Eckstein (1958, 51) defines a program as a set of projects, usually in one general area. In other words, a program of development may contain one or more projects with each of the component projects being separately analysed.

The essential difference between CBA and ordinary investment appraisal methods used by firms is the emphasis placed on the social costs and benefits in CBA. As Sewell et al. (1961, 1) have clearly pointed out, the majority of these ordinary investment appraisal methods used by firms have suffered from a common fault: they have been too limited in scope and as a result have failed to provide a sufficient framework upon which the various benefits and costs involved could be set out in their true perspective. In particular, methods such as cash-flow analysis and private profitability analysis look, according to Pearce and Nash (1981, 1) only at the interests of producers.

Contrary to the above, the aim of CBA is to identify and measure the losses and gains in economic welfare which are incurred by society as a whole if the particular project in question is undertaken. This is the sense in which Little and Mirrlees (1968), Pearce (1983), Mishan (1971), De Wet (1976) and other writers use the term. In principle, CBA is thus used "... to ensure that scarce resources are allocated efficiently, first between competing private sectors and public uses and second, between alternative public sector projects" (Brown and Jackson 1978, 158).

Alongside the development and growth in the use of CBA has been growth in both general and specific criticisms of the technique and it is against this background that the more cautious modern approaches to the use of CBA are best understood. According to Hosking (1983, 4), the initial focal point of the criticism was theoretical in so far as positive economics came to be replaced by normative economics, and at the same time normative economics had itself come under the most severe criticism. In addition to the theoretical aspects, a general criticism has been that CBA attempts to reduce everything to the common denominator of money and that this is simply not possible. Another such criticism is that CBA lacks objectivity because it is biased by the subjective attitudes of those performing the study. This criticism revolves around effects allegedly erroneously included or excluded as benefits or costs as well as their valuation (Rady 1977, 68). Such deficiencies are generally seen as making CBA "... an ambiguous instrument in social decision-making" (De Wet 1976, 51).

Even the proponents of CBA admit that some of these criticisms are justified, and it appears that a more cautious approach to the use of CBA dominates recent economic theory.[3] In most of their writings, the proponents of CBA point to the continued evolution of CBA. More precisely, they contend that over time researchers and practitioners have worked to eliminate the glaring deficiencies of CBA. For example, while in earlier years the only project effects included in CB studies were those affecting gross national product,[4]

3. Prominent proponents in this sphere are Tisdell (1985); Dasgupta, Sen and Marglin (1972); Mishan (1976) and Grut (1976).

4. This point was first raised by Maass (1966, 208) who contends that a major limitation of CBA is its ranking of projects and programme in terms of economic efficiency which "... at the national level ... means that projects and programs are judged by the amount that they increase the national product". In his opinion, the objective functions of most government programs are complex, embracing

today many studies attempt to incorporate environmental and social factors, regional implications and distributional consequences as well. Perhaps the real justification advanced by proponents is summed up by their insistence that

> "... criticisms of cost-benefit analysis are only admissible if they can demonstrate that alternative prescriptive procedures are in some way superior ... (and) to this end there must be criteria of superiority" (Dasgupta and Pearce 1972, 16).

Despite these problems with the CBA technique, CBA would seem to provide a better framework for the evaluation of projects and programmes of resource development than would any other technique (Pearce 1983). To this end it may be considered a useful aid to decision-making.

In the light of the above considerations, it is apparent that the CBA technique incorporates several costs and benefits. The next section will therefore be devoted to the identification of those costs and benefits that need to be included in the analysis.

4.3 IDENTIFYING RELEVANT COSTS AND BENEFITS

Once a project has been clearly defined, the next major problem in performing a CBA is to properly identify costs and benefits. This classification, called the "real base of CBA" by De Wet (1976, 53), derives from the well-established aim of the technique of CBA that all relevant costs and benefits (direct and indirect) associated with an economic action should be included in the analysis.

The most conventional distinction between types of costs and benefits in CBA is that made between private and external (spillover or neighbourhood) effects. This differentiation was made famous by Pigou (1950, 183) who, in the course of his treatise on welfare economics, pointed out that there may be circumstances in which the market price of a good or service does not reflect the external costs or benefits involved in its production or consumption. To this end, he defines private effects as those which directly or indirectly affect the decisions of its performers. On the other hand, external effects exist when the actions of one party harm or benefit another party without any compensation or monetary reward changing hands in the process. The parties may be either consumers or producers, while one or more activity may be involved.

If the recipient party is a consumer, for example, the externality may be represented as an additional variable in his utility function (Buchanan and Stubblebine 1962, 372); that is,

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important objectives such as the redistribution of income to classes or to regions, the promotion of national self-sufficiency, etc.

$$U_a = f(q_1, q_2, ..., q_n, x_b) \qquad 4.1.$$

where $q_1, q_2, ..., q_n$ in equation 4.1 represent activities that are exclusively under the control of party A, x_b is an activity controlled by party B, and $f(x_b) \gtrless 0$ depending on whether it represents a positive or negative externality. A similar formulation can be made for the production function of an individual firm.

External effects may be classified as either technological or pecuniary. Technological external effects entail changes in the real consumption or production possibilities of recipient parties and can manifest themselves in many possible ways. A "producer-producer" externality may be defined as one in which the scale of operation in one production unit affects the output of other units, given that there is no change in their inputs of capital, labour or other factors of production. A new dam constructed upstream to an existing electrical plant may, for example, stabilise the flow of water and increase the downstream capacity to generate electricity. Likewise, a producer-consumer externality occurs when the installation of street lighting reduces the incidence of violent crime or when the smoke emitted by an electric power station causes certain respiratory illnesses amongst residents in the surrounding area.

Consumer-consumer externalities may also be fairly common. An individual homeowner who overloads his own supply connection may cause voltage depressions elsewhere and expose his neighbours to a serious risk of fire, electric shocks, radio interferences and damage to electrical appliances. Consumer-producer effects are typified by vandals who damage electrical substations, transformers and transmission lines. In all these cases, a negative technological externality either reduces utility or decreases productivity, depending, of course on whether it affects a consumer or a producer while a positive externality has the opposite effect.

Pecuniary externalities may also be relevant in a developing region characterised by large inequalities and widespread unemployment and underemployment (Prest and Turvey 1965; Hirschman 1967). These effects are brought about by an alteration in the demand and supply conditions facing the recipient parties and are reflected in changes in the prices of inputs and outputs (Sassone and Schaffer 1978, 38). The construction of a new electrical power station may raise the demand for electrical appliances and boost the profits of retailers, wholesalers and producers of such appliances, thus ultimately leading to increased investment and the creation of new job opportunities.

Formally technological external costs and benefits should always be accounted for in a CBA because they are real and they increase or decrease social welfare. On the other hand, most writers on CBA suggest that pecuniary effects should be excluded because they usually represent a redistribution of income from one group in society to another and therefore do not influence the total welfare of society (Louw 1981, 122). Despite this general assertion, Margolis (1957, 284) and Georgi (1973, 20) have pointed out that pecuniary effects can, at a general level, be significant for most capital investments in the economy, particularly in

infrastructural investments in less developed countries where resources are underutilized. Essentially it should be appreciated that infrastructural projects play a crucial role in developing underdeveloped regions. As a result, it would appear that pecuniary external effects should be included in CBA when it is applied in an underdeveloped region. As a part of infrastructure in such underdeveloped regions, electrification may "induce" pecuniary effects such as the creation of job opportunities for local people and the alleviation of slum conditions. Health improvement through the avoidance of exposure to poisonous gases may also be included in the list of pecuniary effects that could be induced by electrification of a region.

It should not be concluded from this discussion that it is, in practice, easy to distinguish clearly between technological and pecuniary effects. These remote effects are, as Henderson (1965, 88) has stressed, difficult to identify in a comprehensive CBA. By way of example, while the economies of scale which are realised in other industries may represent a technological externality, it is also brought about through a change in demand and is therefore also a pecuniary externality. As a result, a great deal of the art of CBA lies in being able to make appropriate judgements on this question of identifying technological and pecuniary external effects. In addition, external effects can be quite widespread (Prest and Turvey's "wide view") and therefore can easily be 'missed' by the CB analyst.

4.4 VALUATION AND SHADOW PRICING

Having identified the relevant costs and benefits to be included in CBA as presented in the preceding chapter, the next problem is to consider how these costs and benefits can be valued. In this section attention is focussed on procedures that are used in the valuation of costs and benefits.

4.4.1 The use of consumer (producer) surplus and willingness to pay (WTP) in measuring private costs and benefits

Simply stated, consumer surplus[5] represents the excess of the amount a consumer is prepared to pay for a good or service (rather than go without it) over the amount he actually pays for it. On the other hand, a producer surplus represents the excess of the total earnings (revenue) of a supplier of a good or service over the payment he would require just to induce him to continue to supply the amount he currently does supply. Theoretically, the existence of the consumer and producer surplusses can be depicted as in Figure 4.1 below.

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5. The term 'consumer surplus' and a rigorous analysis of the concept was first put forward by Marshall (1930) in the Principles of Economics, although the French engineer Jules Dupuit (1844) first developed the idea in his analysis of the pricing of public services. A historical perspective on this notion is also given in Currie et al. (1971).

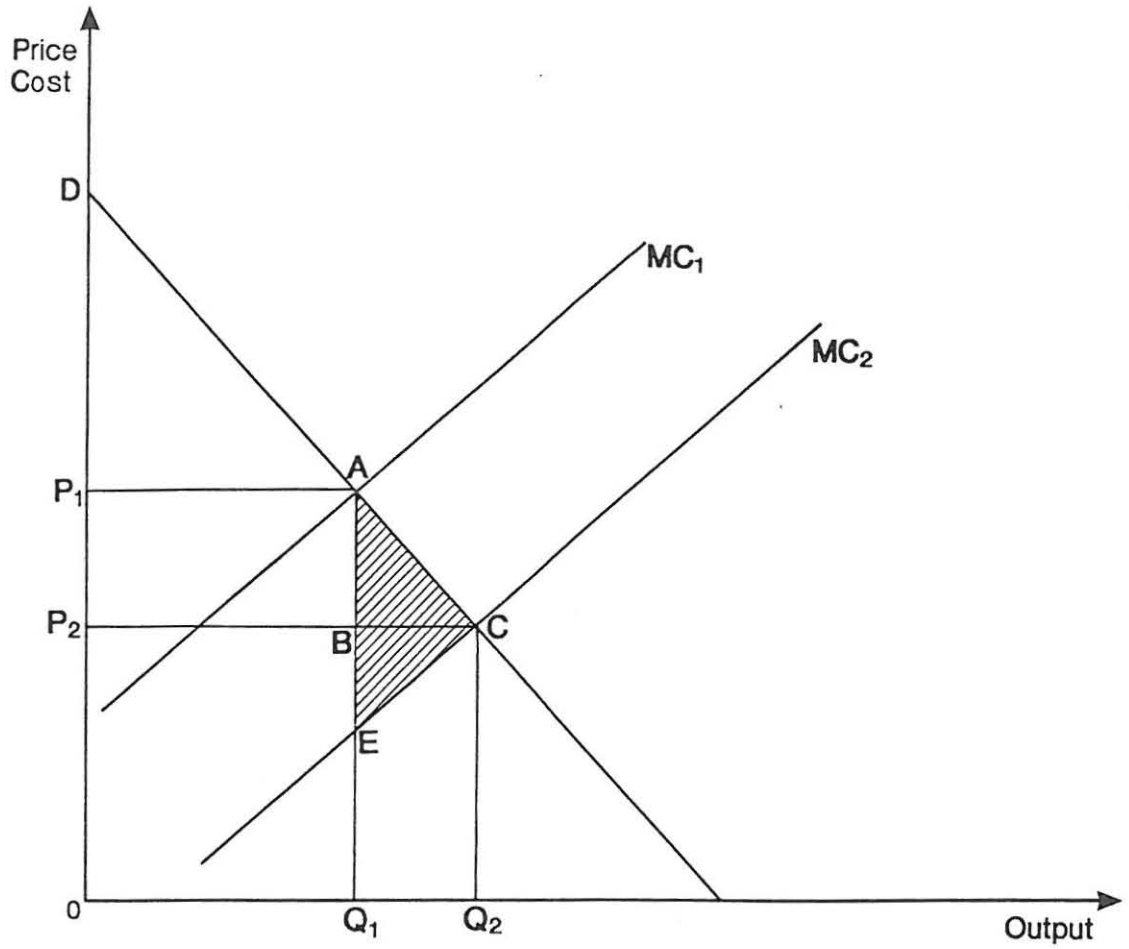

Figure 4.1 : ILLUSTRATION OF CONSUMER AND PRODUCER SURPLUSES.

In Figure 4.1, it is assumed for expositional purposes that an expansion of an existing project (e.g. electricity) has the effect of causing a shift in the supply curve to the right from MC_1 to MC_2, thereby leading to the lowering of price from P_1 to P_2 and an increase in production from Q_1 to Q_2. The total benefits to consumers arising from this change, computed as the WTP for increased output, must be equal to DOQ_2C, that is, the amount they actually pay (OQ_2CP_2) plus the total of the difference between what they are willing to pay (indicated by the demand curve) and what they actually pay, the triangle P_2DC. The total WTP when the price was at P_1 was OQ_1AD, so that the change in WTP is now Q_1Q_2Ca. Of this total, the portion Q_1Q_2CE is made up of extra costs such that the net WTP (benefits minus costs) is given by the shaded triangle ECA. The latter difference is conventionally defined to include both consumer surplus (triangle BCA) and producer surplus (triangle BCE).

These effects reflect a situation when the industry is under perfect competition. A different conclusion will, however, apply in the case of most other markets since marginal cost pricing always generates the highest net WTP, i.e. higher than average cost pricing or the monopoly price (Dasgupta and Pearce 1972, 104).

Electricity supply provides a particularly interesting application of this type of analysis in that it can be characterised as a natural monopoly. In this case the net WTP can be depicted as in Figure 4.2 below.

In Figure 4.2 the total WTP is AOQB, total cost is EOQB and net WTP is given by triangle AEB. Generally speaking this net WTP would have to be compared with the net WTP associated with alternative public projects before a decision can be reached as to which project should be chosen. On the other hand, when consideration is given to the question of how an existing service can be expanded under the above conditions of a natural monopoly, two solutions emerge.

The first possibility is to encourage greater capacity utilisation by means of marginal cost pricing via a subsidy as in Figure 4.3 below. Figure 4.3 shows an expansion of the service from OQ to OR via a subsidy (indicated by area HP_SFG). In the analysis, the total WTP is given by area AORF, total cost (including the subsidy) is HORG and the difference is, as before, the net WTP. The latter difference is by inspection seen to exceed area AEB. Ideally this increase in net WTP must, however, be larger than that associated with the best alternative before a decision can be reached to expand the service.

An alternative solution to expand the service of a natural monopoly may take the form of increased investment (or the creation of greater capacity). This decision would of course shift the cost curves (in Figures 4.2 and 4.3) downwards, thus leading to a greater net WTP than before.

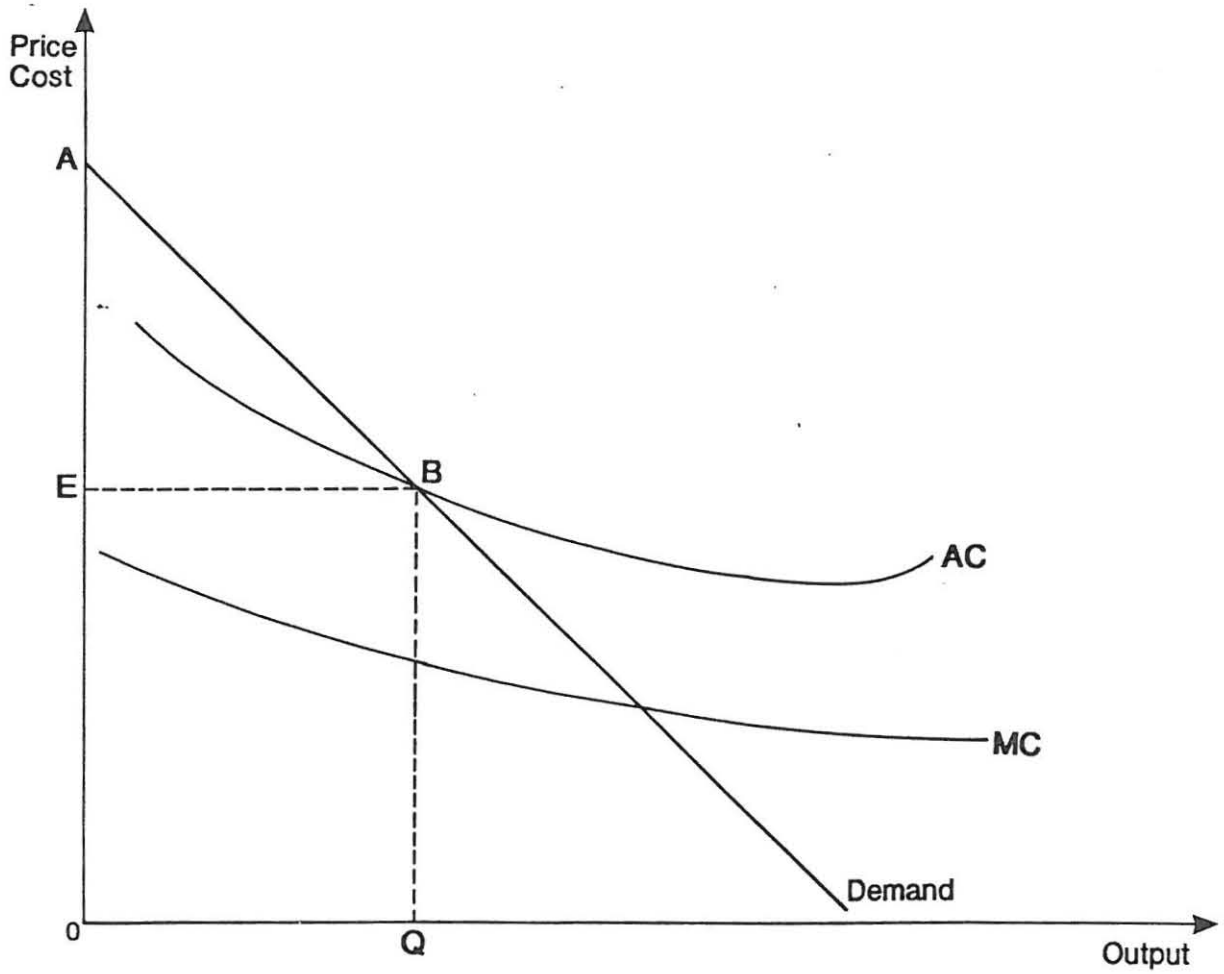

Figure 4.2 : NET WTP IN THE CASE OF A NATURAL MONOPOLY.

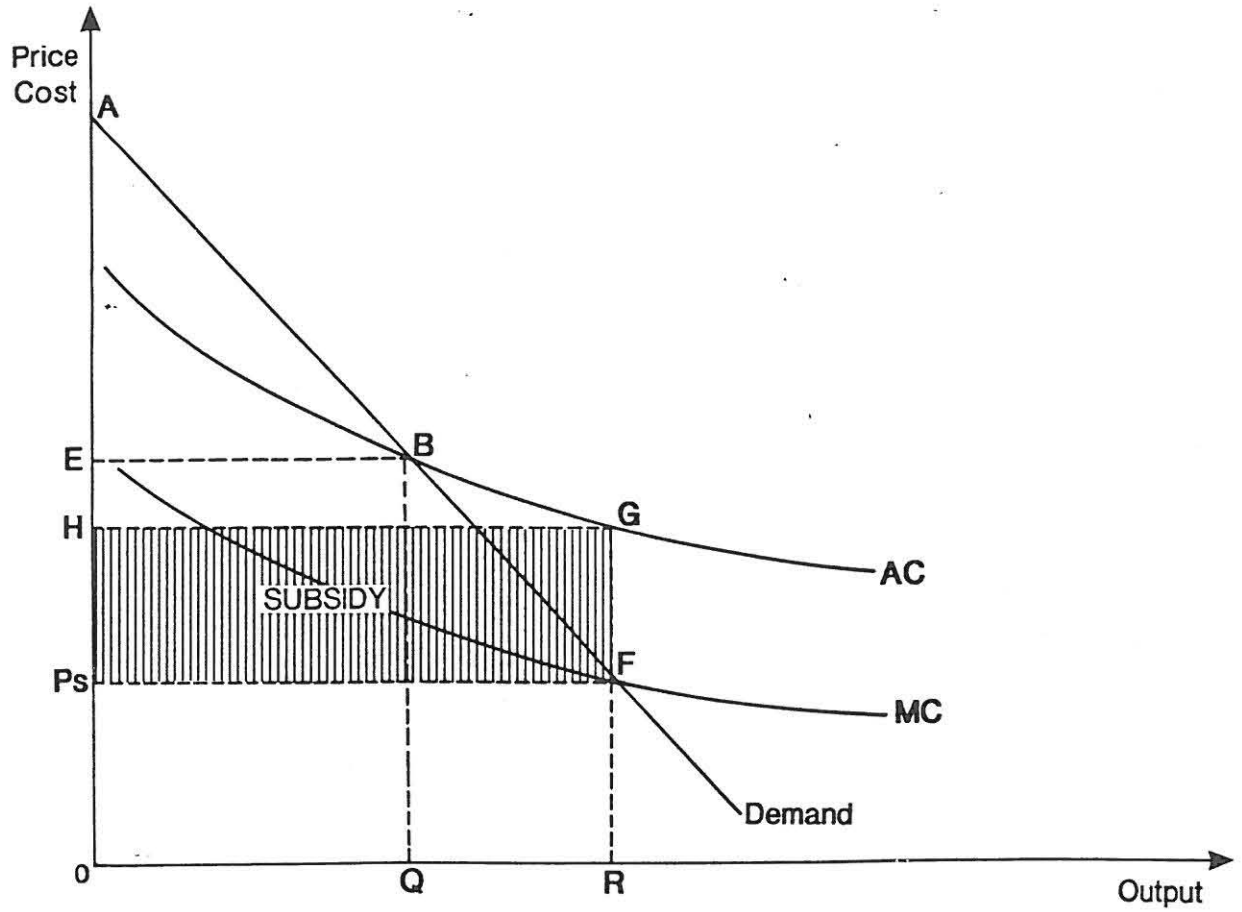

Figure 4.3 : NET WTP WHEN SERVICE IS EXPANDED.

4.4.2 Shadow prices

In CBA it is often suggested that the ideal set of prices used to value various benefits and costs should be Pareto-efficient based upon the perfectly competitive model.[6]

Thus, if it is believed that market or actual prices are Pareto-efficient, then they should be used to compute the value of benefits and costs of a project. On the other hand, if market prices are not Pareto-efficient or if they are non-existent as is the case for a large portion of public sector output, then shadow prices should be computed from the market price information in such a way that a better index for the promotion of efficiency is achieved.[7] The latter is the normal case because of the prevalence of widespread market failures and imperfections or distortions in the economy such as excessively high tariff barriers, politically inflated wages, monopoly profits, taxes, import duties and subsidies. In particular, the profit motive may predominate in the private sector thereby inducing monopolistic industries that are producing under conditions of economies of scale to set their prices above marginal cost. Furthermore, tariffs and taxes are often set for reasons other than to correct for market imperfections. They could, for instance, have been set alternatively as a means of raising revenue, to redistribute income or as an historical or institutional accident (Pearce and Nash 1981, 110). As a consequence of the above distortions, market prices normally would need to be adjusted before they are used in CBA calculations.

The technical literature on the derivation of shadow prices is voluminous and filled with disagreements.[8] As this thesis will only do formal calculations for private costs and benefits, in which prevailing prices are conventionally used, this technical literature will not be discussed any further.

4.4.3 The use of surveys in the case of external effects

There are essentially two situations in which market prices fail to exist. These are where externalities are present and in the case of public goods (Demsetz 1964; Thompson 1980; Coase 1960). In CBA, the analyst can value public goods and externalities in a number of ways, none of which is, according to Sassone and Schaffer (1978, 89), satisfactory. A common approach to this problem is to obtain information by means of questionnaires and from these determine relative prices for such goods (Prest and Turvey 1965, 697).

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6. Prominent in this regard are economic writers such as Bohm (1973, 92); Brown and Jackson (1987, 164); Louw (1982, 124); Sugden and Williams (1978, 99); De Wet (1975, 54) and Tisdell (1985, 23).

7. A shadow price is defined by Bannock et al. (1978, 406) as a price which is imputed as a true marginal value of a good and service or opportunity cost of a resource and which may differ from the market price.

8. Three references which ably demonstrate this are Little and Mirrlees (1974); Scott (1974) and Balassa (1974).

In the case of calculating the benefits of the project, a questionnaire should seek to elicit the consumers' willingness to pay for the benefit, and where the costs of the project are being measured, the objective should be to ascertain how much compensation the consumer would require in order to make him indifferent to the costs of the project as they affect him. The main problem associated with using questionnaires is that of the free-rider (a person who claims that he derives no benefit and thus leave it up to other individuals to make sure that the good is provided and duly paid for). An additional problem is that each person who opposes the electrification of a village or region may be motivated to exaggerate the costs of electrification, whereas each person who favours it may be motivated to understate these costs.

In view of the deficiency of using questionnaires as pointed out above, it is suggested by Sewell et al. (1961, 19) that in a CBA technique, only a qualitative description of the impact of public goods and externalities should be made when all other quantitative methods have failed.

4.5 TIME, DISCOUNTING AND INVESTMENT CRITERIA

All benefit-cost calculations involve the discounting of flows of income over time. For example, if one denotes the benefits received (the analysis is also applicable to costs) in any future year by B_t, where t refers to the year and if the project lasts for n years, then the present value of the benefits of the project is given by the sum of all annual benefits, each discounted to convert this annual total into present-value terms:

$$\text{Net present value of project benefits (NPV)} = B_0 + \frac{B_1}{1 + r_1} + \frac{B_2}{(1 + r_1)(1 + r_2)} + \dots + \frac{B_n}{(1 + r_1) \dots (1 + r_n)} \qquad 4.2$$

Using a more condensed notation and assuming for simplicity that the discount rate, r,is constant over all future periods, the standard equation for the NPV of a project becomes

$$NPV = \sum_{t=0}^{n} \frac{B_t}{(1 + r)^t} \qquad 4.3$$

where n is the life of the project, B_t is the expected net benefits from the investment, and $(1 + r)^t$ is the factor by which each net benefit (benefits minus costs) is discounted.

The calculation of discounted present values is facilitated by the availability of discount tables showing the value of

$$\frac{1}{(1 + r)^t}$$

i.e. the discount factor for any value of r and t.

4.5.1 Choice of the discount rate

The choice of a suitable discount rate with which future costs and benefits are to be discounted is one of the most important problems in the evaluation of investment projects. Two reasons are advanced for this importance. In the first place, if too low a discount rate is chosen, then socially inefficient projects will be undertaken. However, if too high a discount rate is chosen, then efficient projects may fail to clear the hurdle of acceptability. In the second instance, it is noteworthy that what is at stake when choosing a discount rate is not only the acceptance or rejection of specific projects, but also the allocation of resources between the public and the private sectors of the economy.

In traditional capital theory, a single discount rate equates the marginal rate of time preference (or MRTP) of savers with the marginal productivity of capital in investment.[9] However, CBA analysts have recently begun to recognise that in a mixed economy with market imperfections, no single discount rate can be taken as a measure of both time preference and the productivity of capital. In the face of these deficiencies, two types of discount rates have been advocated, namely the social opportunity cost of capital (SOCC) and the social rate of time preference (SRTP).[10]

The SOCC is a measure of the value to society of the next best alternative use to which the resources (funds) employed in the public project might otherwise have been put. In other words, it is the value to society of whatever it is that the project precludes (Henderson 1968). In a perfectly competitive world, the opportunity

9. The marginal rate of time preference or MRTP is defined as an individual's marginal rate of substitution between present and future consumption. On the other hand, the marginal productivity of capital is defined as the rate of transformation of investment opportunity, i.e. the marginal rate of transforming present for future consumption in production (Eckstein 1957; Feldstein 1964; Marglin 1963).

10. A detailed mathematical derivation of these two alternative approaches to the selection of a suitable discount rate is given by Pearce and Nash (1981, 145) and Pearce (1983, 40).

cost of these resources could be represented by the market interest rate. On the other hand, the SRTP assigns current values to future consumption, thereby reflecting society's evaluation of the relative desirability of consumption at different points in time. A social time preference function will reflect social ethics and judgements about future economic conditions and need not take the form of a constant discount rate.

In practice, the SOCC and SRTP are bound to diverge. This is because financial markets are not characterised by a single interest rate, but rather by several different rates. Other reasons that are advanced for the inequality of SOCC and SRTP include differences in risk, inadequate capital markets and the existence of externalities as well as the effects of direct taxation. As an example, it has to be noted that government projects tend to be riskless, not because they are individually subject to less risk than private-sector projects (often the reverse is the case), but because the sheer size of the public sector means that the risk per project is small because of the ability to 'pool' risks across many projects or across the many people who make up society. If risk in the private sector is positive, then the value of SOCC will be increased to reflect the 'risk premium'. In this way SOCC will diverge even further from SRTP (Bohm 1973, 110; Pearce 1983, 45). In view of this divergence, Brown and Jackson (1978, 171) have suggested that a reasonable way of proceeding is for a CB analyst to calculate a shadow price for the social opportunity cost of funds used in public sector investment and to include this in the discount rate calculation.

4.5.2 Investment criteria in the public sector

Once the costs and benefits of an investment project in a CBA technique have been measured and discounted at an appropriate rate of interest, what follows is a means of summarising the information so that the costs and benefits of alternative investments can be compared. There are three basic ways of presenting this information: (1) by means of a calculation of the net present value (NPV) of the investment, (2) by means of a benefit-cost ratio and (3) by calculating the internal rate of return (IRR) of the investment.

However since the NPV and the benefit-cost ratio are, according to Gittinger (1982), very straightforward to apply and are also the most commonly used methods in CBA, the IRR will not be discussed in this study.

The NPV criterion states that investments benefit the economy when the difference between discounted benefits and costs is positive. Mathematically, this would imply accepting the project if the NPV is greater than zero i.e. when

$$NPV = \sum_{t=0}^{n} \frac{B_t - C_t}{(1+t)^t} > 0 \qquad 4.4$$

which is analogous to the discounting equation presented in equation 4.3 except that the annual costs of the investment are subtracted in the numerator to give the present value of the net benefits of the project.[11] When there is more than one mutually exclusive project to choose from, the projects are ranked in terms of the present values of their net benefits and that project with the largest NPV is chosen provided, of course, that its NPV is positive. The principal problem associated with using the NPV method is, however, the determination of the appropriate discount rate.

The benefit-cost ratio advocates the maximisation of the benefit-cost ratio i.e. it shows the relation between the present value of the realised benefits and the present value of the realised costs by means of the formula

$$\frac{B}{C} = \sum_{t=0}^{n} \frac{B_t}{(1+r)^t} \Big/ \sum_{t=0}^{n} \frac{C_t}{(1+r)^t} \qquad 4.5$$

The decision rule regarding project investment is that projects are beneficial when their benefit-cost ratio is greater than 1 (criterion of exclusion). Furthermore, the projects with the highest ratio are preferred. Like the NPV method, the main disadvantage of the benefit-cost ratio is that of choosing an appropriate discount rate.

4.6 DISTRIBUTION, UNCERTAINTY AND RISK[12]

In any conventional CBA of public projects, there is a frequent need to consider the distributional impact of a project and to allow for risk and uncertainty.

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11. In infrastructure investments, e.g. electricity supply, Georgi (1973, 15) has asserted that it is practical to assume that C contains only costs which are directly related to the project, e.g. repair, capital and maintenance costs.

12. Since these distribution and risk uncertainty issues are not considered in this study, a discussion on their major properties will not be attempted in this section.

In assessing the distributional impact, two schools of thought are identifiable in most of the literature on CBA, namely the cardinal and ordinal approaches.[13] Both, however, arrive at the same conclusion: that unless some prior value judgements are made about the distributional impact of the project, very little can be said without considerable qualification about alternative economic situations.

As far as the question of risk and uncertainty is concerned, it is asserted by most observers that the future stream of benefits and costs, particularly for projects with effects far into the future such as the supply of electricity, is not known with complete certainty. In fact not even effects in the immediate future, that is the investment costs of projects, can always be known with certainty. As a result several approaches are employed in most CBA calculations to allow for risk and uncertainty.[14]

4.7 OTHER CONSTRAINING CONSIDERATIONS IN CBA

Investment decisions in CBA are always subject to a number of diverse constraints that should be satisfied before a project can be chosen. Such constraints may be usefully classified into a number of categories (Henderson 1965, 144):

To begin with, physical constraints restrict choices to what is technically feasible. For example, in the case of a hydropower project, the topography often limits the range of choice. In some cases, legal rights may prohibit some developments. Administrative constraints may prevent the selection of certain courses of action which involve excessive complexity or too drastic a change in existing practice. Political constraints may affect the freedom of choice of governments. For example, if benefits and costs of the project are not equitably divided among different political jurisdictions or states, this may lead certain regions to over-rule the project. In addition, labour scarcity constraints are very important at the project planning stage. For example, it is of limited value to embark on a massive infrastructural project if the skilled personnel necessary to execute the project do not exist.

However, in respect of its relevance to CBA, perhaps the greatest limiting factor is that of finance. Financial constraints may set limits on the amounts that can be spent by public enterprises or agencies over some specified period, including both the initial cost and annual operating costs. These constraints need to

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13. For a detailed discussion on the redistributive effects of a project, see McGuire and Garn (1960) and Pearce and Nash (1981).

14. Several approaches to allowing for risk and uncertainty have been suggested by Pearce (1983); Marglin (1967); Fisher (1973); Arrow and Lind (1970); Menges (1974) and Graham (1981).

be communicated to the analyst at the start of the CBA to enable the exclusion of alternatives that obviously are not feasible. Of major importance in CBA, however, is that where these constraints exist, both the form which they assume and the underlying reasons for imposing them should be made explicit. They should not be taken for granted or accepted without question.

PART THREE: APPLICATION - THE COSTS AND BENEFITS OF ELECTRIFICATION IN VENDA

Invariably, the application of general principles to practical cases permits the relevance of theories to be tested and refined. In this section, an attempt is made to realise the objectives of the present study as set out in the Introduction - using in most instances, the basic principles that were established in Parts One and Two. The chief aim is to outline the nature of the private and external costs and benefits involved in the electrification project in Venda, and to point out where further research is necessary to achieve quantification of the factors discussed.

Since the incidence and nature of certain electrification costs and benefits can only be ascertained from individual households, it was deemed necessary to survey the population of Makwarela township and its peri-urban settlement of Lufule-Tshisele. To this end, a questionnaire (Appendix A) was designed with the main objective of identifying those private and external costs and benefits which need to be accounted for in analysing the role of electricity supply in the process of development in Venda. Accordingly, Chapter 5 is devoted to a brief discussion of the data collection and processing procedures employed in the survey and Chapter 6 presents a detailed summary of the survey results.

CHAPTER 5

BACKGROUND TO SECURING INFORMATION AND PROCESSING

5.1 DATA COLLECTION

Empirical research into economic phenomena typically makes use of information collected and published by government bodies or research institutions. Frequently, however, the type of data required does not exist in published form, thus necessitating the direct collection of information through fieldwork. Unquestionably, the types of information sought from respondents constitute a major influence on how the information is collected (Moser and Kalton 1986, 240). From the point of view of social research, the major types of information fall into the following six categories: behaviour, attitudes and opinions, socioeconomic and psychological traits, intentions, knowledge and motivation. With the exception of psychological traits, economic research may require all the abovementioned information and this study is no exception.

The selection of the most appropriate way of data collection rests on a number of universally applicable criteria. Schoner and Uhl (1976, 8) have briefly captured these criteria as follows:

> "... In attempting to collect information from respondents, investigators must strive to acquire sufficiently accurate and unambiguous information at appropriate costs and within specified time limits".

This has equal application to all aspects of research - if poor data is collected, poor conclusions will be forthcoming. No matter what the basic design of the research is, it is necessary to collect accurate data to achieve useful results. Given these criteria and the physical constraints imposed upon the researcher, he or she must choose specific means of seeking information.

In essence, there are two basic ways of collecting survey data, namely by asking questions and by observing (Crimp 1985, 33). "Questioning", as the name suggests, is distinguished by the fact that data is collected by asking questions of people who are thought to have the desired information. Questions may be asked in person or in writing. On the other hand, when data is collected by observation, researchers ask no questions. Instead, they keep track of the objects or actions in which they are interested. No matter what research design is used, the necessary data must be collected by one or both of these two methods. Under most circumstances, "observational" data is more expensive to obtain than questioning. Strictly speaking, direct observation of attitudes, intentions, motivations, knowledge and traits is impossible. According to

Boyd et al. (1977, 133), these deficiencies render "observation" not entirely objective, and consequently methods of "questioning" remain the only feasible way of gathering information.

Three different methods of communication with questionnaires are available, namely personal interviews, by telephone and by mail. Each of these methods suffers from various drawbacks and none is superior in all situations (Churchill 1979, 1984). Under most circumstances, the best way to assess the advantages and disadvantages of these techniques is by applying a set of criteria such as those proposed by Tull and Hawkins (1984, 133), namely informational control, sample control and administrative control.

In the first instance, the criterion of informational control centres on the complexity, volume and accuracy of the information sought. With respect to the complexity of the information required, it is argued, for obvious reasons, that the more complex the information required of the respondent, the stronger the case for personal interviews. In addition, personal interviews are deemed most suitable in cases where a large quantity of information is required.

The criterion of sample control focusses on two constituent elements: that of deciding how the universe should be defined and the sample drawn. Obviously none of the techniques possesses any special advantage in this respect. The chief differences between the three methods of communication arise from the actual procurement of information from the sample. The problem here is twofold, primarily that of non-response, but also that of ensuring that the person who provides the information is actually the intended respondent. It is widely held that personal interviews are the most effective with regard to both aspects.

In the final analysis, the dual requirements of limited time and minimum cost are the principal constituents in administrative control. When time is considered the crucial variable, the telephone survey is the obvious means of communication and personal interviews are the most time-consuming method (Davies 1976, 132). Moreover, the high cost of field interviewing tends to be the primary influence in making personal surveys the most expensive of the three methods. It is generally found that telephone surveys rank second in terms of cost per respondent, while mail surveys remain the least expensive method.

Despite the drawbacks outlined above, most notably the cost factor, the personal interview is in principle considered the most desirable means of communication for the purpose of the present study. Stringent precautions have been taken to overcome these drawbacks through proper planning, adequate training and supervision. In short, it is felt that in this particular study, none of the above disadvantages presents any valid reason for rejecting the personal interview as the soundest method of communication. Also, the nature of the information sought (i.e. external benefits and costs) suggests that personal interviews may be preferable to both mail and telephone interviews.

5.2 THE USE OF PILOTING

Piloting plays a vital part in questionnaire development, but too often it consists of just getting interviewers to conduct a few interviews to see if the questionnaire "works". Simply using a questionnaire will reveal the most obvious ambiguities and incongruities as the informant is likely to ask questions or give answers that clearly indicate obvious inconsistencies.

In this study, the pilot survey consisted of two stages, namely what may be termed an "internal" phase and subsequently the actual pre-testing of a group from the population in areas other than those of the target regions. During the initial period, draft copies of the questionnaires and a letter covering instructions for fieldworkers were given to academics and civil servants for comment. Modified versions of the documents were then prepared for use during the first pilot study proper. The respondents for the pilot study were chosen at random from Shayandima (a residential urban township) and Itsani (a peri-urban area situated near Shayandima), both of which resembled the study areas very closely.

On the basis of the feedback from respondents during the first pilot study, certain changes were made to some of the questions. The major problem with the questionnaire was that not all the variables needed for computing the costs and benefits had been included. A second pilot study of the questionnaire in its modified form was subsequently conducted in other sections of Shayandima and Itsani. Almost all of the alterations made during this second pilot study were of a minor linguistic nature and none of the questions required more drastic redrafting. The most striking feature is that the two pilot studies provided the opportunity of familiarising the interviewers with the field of study and the research requirements. Moreover, the average time taken to complete the questionnaire was determined and found to be about twenty minutes. A final questionnaire was then drawn up, and it was felt that this final version was in the best possible form to collect the required information.

The final questionnaire (Appendix A) was divided into four parts. The first section dealt with general information about the interviewer including the date and the time taken to complete the interview. The second and third sections focussed upon the household profile as reported by the head of the household. Questions dealt with the respondent's position in the household, sex, age, educational level passed, present employment and income sources, household size and the number of rooms in the house/homestead. To all these questions, the respondent could only give an explicit response or had to select a particular option from a series of alternatives. The series of options listed included the category "other", in case the respondent's answer fell into none of the categories listed.

The final section of the questionnaire attempted to establish whether respondents would prefer to use electricity rather than other alternative sources of energy. The respondents were required to specify the

types and cost of fuel they use in their houses/homesteads, the electrical appliances they now have and those they plan to buy. At this stage it was felt necessary to require the respondents to rank statements about the direct and indirect benefits of electricity usage in terms of their importance in the households. In sum the information required was essentially descriptive and questions could be categorised or set out in tabular form as well as being open-ended.

5.3 SAMPLING TECHNIQUES FOR THE MAIN SURVEY

In order to undertake the main survey, a sketch map of the Lufule-Tshisele area and a site plan of Makwarela township were required. These were obtained from the relevant authorities. The population size in both areas was also established. This was vital for the sample selection and choice of sampling method. Accordingly, in an attempt to obtain a representative unbiased sample, random sampling tables were used as the means of selecting the cases for study. To this end, a sample of 6% was drawn for each area. Prinsloo (1982, 31) and Preston-White (1982, 44) maintain that a sample of more than 5% is suitable for making assumptions about the population being studied. Thus 90 households in Makwarela and 29 households in Lufule-Tshisele were visited.

5.4 DATA COLLECTION AND PROCESSING

Training (before the actual fieldwork) allowed fieldworkers to become familiar with the questionnaires and with the meaning of the questions. Cross-checks facilitated considerable control over fieldworker performance. All questionnaires were checked for completeness and accuracy by the author. The survey was carried out in August 1988 by a team of five male fieldworkers. Sample addresses were marked on the maps of the Makwarela and Lufule-Tshisele areas. Every fieldworker was allocated a portion of the map each day, together with a list of addresses. This was to avoid the possibility of going to the wrong dwelling.

Despite the satisfactory nature of the completed questionnaires, the survey did encounter several problems. Firstly, the work and school boycotts in protest of the ritual murders in Venda caused a few problems in the field. In particular, adequate supplementary fieldwork and the clarification of apparent irregularities and errors incurred during the main survey could not be completed. Secondly, the interviews had to be conducted in the evenings during the week, at a time which unfortunately coincided with meal times. As the fieldworkers all worked full time, it was difficult to obviate this problem. In addition, some respondents, especially those in single parent matrilineal households and members of the police unit, seemed reluctant to respond. Finally, elderly illiterate people could not supply their age and were uncertain about dates. In response to this problem, a list of significant local historical events was drawn up to aid fieldworkers.

On the other hand, it is noteworthy that the usual problems of refusals and poorly completed questionnaires (i.e. filled in so badly as to be rendered useless) were not encountered. Considerable effort was, in fact, taken to ensure that the fieldworkers understood the questions so that the possibility of misinterpretation on the part of respondents was reduced. Fieldworkers were also instructed not to encourage guesses, and to call back for information not known at the time of the interview. There may have been some deliberate provision of incorrect information although fieldworkers were advised to gain the confidence of the respondent and to explain carefully the confidentiality of the data. There was no language barrier because all the fieldworkers were fully conversant in Venda. In addition, they were reasonably familiar with the contents of the questionnaires.

Respondents in the survey were questioned about the satisfaction of their day to day energy needs. Depending upon the issue in question, the respondents acted as spokespersons for themselves or the entire household of which they were members. Questions were asked in such a way that the responses elicited, if answered accurately, could be considered as objective assessment of energy fulfillment by the entire household.

Once the survey had been completed, a computer package of statistical analysis, namely the Business Management Data Processing (BMDP) package was used to analyse the data. In practice, this computer package often enables the social researcher to carry out a wide range of statistical procedures and to manipulate research data. Simple descriptive statistics such as means, standard deviations, standard errors, coefficients of variation, extreme values and frequencies were used to bring order to the raw data and to construct the relevant tables and histograms. The results of the survey are summarised in the next chapter.

CHAPTER 6

COSTS AND BENEFITS OF ELECTRICITY SUPPLY IN VENDA: SURVEY FINDINGS

6.1 INTRODUCTION

This chapter presents a detailed description of the data of the survey conducted in Venda. Essentially it is hoped that this description will assist in the identification of private and external costs and benefits of electrification that need to be accounted for in analysing the role of electricity supply in the process of development in Venda. However, before an interpretation of the survey results can be made, it is deemed necessary to present a brief account of conditions that were found to exist in the survey areas.

To begin with, it is essential to note that all houses (some 1 489 in August 1988) in Makwarela township already have access to electricity, although not everyone makes use of this service. Those individual households who do not have electricity either cannot afford the high connection and other installation charges, have houses presently under construction or have had their supplies cut off through defaults on the payment of electricity bills. In these instances, households are forced to rely on other fuels such as gas, wood, coal, candles and paraffin.

In the Lufule-Tshisele area, few people have electricity. A visit to the area revealed that less than fifteen households out of about 480 in August 1988, including all existing business outlets, had access to electricity. Most of these are situated close to the main road and the existing power line that has been erected in the area.

6.2 BASIC TRENDS

6.2.1 Income

A number of basic trends were evident from the research results. As far as income levels were concerned, it appeared that households in the Makwarela area earned or received an average income of R729,06 per month while those in the Lufule-Tshisele area earned or received a monthly average of R496,89 (Figures 6.1 and 6.2 overleaf). The low income figure in the Lufule-Tshisele area is consistent with the survey's finding that the majority of households in the area were headed by females who were either not employed

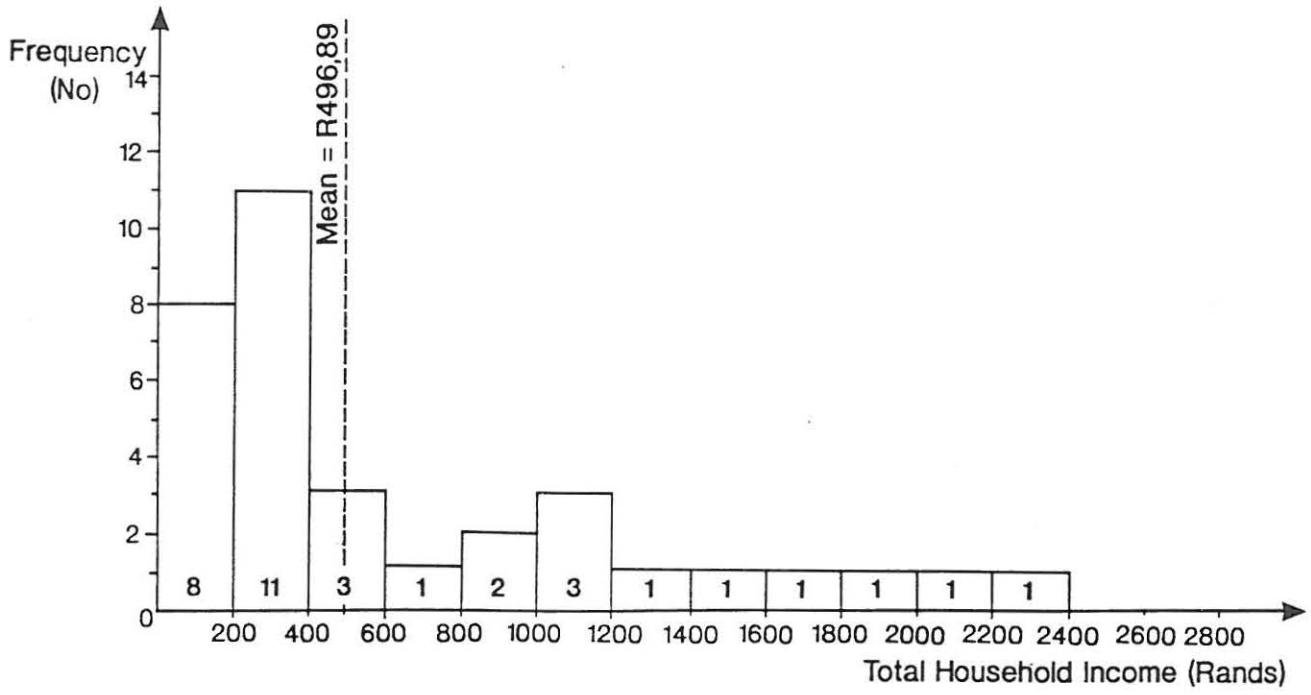

Figure 6.1: DISTRIBUTION OF HOUSEHOLD INCOME IN LUFULE-TSHISELE, AUGUST 1988.

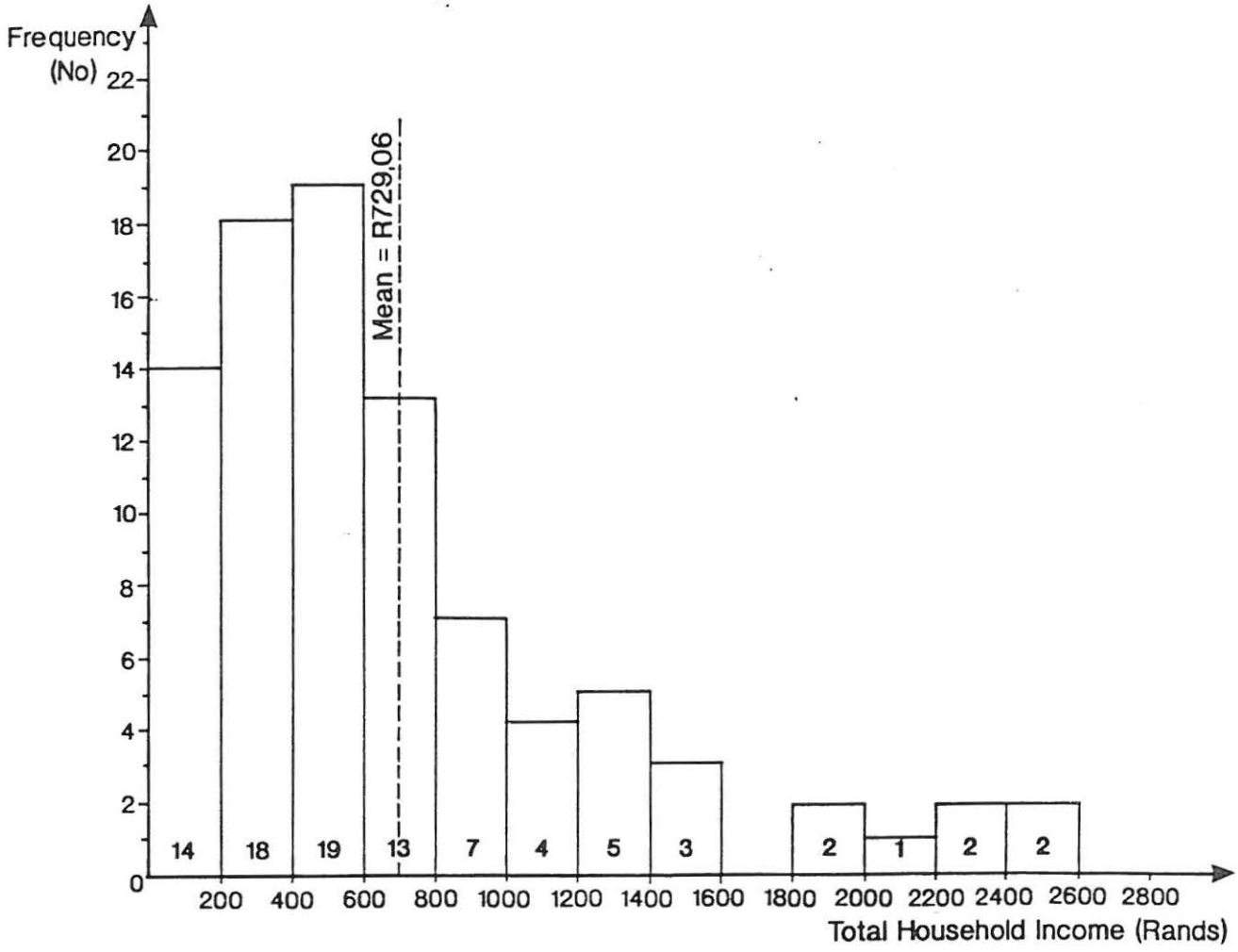

Figure 6.2: DISTRIBUTION OF HOUSEHOLD INCOME IN MAKWARELA, AUGUST 1988.

at all, or were informally employed. Accordingly, these families were found to be heavily dependent on monthly remittances from the household head/father who was usually employed as a migrant labourer in the neighbouring urban areas. Furthermore, a higher percentage (about 73%) of households in the Lufule-Tshisele area was found to be earning below R600,00 per month as opposed to a low figure (about 57%) recorded in the Makwarela area.

6.2.2 The extent of energy usage

Wood, paraffin and candles constituted the most commonly used fuels in the Lufule-Tshisele area. Wood and paraffin were predominantly used for cooking and heating purposes while candles and to a lesser extent, paraffin were largely utilised for lighting purposes. Different trends were apparent in Makwarela where electricity was observed to account for the major share of domestic energy consumption. This broad use of electricity for all household chores was not surprising as all households already have access to it.

Most of the wood consumed in the two areas is bought from vendors, though in the Lufule-Tshisele area it can also be collected from the nearby bush. It appeared that the use of wood and other fuels such as coal was a function of marketing and their availability through vendors. Nine of the households interviewed in the two areas also had small petrol driven generators. Another feature was the prevalence of dry cell batteries as well as car batteries in the Lufule-Tshisele area. These were used mostly to power radios and/or television sets. Car batteries were, however, allowed to run completely flat before being carried to the nearest service station in Thohoyandou town for recharging.

6.2.3 Electricity

An overwhelming majority (about 92%) of the community in the two areas would prefer to use electricity for household chores such as cooking, heating and lighting rather than its substitutes. The remaining 8% of those interviewed stated that they would not prefer electricity due to perceived cost implications. In spite of the overwhelming desire for electricity services, only about 61% of those interviewed in the Makwarela area were found to be utilising electricity and had already paid the deposit fee that all domestic consumers - whether living in or using government-owned property or not - are required to pay before being connected.[1] In the Lufule-Tshisele area, only one household of those interviewed was found to be making use of electricity services. Generally speaking, the slack use of electricity by households in the two areas can be related to the willingness to pay concept introduced in Chapter 4. In this instance, it appeared from the survey that households perceived private costs of electricity to exceed private benefits and as a result, they were not prepared to pay for the service. This trend was confirmed by the fact that many respondents in the

1. Before October 1988, the deposit fee for electricity charged by the Venda Electricity Corporation (VEC) used to be R120,00. This amount has since been raised to R145,00.

two areas did not own many electrical appliances (see Table 6.1), particularly those households in the Lufule-Tshisele area where electricity was not readily available. As a result, it was not surprising to note that many respondents in the two areas were found to own a substantial proportion of non-electrical appliances (see Table 6.2), notably those that are useful for cooking, heating and lighting purposes such as paraffin stoves and lamps.

Those who had not yet paid the mandatory deposit fee and were thus ineligible to use the electrical services gave obvious reasons for not doing so, such as a lack of funds and the fact that their houses were "presently under construction". Generally speaking, these two reasons are acceptable as they form part of the main determinants of household demand. In practice, even if large subsidies are offered on electricity rates, electrical appliances and their running costs can still be expensive for a low income family. Furthermore, it is often those families seeking better housing who are likely to want electricity (Jansen 1988, 3). In other words, an important fact to consider is that some kind of solidity or permanence in house structure is an important indicator of the likely demand for electricity. In addition, the extent to which electricity is used tends to increase with proximity to the modern sector both in geographical sense as well as in terms of the amount of contact individuals have had with this sector.

6.3 COSTS AND BENEFITS OF ELECTRICITY

Having outlined the main features of the survey findings in the preceding section, it is now appropriate to identify and evaluate the relative importance of some of the private and external costs and benefits of electricity vis-à-vis those associated with alternative sources of energy. However, for the purpose of the present study, the ensuing discussion will concentrate only on those findings that are considered relevant. Accordingly, an attempt will be made to distinguish between the various private and external effects as defined in Chapter 4.

6.3.1 Benefits

As far as the various benefits are concerned, the survey indicated a strong preference for electricity to alternative forms of energy; in other words, respondents tended to place a much higher value on both the private and external benefits associated with electricity.

6.3.1.1 Private benefits

There was general agreement amongst the respondents that electricity was a more convenient and safer service capable of providing much greater comfort than alternative fuels. Users of electricity pointed out that its plug-in capability was a source of much convenience because it enabled them to carry out household

TABLE 6.1: POSSESSION OF ELECTRICAL APPLIANCES: LUFULE-TSHISELE AND MAKWARELA AREAS, AUGUST 1988

	NUMBER WHO OWN ELECTRICAL APPLIANCES		PERCENTAGE WHO OWN ELECTRICAL APPLIANCES		NUMBER WHO DO NOT OWN ELECTRICAL APPLIANCES		PERCENTAGE WHO DO NOT OWN ELECTRICAL APPLIANCES	
	Lufule Tshisele	Makwarela	Lufule Tshisele	Makwarela	Lufule Tshisele	Makwarela	Lufule Tshisele	Makwarela
ELECTRICAL APPLIANCES								
Refrigerator	4	41	13,8	45,6	25	49	86,2	54,4
Dishwasher	-	2	-	2,2	29	88	100,0	97,8
Kettle	2	34	6,9	37,8	27	56	93,1	62,2
Freezer	-	5	-	5,6	29	85	100,0	94,4
Washing machine	-	1	-	1,1	29	89	100,0	98,9
Power tools	1	4	3,4	4,4	28	86	96,6	95,6
Sewing machine	1	3	3,4	3,3	28	87	96,6	96,7
TV	6	46	20,7	51,1	23	44	79,3	48,9
Stove	1	45	3,4	50,0	28	45	96,6	50,0
Hi-fi	7	31	24,1	34,4	22	59	75,9	65,6
Radio	6	34	20,7	37,8	23	56	79,3	62,2
Iron	2	50	6,9	55,6	27	40	93,1	44,4
Heater	1	40	3,4	44,4	28	50	96,6	55,6
Geyser	1	21	3,4	23,3	28	69	96,6	76,7

TABLE 6.2: POSSESSION OF NON-ELECTRICAL APPLIANCES: LUFULE-TSHISELE AND MAKWARELA AREAS, AUGUST 1988

	NUMBER WHO OWN NON-ELECTRICAL APPLIANCES		PERCENTAGE WHO OWN NON-ELECTRICAL APPLIANCES		NUMBER WHO DO NOT OWN NON-ELECTRICAL APPLIANCES		PERCENTAGE WHO DO NOT OWN NON-ELECTRICAL APPLIANCES	
	Lufule-Tshi-sele	Makwa-rela	Lufule-Tshi-sele	Makwa-rela	Lufule-Tshi-sele	Makwa-rela	Lufule Tshi-sele	Makwa-rela
NON-ELECTRICAL APPLIANCES								
Gas heater	1	5	3,4	5,6	28	85	96,6	94,4
Gas stove	5	38	17,2	42,2	24	52	82,8	57,8
Gas lamp	1	8	3,4	8,9	28	82	96,6	91,1
Gas geyser	-	-	-	-	29	90	100,0	100,0
Paraffin stove	19	53	65,5	58,9	10	37	34,5	41,1
Paraffin lamp	22	36	75,9	40,0	7	54	24,1	60,0
Paraffin heater	1	8	3,4	8,9	28	82	96,6	91,1
Paraffin refrigerator	2	4	6,9	4,4	27	86	93,1	95,6
Kettle	25	75	86,2	83,3	4	15	13,8	16,7
Wood stove	1	1	3,4	1,1	28	89	96,6	98,9
Coal stove	2	14	6,9	15,6	27	76	93,1	84,4
Oil stove	-	-	-	-	29	90	100,0	100,0
Iron	23	55	79,3	61,1	6	35	20,7	38,9
Hi-fi	2	11	6,9	12,2	27	79	93,1	87,8
Radio	28	44	96,6	48,9	1	46	3,4	51,1
Sewing machine	4	11	13,8	12,2	25	79	86,2	87,8

tasks more rapidly than before and save much time and effort in the process. This contrasted sharply with the round trip of about 3,3 kilometres which residents had to complete previously in order to collect firewood in the Lufule-Tshisele district (see Table 6.3 on the time and distances involved in gathering alternative sources of energy). Many respondents in this area complained of the growing shortage of firewood and the resultant increase in the length of journey. They also mentioned the necessity to go out when ill, or in rain, and even at the risk of falling victim to ritual murder or being attacked by wild animals in the woodlands. Likewise, gas cylinders and car batteries were reportedly cumbersome to handle.

Respondents generally perceived electricity to provide better lighting, heating and personal security than other energy forms. Household heads in Makwarela stated that the introduction of electricity had significantly improved health conditions and reduced the risk of damage to personal property. They also felt that electricity was an important means of improving the educational standards of individual users within the household. These advantages can be viewed as private benefits which accrue to the individual users of electricity themselves.

6.3.1.2 External benefits

(a) Technological

As far as technological external benefits were concerned, a consumer-to-consumer linkage emerged from the survey. Respondents who are using electricity in their homes mentioned that the quality of family life as well as that of friends and relatives had considerably improved by adequate heating and better lighting. Specifically, respondents in Makwarela indicated that the presence of a television set in the home was an important focal point of entertainment not only for the family but also for visiting relatives and friends. The security of neighbours and passers-by was also seen to have improved as a result of electric lights installed outdoors.

It was also evident from the survey that certain producer-consumer external benefits arose from electrification. Street lighting was considered to have contributed to a significant drop in the number of criminal acts in the Makwarela area. Respondents also mentioned that the introduction of electricity made it easier to organise and attend social events such as wedding receptions, funeral night vigils and meetings at the community centre and churches in the evening. Given the structure of urban township societies, this is arguably one of the most important and neglected external benefits of electrification.

(b) Pecuniary

In addition to the above technological external benefits, electricity may also give rise to certain pecuniary external benefits which exceed those associated with alternative energies. A comprehensive programme of

TABLE 6.3: AVERAGE DISTANCE, TIME AND NUMBER OF TRIPS INVOLVED IN FUEL CONSUMPTION: LUFULE-TSHISELE AND MAKWARELA AREAS, AUGUST 1988*

FUEL USED	MOST COMMON METHOD USED TO FETCH FUEL		DISTANCE PER RETURN TRIP IN KILOMETERS		TIME PER RETURN TRIP IN MINUTES		NUMBER OF TRIPS PER MONTH	
	Lufule-Tshi-	Makwa-rela	Lufule-Tshi-	Makwa-rela	Lufule-Tshi-	Makwa-rela	Lufule-Tshi-	Makwa-rela
Wood	walk	walk	3,3	5,9	3h 19m	1h 02m	1	1
Coal	-	walk	-	2	-	22,5m	-	1
Paraffin	walk	walk	7,5	4,1	1h 09m	41,7m	1	1
Gas	walk	walk	7,6	4,2	43m	44,8m	1	1
Candles	walk	walk	5,1	3,7	1h 01m	39,2m	1	1

* Table 6.3 takes into account the distance, time and number of trips covered in cases where respondents had to walk only. If other methods used to fetch fuel had been considered (e.g. own car, delivery van, etc.), the figures for the time taken would have been smaller than those indicated in the table, but, of course, all of these alternatives are costly. The choice to walk seems to indicate that the cost of the time used in walking is less for the residents than the cost of alternative transport arrangements.

electrification is likely to boost both the demand for and supply of electrical appliances such as television sets, refrigerators, smoothing irons and stoves, and ultimately also the demand for productive inputs used in these industries. The introduction of electricity may likewise encourage existing industries and business enterprises to expand their operations, or induce new ones to establish themselves in the area, thus creating new job opportunities for the unemployed and underemployed. Similarly, to the extent that electricity improves the health and education standards of individual users, it may ultimately generate positive spillover effects on other consumers and producers alike.

6.3.2 Costs

Turning now to the various costs involved, the following survey highlights emerged.

6.3.2.1 Private (monetary) cost

The survey found that the private (or monetary) cost of electricity far exceeded the corresponding costs of alternative energy sources. The average amount spent on energy requirements (including wood, paraffin, gas and candles) by those households that did not use electricity in the Lufule-Tshisele and Makwarela areas came to R20,57 and R21,71 per month respectively (see Table 6.4). This compared with an average amount of R53,77 spent on electricity (not including the deposit fee of R145,00 and other standard electricity charges indicated in Table 6.5) by the remaining households in the two areas. These findings clearly contradict Rivett-Carnac's (1979, 9) assertion that the introduction of electricity in domestic consumption usually reduce energy bills to a considerable extent. The contrary appears to be true of Lufule-Tshisele and Makwarela where the additional costs due to electrification amounted to R33,13 and R32,06 per month respectively. Small wonder, then, that all individual users in the two areas indicated that they would prefer to pay a lower monthly electricity bill ranging between R15,00 and R45,00 because they were, at present, utilising it at great cost to themselves.

6.3.2.2 External costs

As far as external effects were concerned, certain technological costs of a consumer-consumer and consumer-producer nature were found to be significant in the case of alternative energy sources but virtually non-existent in the case of electricity. Respondents in both areas mentioned the constant high risk of damage and injuries to others in the form of open fires. In one extreme case, a respondent in the Lufule-Tshisele area recounted how a gas fire once set his house ablaze and in the process completely gutted an adjacent resident's two thatch-covered houses. Several gutted houses in the Lufule-Tshisele area bore testimony to the danger that open fires and gas stoves may pose to people and property. Individual users of

TABLE 6.4: AVERAGE MONTHLY HOUSEHOLD FUEL EXPENDITURE: LUFULE-TSHISELE AND MAKWARELA AREAS, AUGUST 1988

	EXPENDITURE (RANDS)		AVERAGE PERCENTAGE OF HOUSEHOLD INCOME (%)		RANGE OF EXPENDITURE (RANDS)	
	Lufule-Tshisele	Makwa-rela	Lufule-Tshisele	Makwa-rela	Lufule-Tshisele	Makwa-rela
FUEL USED						
Wood	9,68	4,98	1,94	0,68	0-50	0-80
Coal	-	1,13	-	0,15	-	0-33
Paraffin	7,31	8,03	1,47	1,10	0-20	0-50
Gas	1,79	6,32	0,36	0,86	0-30	0-45
Candles	1,79	1,25	0,36	0,17	0-15	0-15
Electricity	-	53,77	-	7,37*	-	0-265

* This figure corresponds well with the 7,74% recorded in a survey undertaken in 1984 in a range of Cape Town suburbs (Eberhard 1984, 2).

TABLE 6.5: ELECTRICITY STANDARD CHARGES FOR DOMESTIC AND INDUSTRIAL USERS IN VENDA

VENDA ELECTRICITY CORPORATION
STANDARD CHARGES (RANDS) - 1989

	URBAN		RURAL	
	1 Phase	3 Phase	1 Phase	3 Phase
Connection fee	100	300	120	400
Re-connection fee	30	30	30	30
Meter test fee	25	45	25	45
Meter test fee MD1	-	60	-	60
Special meter reading at consumer's request	10	10	10	10
Inspection of existing installation (e.g. extensions)	30	45	30	45
Re-inspection of a new installation	30	30	30	30
Call-out fee (when it is found that the fault was on the consumer's side)	30	30	30	30

Deposits: Before being connected all consumers must pay a power account deposit selected from the table below to suit the type and size of load.

Tariff C	Domestic	R145,00	(R20,00 down plus R10,00/month)
Tariff B	10 kV.A	R230,00	
	16 kV.A	330,00	
	20 kV.A	510,00	
	30 kV.A	730,00	
	40 kV.A	960,00	
	50 kV.A	1 420,00	
	75 kV.A	2 100,00	
	100 kV.A	2 790,00	

alternative energy fuels all indicated that smoke pollution emitted from coal and wood fires was a constant danger to the health of the community.

In addition to the above effects, there are other external costs associated with alternative energy sources that need to be identified. The excessive use of woodfuel is, of course, usually accompanied by the more serious problem of deforestation. More specifically, the excessive cutting of wood by individuals and the consequent use of substitutes such as dung and other waste materials means that other users now have to contend with greater shortages and longer distances in search of wood. At the same time, farmers (producers) in the area have to contend with lower soil fertility, dwindling crop yields and a scarcity of livestock feed, all of which can be partly attributed to the use of wood and other hazardous sources of energy.

6.4 COST-BENEFIT CALCULATION

Having outlined the numerous costs and benefits pertaining to electricity and alternative sources of energy in the preceding section, this part is devoted to a quantification of the private costs and benefits relating to electricity. This quantification is deemed necessary because of the policy implications that are envisaged from the above survey findings. However, before this calculation can be made, two essential points need to be considered. In the first place, it should be noted that, unlike in conventional CBA where a cost-benefit assessment is directed at (or relates to) some well-identified project or programme per se, the present study focusses, as indicated in the introductory chapter, on costs and benefits of various kinds that accrue to users or consumers of electricity in Venda. This specific focus is necessitated by the fact that Venda has an already well-established electricity supply institution - the Venda Electricity Corporation Ltd.[2] In this regard, the cost-benefit calculation presented here is directed at determining the social desirability of extending the supply of electricity in Venda - and not the evaluation of some proposed new system.

In the second place, very few of the costs and benefits identified in the previous section can be quantified and incorporated into a standard CBA. In particular, procedures involved in the valuation of external costs and benefits of any public project are both complicated and controversial at best, and, as noted earlier in chapter 4, many economists have argued that the most sensible possibility should be to mention these

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2. The Venda Electricity Corporation (VEC) was established on 1 April 1987 as a fully autonomous, self-accounting, self-financing and legally licensed body corporate. It is responsible for the administration, management and handling of all aspects regarding the procurement and distribution of electricity in Venda. In particular, it has taken over assets of Eskom within Venda which form part of the existing interconnected system and has assumed responsibility to negotiate loans with the Industrial Development Corporation (IDC) of South Africa and with the Development Bank of Southern Africa (DBSA) in respect to a new transmission system that thas been erected to supply electricity to Venda.

external effects in a qualitative manner.[3] Consequently, a similar qualitative procedure will be followed in this study. Nevertheless, it is considered essential here to examine the case of private costs and benefits which may at least facilitate further qualitative discussion. A private cost-benefit table is thus computed in Table 6.6.

6.5 APPRAISAL OF FINDINGS AND POLICY IMPLICATIONS

In our illustrative example presented in Table 6.6, it is evident that the private costs of electricity consumption are equal in value at least to private benefits. The reason for this equality is that the survey sample of electricity users had paid installation charges, must carry maintenance charges and also paid monthly charges and had not - by defaulting on payments - had themselves cut off from the service. In view of this, it was presumed that their private benefits were equal in value to all charges. Essentially, however, it should be borne in mind that no attempt was made to include external benefits to electricity consumption due to invidious valuation problems.[4] The argument here is that since the survey results reveal that these additional benefits tip the scale, then if they were easily calculable and included in the calculation, benefits would presumably exceed costs. This conclusion would, in a general economic sense,suggest that increased consumption of electricity should be encouraged through a lower tariff. Expansion or extension of electricity supply would now imply simply increased consumption (and generation) of electricity as a result of lower tariff - whether with given generation capacity or increased capacity (in the long-run).

In essence, however, the survey work makes it clear that there are a number of additional factors which are important enough to warrant consideration in assessing the social desirability of extending the supply of electricity in Venda.

In the first place, the survey indicated that the private (or monetary) cost of electricity was much higher than the corresponding cost of alternative energies. This may be partly related to the "public utility" character of Venda Electricity Corporation. The latter is reported to be a decreasing cost industry which has to set its price equal to average cost in order to break even.[5] Secondly, most of the respondents felt that the external costs of alternative energies were very considerable indeed, but that no such costs existed in the case of electricity. Finally, there was general agreement amongst the respondents that both the private and

3. A detailed discussion on external effects affecting infrastructural projects is given by Sewell et al. (1961, 19) and Little and Mirrlees (1974, 348).

4. As already mentioned in Section 6.3.2.2, the survey results indicated that external costs were virtually non-existent in the case of electricity but were found to be significant in the case of alternative energy sources.

5. Personal communication with the chief executive and the public relations divisions of the Venda Electricity Corporation.

TABLE 6.6: ANALYSIS OF COSTS AND BENEFITS OF ELECTRICITY PERTAINING TO RESPONDENTS FOUND UTILISING THE SERVICE IN THE LUFULE-TSHISELE AND MAKWARELA AREAS, AUGUST 1988

	COSTS										BENEFITS								
Year	Instal-lation Costs	Mainte-nance Costs	Monthly Payments	Gross Costs	Discount factor 8%	12%	15%	Present worth 8%	12%	15%	Benefits to be received	Discount factor 8%	12%	15%	Present worth 8%	12%	15%
t_1	R127 385	R11 315	R43 177,31	R181 877,31	,926	,893	,870	R168 418,39	R162 416,44	R158 233,26	R181 877,31	,926	,893	,870	R168 418,39	R162 416,44	R158 233,26
t_2	0	11 315	47 102,52	58 417,52	,857	,797	,756	50 063,82	46 558,76	44 163,65	58 417,52	,857	,797	,756	50 063,82	46 558,76	44 163,65
t_3	0	11 315	47 102,52	58 417,52	,794	,712	,658	46 383,51	41 593,27	38 438,73	58 417,52	,794	,712	,658	46 383,51	41 593,27	38 438,73
t_4	0	11 315	47 102,52	58 417,52	,735	,636	,572	42 936,88	37 153,54	33 414,82	58 417,52	,735	,636	,572	42 936,88	37 153,54	33 414,82
t_5	0	11 315	47 102,52	58 417,52	,681	,567	,497	39 782,33	33 122,73	29 033,51	58 417,52	,681	,567	,497	39 782,33	33 122,73	29 033,51
t_6	0	11 315	47 102,52	58 417,52	,630	,507	,432	36 803,04	29 617,68	25 236,37	58 417,52	,630	,507	,432	36 803,04	29 617,68	25 236,37
t_7	0	11 315	47 102,52	58 417,52	,583	,452	,376	34 057,41	26 404,72	21 964,99	58 417,52	,583	,452	,376	34 057,41	26 404,72	21 964,99
t_8	0	11 315	47 102,52	58 417,52	,540	,404	,327	31 545,46	23 600,68	19 102,53	58 417,52	,540	,404	,327	31 545,46	23 600,68	19 102,53
t_9	0	11 315	47 102,52	58 417,52	,500	,361	,284	29 208,76	21 088,73	16 590,58	58 417,52	,500	,361	,284	29 208,76	21 088,73	16 590,58
t_{10}	0	11 315	47 102,52	58 417,52	,463	,322	,247	27 047,31	18 810,44	14 429,13	58 417,52	,463	,322	,247	27 047,31	18 810,44	14 429,13
t_{11}	0	11 315	47 102,52	58 417,52	,429	,287	,215	25 061,12	16 765,83	12 559,77	58 417,52	,429	,287	,215	25 061,12	16 765,83	12 559,77
t_{12}	0	11 315	47 102,52	58 417,52	,397	,257	,187	23 191,76	15 013,30	10 924,08	58 417,52	,397	,257	,187	23 191,76	15 013,30	10 924,08
t_{13}	0	11 315	47 102,52	58 417,52	,368	,229	,163	21 497,65	13 377,61	9 522,06	58 417,52	,368	,229	,163	21 497,65	13 377,61	9 522,06
t_{14}	0	11 315	47 102,52	58 417,52	,340	,205	,141	19 861,96	11 975,59	8 236,87	58 417,52	,340	,205	,141	19 861,96	11 975,59	8 236,87
t_{15}	0	11 315	47 102,52	58 417,52	,315	,183	,123	18 401,52	10 690,41	7 185,36	58 417,52	,315	,183	,123	18 401,52	10 690,41	7 185,36
t_{16}	0	11 315	47 102,52	58 417,52	,292	,163	,107	17 057,92	9 522,06	6 250,67	58 417,52	,292	,163	,107	17 057,92	9 522,06	6 250,67
t_{17}	0	11 315	47 102,52	58 417,52	,270	,146	,093	15 772,73	8 528,96	5 432,83	58 417,52	,270	,146	,093	15 772,73	8 528,96	5 432,83
t_{18}	0	11 315	47 102,52	58 417,52	,250	,130	,081	14 604,38	7 594,28	4 731,82	58 417,52	,250	,130	,081	14 604,38	7 594,28	4 731,82
t_{19}	0	11 315	47 102,52	58 417,52	,232	,116	,070	13 552,87	6 776,43	4 089,23	58 417,52	,232	,116	,070	13 552,87	6 776,43	4 089,23
t_{20}	0	11 315	47 102,52	58 417,52	,215	,104	,061	12 559,77	6 075,42	3 563,47	58 417,52	,215	,104	,061	12 559,77	6 075,42	3 563,47
t_{21}	0	11 315	47 102,52	58 417,52	,199	,093	,053	11 625,09	5 432,83	3 096,13	58 417,52	,199	,093	,053	11 625,09	5 432,83	3 096,13
t_{22}	0	11 315	47 102,52	58 417,52	,184	,083	,046	10 748,82	4 848,65	2 687,21	58 417,52	,184	,083	,046	10 748,82	4 848,65	2 687,21
t_{23}	0	11 315	47 102,52	58 417,52	,170	,074	,040	9 930,98	4 322,90	2 336,70	58 417,52	,170	,074	,040	9 930,98	4 322,90	2 336,70
t_{24}	0	11 315	47 102,52	58 417,52	,158	,066	,035	9 229,97	3 855,56	2 044,61	58 417,52	,158	,066	,035	9 229,97	3 855,56	2 044,61
t_{25}	0	11 315	47 102,52	58 417,52	,146	,059	,030	8 528,96	3 446,63	1 752,53	58 417,52	,146	,059	,030	8 528,96	3 446,63	1 752,53
TOTAL	R127 385	R282 875	R1 173 637,80	R1 583 897,80	10,675	7,843	6,464	R737 872,41	R568 593,45	R485 020,91	R1 583 897,80	10,675	7,843	6,464	R737 872,41	R568 593,45	R485 020,91

i) a) All computations in Table 6.6 are based on the survey findings as well as on information on electricity charges outlined in Table 6.5.

b) Calculations are made only for individual users of electricity in the Makwarela and Lufule-Tshisele areas. In the survey, these users comprised only 61% of the respondents. This can be calculated as follows:

61% x no. of respondents = $\frac{61}{100}$ x 119

= 72,59 or

= 73 individual users.

ii) The t_{25} period is used for illustration purposes. It is, however, based on the contention made by Gittinger (1980, 87) that the economic life to be used in computing costs and benefits of infrastructural projects should be about 20 to 25 years because, due to discounting, returns beyond 25 years are alleged to make no difference in the evaluation of such projects.

iii) Project costs

a) Figures used for computing maintenance and some of the capital costs are those pertaining to a single (or 1 Phase) supply system outlined in Table 6.5. In Venda, the 1 Phase system is often used to relay power to housing and small business premises.

b) Installation costs comprise of the following components:

Connection fee x no. of individual users:	R100 x 73 =	R7 300
Deposit fee x no. of individual users:	R145 x 73 =	R10 585
Wiring costs x no. of individual users:	R1 500 x 73 =	R109 500
	Total	R127 385

The wiring costs amount varies according to the size of the premise. The above amount of R1 500 is an estimated figure charged for a 6-roomed house by authorized wiring operators who are registered with the Venda Electricity Corporation (VEC). This figure was obtained from the Public Relations office at VEC.

c) The maintenance costs are items 2 to 7 or all the other standard charges except the connection fee in Table 6.5. For our illustrative purposes, it is assumed that each of items 2 to 7 in Table 6.5 may affect every household using electricity once a year. Thus maintenance costs

= standard charges except connection fee x no of users
= R155 x 73
= R11 315.

d) The monthly payment amounts are computed as follows:

t_1: R53,77 (monthly average) x 11 months x 73 = R43 177,31, assuming for illustrative purposes that individual users will devote the first month of t_1 to all initial connection work.

t_2 to t_{25}: R53,77 x 12 months x 73 = R47 102,52.

e) Gross costs = Installation costs + maintenance + monthly payments.

iv) The discount factor

Although there is an arbitrary element in settling for an appropriate discount rate in most practical cases, Gittinger (1980, 61) recommends that the opportunity cost of capital in the society which is in the neighbourhood of about 8% to 15% should be used in underdeveloped countries. For our computations we will assume discount rates of 8%, 12% and 15% to indicate cases where individual users of electricity rank future consumption lowly, averagely and highly, respectively. A convenient set of Compounding and Discounting Tables for Project Evaluation published by the Economic Development Institute of the World Bank was used to compute these discount rates.

v) Benefits to be received

Calculating the willingness to pay (WTP) from the survey findings was a problem. This was because respondents indicated their willingness to pay amounts that were far less than even their monthly average payments of R53,77. However, since our sample of electricity users had paid installation charges, must carry maintenance charges and also paid monthly charges and had not - by defaulting on payments - had themselves cut off from the service, it was presumed that their private benefits were equal in value at least to all charges (i.e. installation, maintenance and monthly payments). This can be calculated as follows:

Benefits to be received	=	Installation Costs	+	Maintenance Costs	+	Monthly Payments

external benefits derived from electricity were much greater than those associated with alternative energies. As far as the external benefits from electricity are concerned, it was possible to identify several technological externalities of a consumer-consumer and producer-consumer kind, as well as certain pecuniary externalities which can be expected to boost incomes and employment not only in the Venda region, but also in towns and cities elsewhere in Southern Africa.

The situation as regards electricity supply in Venda can be illustrated with the aid of Figure 6.3. The supplier is, as mentioned before, reported to be a natural monopolist experiencing decreasing costs and setting price equal to the average (social) cost of production. It thus supplies OQ units of electricity at price OP in Figure 6.3. As a first step towards piecemeal optimization (Wallis, 1984), the authorities might consider setting the price of electricity equal (or close) to marginal cost by means of an appropriate subsidy - that is, point C in Figure 6.3. However, this would imply that the marginal social benefit exceeds marginal social cost by the distance BC. It may therefore be justifiable to match marginal social cost and benefit by means of a unit subsidy equal to HG, in which case the price paid by consumers would be OF and quantity supplied OR, while the supply authority would be breaking even at point H.

As already mentioned in Chapter 3, there are, however, several problems associated with the practical implementation of a subsidy scheme. The state may have to levy or increase taxes elsewhere in the economy in order to raise the revenue necessary to pay for the subsidy. Such a tax hike will reduce the disposable incomes of taxpayers and change the distribution of income and may also have an adverse effect on productivity levels in the economy as a whole. In addition, the public utility may be less inclined to minimise costs and maintain an acceptable level of X-efficiency under a subsidy scheme (Leibenstein, 1978) while the administration of the scheme itself may impose additional costs on the community.

Alternatively, the supply authority might consider a multi-part pricing scheme which discriminates between consumers in accordance with the quantity of the service they consume. In the example of Figure 6.3, a price of OP could thus be charged for all units consumed up to OQ and a lower price OF for additional units, and so on. The basic intent of such a scheme is, of course, to capture for the supplier a portion of the surplus that would otherwise go to consumers. Of more importance, however, is the fact that a multi-part tariff may enable the economy to reach the optimal point W (in Figure 6.3) at little or no cost to the taxpayer.

But price discrimination is rarely desirable and often not feasible. Its major drawback is that it tends to discriminate against the small consumer who may well choose to forego the service if the fixed price charged for initial units has to be very high. Likewise, multi-part tariffs often require sophisticated metering devices, extensive computation and administration as well as additional manpower which may significantly

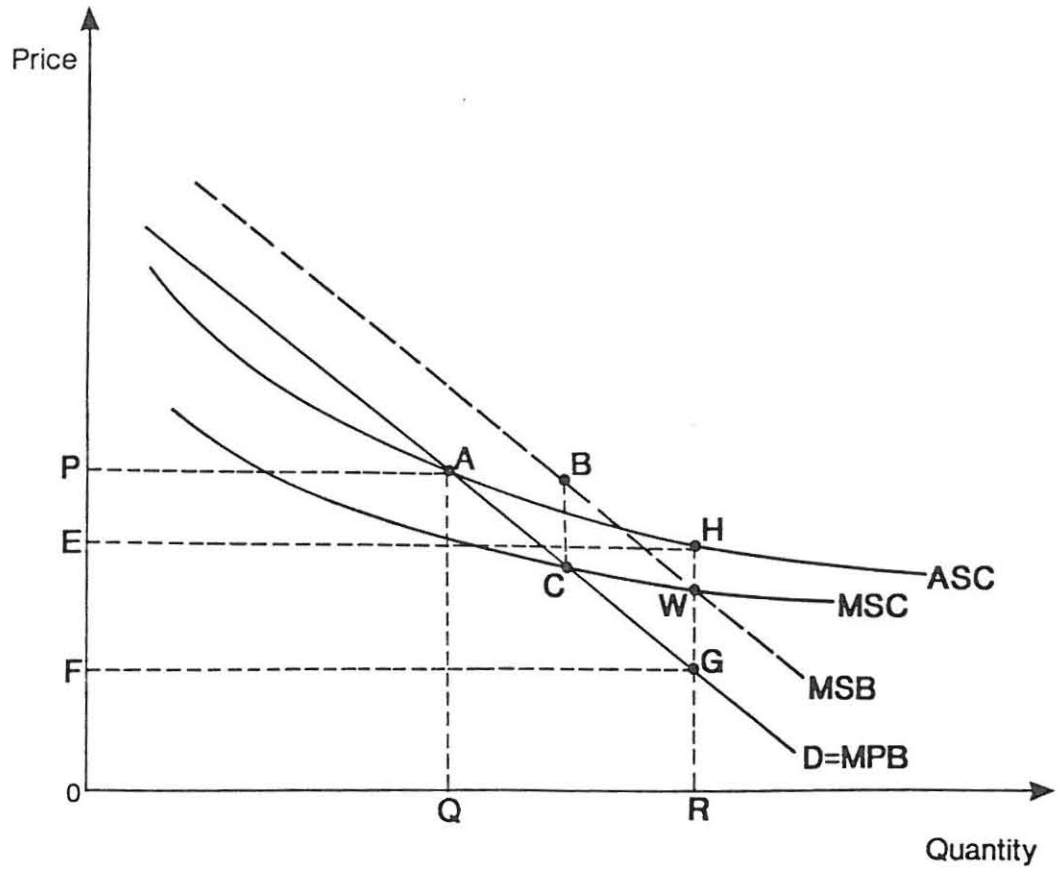

Figure 6.3: THE EFFECT OF A SUBSIDY IN THE PRESENCE OF EXTERNAL BENEFITS

add to the cost of the service. It may therefore be necessary to combine a multipart tariff with an appropriate subsidy in order to provide a cost-effective and efficient system of electrification.

On the whole, the Venda survey seems to suggest that an economic case can indeed be made for involving the broader community in subsidising the supply of electricity in Makwarela and Lufule-Tshisele. This may be achieved either by a subsidy paid for by the South African or Venda governments, or by means of cross-subsidisation within the Eskom organisation itself. While such a subsidy can perhaps be justified on distributional grounds alone, and more specifically in terms of the rapid and pronounced effect it is likely to have on the quality of life in the area, its real worth lies in the fact that it may confer certain external benefits on the community. These include increased levels of production and employment in the Venda region, an improvement in health conditions and the creation of an environment conducive to furthering education and schooling amongst the consuming public.

Some of these externalities are likely to have a profound effect on producers and consumers outside Venda, and it therefore seems reasonable to argue that the required subsidy should be paid for by both the Venda and South African governments. But this does not mean that the subsidy should become a permanent feature of public policy in Southern Africa: to the extent that it does boost the earning capacity of the users of electricity, the need for it will ultimately disappear. It should therefore do what a subsidy is supposed to do - that is, provide temporary assistance in situations where markets fail.

CHAPTER 7

SUMMARY AND CONCLUSIONS

In Chapter 1, the objectives of the study were outlined which were believed to be generally applicable to electricity supply in a developing country. In the subsequent chapters, the general theoretical background of economic development, electricity supply and public utilities was given with an emphasis on the description of the objectives of economic development and the characteristics of public utilities. This was followed by a general overview of cost-benefit analysis which, in particular, incorporated an identification of the private and external costs and benefits of electrification. The general approach was then applied to electricity supply in two small areas in Venda which has only recently established an authority to develop the region's electricity supply system. Particular attention was given to the affordability of electricity to consumers, the replicability of a possible supply as well as the sustainability of an electrification project.

The study found that with the exception of the cost implications to consumers, electricity supply is an important commodity to a community in a developing region in as far as it possesses many private and external benefits over its substitutes. It was pointed out that electricity is important for essential household chores such as cooking, heating and lighting, and convenient in that it saves time and improves the standard of living. The plug-in capability was perceived as a source of great convenience to the household as is the continuity of supply. As well as its contribution to the development and improvement of social life, electricity was found to be an essential commodity for the overall development of a community. To this end, it was concluded in the study that if a government considers that encouragement of electrification is advantageous to a country in the same way as other development policies, then there is every reason for it to subsidise expansion of the system.

However, expansion has to take into account changing environmental conditions. It should be compatible with the political and social characteristics of the community, and economically viable within the wider sphere of economic development. Patterns of development in other regions under similar conditions may be used as guidelines for expansion, but need to be adapted to the specific environment, objectives and strategy of an electricity supply utility. The supply utility should also consider the suitability to the development of the region of the technologies it introduces and supports. Furthermore, expansion of the electricity system will create a demand for technical staff, and plans for specific training should accordingly

be incorporated into any proposals to extend electricity supply in areas where there is a shortage of trained personnel as is the case in Venda.

The general validity of the conclusions reached in this study would, however, have to be refined further before they could be experimentally tested, but it is hoped that this study will act as an input for more generalised conclusions regarding the role of electricity supply in the broader context of development. Based on this consideration and in order to fully realise the impact as well as the benefits of electrification in Venda, the following recommendations are made:

7.1 If significant participation in an electrification scheme is to be achieved, a new approach for the provision of more affordable electrical energy should be investigated. This recommendation is made because the present direct private electricity costs to consumers are considered to be high relative to those pertaining to alternative sources of energy. As a result of this constraint, it is feared that electrical energy will rapidly become beyond the reach of a broad spectrum of consumers in Venda. Since this would deprive people of access to a modern lifestyle and other benefits of electrification, a package should be assembled to suit consumers with an income of as low as R500-00 per month. In the survey findings, it emerged that the present charges are already beyond the means of a significant number of consumers.

7.2 The consumer awareness programme that brings the advantages of electricity to the notice of the Venda consumer and which is currently being undertaken by the marketing division of the Venda Electricity Corporation (VEC), should be vigorously intensified. To this end, the media could be of much assistance. At the same time, several pilot projects providing details of perceptions, preferences and affordability levels concerning the use of electrical energy could be included as a part of the consumer awareness programme. Such pilot projects may greatly facilitate the determination of the replicability of the project in Venda.

7.3 VEC should continue to negotiate for more loans with the Industrial Development Corporation (IDC) and the Development Bank of Southern Africa (DBSA) with a view to developing existing and new systems to suit the challenges of Venda.

7.4 The VEC should be significantly expanded to cater for the present high demand for electrical energy, the inspection of installations, the connection of houses, the reading of meters and the general maintenance of the scheme. This will, undoubtedly assist in ensuring the sustainability of the project.

APPENDIX A - QUESTIONNAIRE

CONFIDENTIAL

RHODES UNIVERSITY

DEPARTMENT OF ECONOMICS

COST-BENEFIT ANALYSIS QUESTIONNAIRE - 1988

INTRODUCTION

The purpose of this questionnaire survey is to identify those private and social costs and benefits which need to be accounted for in analysing the role of electricity in the process of development in Venda.

INSTRUCTIONS TO INVERVIEWER

Fill in answer which best describes the respondent's opinion or mark correct block with cross (X).

A GENERAL

1. Case number ☐☐

2. Name of fieldworker _____

3. Date _____

4. Time at beginning of interview _____

   Time interview completed _____

B HOUSEHOLD PROFILE (as reported by the de facto head* of the household**)

5. What is your position in the household?

Household head/father	☐
Household head/mother	☐
Grandparent	☐
Relative	☐
Child	☐
Other (specify)_____	☐

---

* A de facto head of household is a person who stays in the house/homestead permanently, who makes day-to-day decisions and is in charge.

** A household is defined as a group of persons sharing a common table, and consequently contributing to a common budget. This includes lodgers, family members and relatives.

6. Complete the table for the household head (who is living at home)

Sex (M/F)	Age (years)	Educational Level (std passed)	Formal Employment			*** Informal Employment			Pension and other grants	
			Yes/ No	If yes, type and place of employment	Earnings in rands per month contributed to household	Yes/ No	If yes, type and place of employment	Earnings in rands per month contributed to household	Yes/ No	If yes, amount in rands per month contributed to household

*** The informal sector involves a wide diversity of activities and an individual can be involved in one or more forms of non-wage money making. Informal sector activities include:

a) Services provided from peoples' homes such as motor mechanics, herbalists, builders, barbers, tailors, dressmakers, evangelists, etc.

b) Making things to sell such as clothes, mats or food, or selling fruit or vegetables from your garden.

c) Buying things from shops or wholesalers to sell in smaller quantities.

d) Running shackshops or shebeens in their houses.

C DEMOGRAPHICS OF OTHER HOUSEHOLD MEMBERS

7. Do any other members of your household receive a regular income? Yes ☐
(e.g. from work, pensions, disability grants, maintenance grants, etc. No ☐

8. If answer is YES to Question 7, complete the following table for both those living at home and migrants

				Formal Empoyment		Informal Employment		Pension and other grants
First Name	Relation to household head	Sex (M/F)	Educational level (std passed	Type and place of employment	Earnings or remittances in rands per month contributed to household	Type of Activity	Earnings or remittances in rands per month contributed to household	Amount in rands per month contributed to household
1.								
2.								
3.								
4.								
5.								
6.								
7.								
8.								

9. How many people are living permanently in this household? ☐☐

10. How long has the household lived at

    a) Makwarela? (years) _____

    b) Lufule? (years) _____

11. Where did the household live before? _____

12. How many rooms are there in your house/homestead? _____

D· TYPES OF FUEL USED BY THE HOUSEHOLD

13. Do you want electricity? Yes ☐ No ☐

    Explain why:

_____

_____

_____

_____

_____

14. Have you already paid the deposit fee for electricity? Yes ☐ No ☐

15. If answer is NO to Question 14, give reason

_____

_____

_____

16. If answer is YES to Question 14, how much have you paid?

R _____

17. What deposit fee would you be prepared to pay for electricity

R _____

18. Are you still using electricity in your house? Yes ☐ No ☐

19. If answer is NO to Question 18, give reason

_____

_____

_____

_____

_____

20. What fuel do you use for the following purposes?

	COOKING				HEATING (water, space)				LIGHTING			
	Al-ways	Of-ten	Sel-dom	Never	Al-ways	Of-ten	Sel-dom	Never	Al-ways	Of-ten	Sel-dom	Never
Wood												
Coal												
Dung												
Paraffin												
Gas												
Electricity												
Candles												
Other (Specify)												

21. Complete the table

Fuel Used	**** Where fuel is obtained e.g. hawker, veld, forest	Cost in rands per month	Who fetches fuel? Give first name	How fetched e.g. bus car, cart, walk, etc.	Distance per return trip in kms	Time per return trip in minutes	No. of trips per month
Wood							
Coal							
Dung							
Paraffin							
Gas							
Electricity							
Candles							

**** In the case of electricity, please indicate if fuel is obtained from:

- powerlines supply (government) - G
- own generators - OG
- batteries (e.g. car batteries) - B

22. What electrical appliances do you now have in your house?

Refrigerator	
Dishwasher	
Kettle	
Freezer	
Washing machine	
Power tools, e.g. vacuum cleaner	
Sewing/knitting machine	
TV	
Stove	
Hi-fi	
Radio	
Iron	
Heater	
Geyser	
Other	
(specify) _____	

23. If you had electricity, what appliances would you buy?

Refrigerator	
Dishwasher	
Kettle	
Freezer	
Washing machine	
Power tools, e.g. vacuum cleaner	
Sewing/knitting machine	
TV	
Stove	
Hi-fi	
Radio	
Iron	
Heater	
Geyser	
Other	
(specify) _____	

24. Do you own any of the following non-electrical appliances?

Gas heater	
Gas stove	
Gas lamp	
Gas geyser	
Paraffin stove	
Paraffin lamp	
Paraffin heater	
Paraffin refrigerator	
Kettle	
Wood stove	
Coal stove	
Oil stove	
Iron	
Hi-fi	
Radio	
Sewing/knitting machine	
Other (specify)	
_____	
_____	
_____	
_____	

25. Rank the following six statements about the direct benefits of electricity usage in terms of importance to your household.

Please note that there are no right or wrong answers. What is important, is the respondent's opinion. Simply rank 1 to 6 with 1 = most important and 6 = least important.

Statements

To have light in the house (e.g. for studying)	
To have light to improve the security of the home	
To provide heat in the house	
To have electricity for cooking facilities	
To have hot water from geyser	
To have electricity for other appliances (e.g. hi-fi, TV, vacuum cleaner)	

26. Rank the following four statements about the indirect benefits of electricity usage in terms of importance to your household.

Statements

To reduce the risk of fire	
To have street lights	
To start your own business (knitting, sewing)	
Other (specify) _____	

27. Has any member of your household experienced any loss to property or personal injury due to accidents cause by:

	Yes	No
Gas		
Paraffin		
Wood		
Candles		
Electrical appliances		
Coal		
Dung		

28. If answer is YES to Question 27, explain and state if you made a claim:

_____

_____

_____

_____

THANK YOU FOR YOUR CO-OPERATION.

ANY OTHER COMMENTS:

_____

_____

_____

_____

INSTRUCTION TO FIELDWORKERS

1. Questionnaires must be filled in at the addresses printed on the cover of the questionnaire.

2. All the fieldwork will be checked. If dishonesty is established, the fieldworker concerned will be dismissed immediately without payment for the work he has already done.

3. When you arrive at a point of call, ask to speak to the head of the household. Explain to the household head who you are and what you are doing. Give the letter of introduction to him/her to read or read it aloud if necessary.

5. Give the respondents enough time to answer the questions clearly and fully.

7. Do not try to influence the respondent or put words in his mouth. If you think he has given wrong answers deliberately, make a note of it next to the questions on the questionnaire.

8. After completing a questionnaire, go through it to make sure that you have not skipped any questions.

9. Encourage respondents to look up records as far as possible.

VENDA ELECTRICITY CORPORATION
KOPORASI YA MUDAGASI YA VENDA
Incorporated in Venda in terms of the Corporations Act (Act 17 of 1981)

BLOCK D
V D C BUILDINGS
PRIVATE BAG 2539
SIBASA, VENDA
TEL.: (015581) 21062/3/4
22912/17
FAX TEL.: 23131

1988 July 21

TO WHOM IT MAY CONCERN

This is to introduce Mr. T.B. Themeli of the Economics Department of Rhodes University. He is undertaking research into the costs and benefits of supplying electricity to certain areas in Venda.

I would appreciate it if you could assist him by answering various questions.

Thanking you for your co-operation.

Yours faithfully

J.P. RODGER
CHIEF EXECUTIVE OFFICER
/msm

RHODES UNIVERSITY

P.O. Box 94, Grahamstown, 6140 South Africa

Telegrams 'Rhodescol' Telex 24-4219 SA Telephone (0461) 2-2023

DEPARTMENT OF ECONOMICS

Dear Householder,

SURVEY OF ELECTRICITY SUPPLY AND USAGE IN VENDA

I am a post-graduate student in the Department of Economics at Rhodes University, currently undertaking research towards a master's degree. The subject of my research is the cost-benefit analysis of electricity supply in a less developed country or region, with particular reference to Venda.

I would therefore be extremely grateful if you would kindly assist my fieldworker, Mr _____ in completing the accompanying short questionaire.

Similar studies undertaken in the Republic of South Africa and elsewhere have elicited an excellent response and I hope that you will be willing to contribute by answering the questionaire to the success of this project relating particularly to Venda.

I wish to assure you that the information gathered in this study will be treated as strictly confidential, and used in such a way as to render it impossible to identify individual respondents.

Should you have any queries about the survey, please telephone me at Thohoyandou (015581) 22119 or 31356.

I look forward to your cooperation.

Yours faithfully,

B Themeli

BOOI T. THEMELI (Student)

Department of Economics and Economic History
RHODES UNIVERSITY
P.O. Box 94, Grahamstown, 6140 South Africa
Telegrams 'Rhodescol' Telex 24-4219 SA Telephone (0461) 2-2023

TO WHOM IT MAY CONCERN:

This is to confirm that Mr. B. T. Themeli is a Masters degree student in the Department of Economics and Economic History at Rhodes University, and that he is engaged in research into electricity supply and usage in Venda. Any help which you can give him in the survey which he is undertaking would be very much appreciated.

Yours sincerely,

R. T. BELL
Professor and Head of Department

BIBLIOGRAPHY

Amin, G A 1978. Project Appraisal and Income Distribution. World Development vol. 6 No. 2, pp. 139-152.

Amin, S 1978. Modern Migration in West Africa. London: Oxford University Press.

Armstrong, H and Taylor, J 1978. Regional Economic Policy and its Analysis. Oxford: Phillip Allan Ltd.

Arrow, K J and Lind, R C 1970. Uncertainty and the Evaluation of Public Investment Decisions. American Economic Review vol. 60. June, pp. 364-378.

Balassa, B 1974. Estimating the Shadow Price of Foreign Exchange in Project Appraisal. Oxford Economic Papers. July, pp. 148-167.

Bannock, G et al. 1981. The Penguin Dictionary of Economics. 2nd Edition, England: Penguin Books Ltd.

Batson, H E 1933. The Economic Concept of a Public Utility. Economica vol. 13. November, pp. 457-472.

Begg, D et al. 1984. Economics. British Edition. London: McGraw-Hill Book Company (UK) Ltd.

Bequele, A and Freedman, D H 1979. Employment and Basic Needs: An Overview. International Labour Review vol. 118 No. 1, pp. 315-328.

Berrie, T W 1967. The Economics of System Planning in Bulk Electricity Supply. Electrical Review, 15 September, pp. 384-468.

Berrie, T W 1979. What Quality of Electricity Supply Can We Afford? Electrical Review International vol. 202 No. 1, 6 January.

Black, P A 1980. The Structuralist Approach to Economic Development. Development Studies Southern Africa vol. 2 No. 1, April, pp. 49-57.

Black, P A et al. 1987. Industrial Development Strategy for Region D. Final report. Institute of Social and Economic Research, Grahamstown: Rhodes University.

Blaug, M 1983. Economic Theory in Retrospect. 3rd Edition. London: Cambridge University Press.

Bohm, P 1973. Social Efficiency: A Concise Introduction to Welfare Economics. London: MacMillan Press Ltd.

Boyd, H W et al. 1977. Marketing Research, Text and Cases. 4th Edition. Illinois: Richard D Irwin Inc.

Brown, C V and Jackson, P M 1978. Public Sector Economics. Oxford: Martin Robertson and Company Ltd.

Buchanan, J M 1978. From Private Preference to Public Philosophy, The Development of Public Choice. The Economics of Politics, London: Institute of Economic Affairs, Reading 18, pp. 1-18.

Buchanan, J M and Stubblebine W 1962. Externality. Economica vol. 29, pp. 371-384.

Burki, S J 1980. Sectoral Priorities for Meeting Basic Needs. Finance and Development vol. 17 No 1, March, pp. 18-22.

Chambers, R 1978. Project Selection for Poverty-Focussed Rural Development: Simple is Optimal. World Development vol. 6 No. 2, pp. 209-219.

Chruchill, G A 1979. Marketing Research: Methodological Foundations. New York: Dryden Press.

Clay, H 1961. Electricity as an Industrial Commodity. Electrical Review, 9 June, pp. 1012-1014.

Coase, R H 1960. The Problem of Social Cost. Journal of Law and Economics, October.

Coetzee, S F 1983. Development; False Hopes and New Directions. Development Studies Southern Africa vol. 6 No. 1, October, pp. 27-41.

Cole, J P 1981. The Development Gap: A Spatial Analysis of World Poverty and Inequality. New York: John Wiley and Sons.

Corti, G 1973. Risk and Uncertainty and Cost-Benefit: Some Notes on Practical Difficulties for Project Appraisals in Wolfe, J N (Ed.): Cost-Benefit and Cost Effectiveness, Studies and Analysis. London: George Allan and Unwin.

Cottrell, F 1955. Energy and Society: The Relation Between Energy, Social Change and Economic Development. London: McGraw-Hill Book Inc.

Crew, M A and Kleindorfer, P R 1979. Public Utility Economics. London: The MacMillan Press Ltd.

Crimp, M 1986. The Marketing Research Process. United Kingdom: Prentice Hall International Ltd.

Currie, J M et al. 1971. The Concept of Economic Surplus and its Use in Economic Analysis. Economic Journal vol. 81, December.

Curwen, P J 1979. The Theory of the Firm. Hong Kong: The MacMillan Press Ltd.

Dasgupta, A K and Pearce, D W 1972. Cost-Benefit Analysis: Theory and Practice. London: McMillan Press.

Dasgupta, P et al. 1972. Unido Guidelines for Project Evaluation. New York: United Nations.

Davies, A H 1976. The Practice of Marketing Research. London: William Heinemann Ltd.

Demsetz, H 1964. The Exchange and Enforcement of Property Rights. Journal of Law and Economics, October.

Demsetz, H 1968. Why Regulate Utilities? Journal of Law and Economics vol. II, April.

DeSerpa, A C 1985. Microeconomic Theory: Issues and Applications. London: Allyn and Bacon Inc.

De V Graaff, J 1975. Cost-Benefit Analysis: A Critical View. The South African Journal of Economics vol. 43 No. 2, pp. 233-244.

Development Bank of Southern Africa (DBSA). SATBVC Statistical Abstracts 1987. Data Bank Department Sandton, Republic of South Africa.

Dewar, D and Watson, V 1981. Unemployment and the Informal Sector: Some Proposals. Cape Town: Citadel Press, Landsdowne.

De Wet, G L 1976. The State of Cost-Benefit Analysis in Economic Theory. The South African Journal of Economics vol. 44 No. 1, pp. 50-63.

Diwan, R K and Livingston, D L 1979. Alternative Development Strategies and Appropriate Technology, Science Policy for an Equitable World Order. New York: Pergamon Press.

Dollery, B E and Wallis, J L 1987. Regulation, Rent Seeking and Occupational Licensure. Unpublished Paper, Rhodes University, Department of Economics and Economic History, Grahamstown. July, pp. 1-19.

Dorfman, R 1973. Measuring Benefits of Government Investment. Washington D.C.: The Brookings Institution.

Eberhard, A A 1984. The Real Energy Crisis; Energy Demand in Underdeveloped areas in Southern Africa. Energy, January/February, pp. 2-5.

Eberhard, A A 1984. Energy and Poverty in Urban and Peri-Urban Areas Around Cape Town. Carnegie Conference Paper No 155, April. Energy Research Institute, University of Cape Town, Cape Town.

Eberhard, A A and Gandar, M W 1984. Energy, Poverty and Development in South Africa. Carnegie Conference Paper No. 154, April. Energy Research Institute, University of Cape Town, Cape Town.

Eckstein, O 1958. Water Resource Development: The Economics of Project Evaluation. Harvard University Press.

Eden, R et al. 1981. Energy Economics; Growth, Resources and Policies. New York: Cambridge University Press.

Erskine, J M 1985. Rural Development: Putting Theory into Practice. Development Southern Africa vol. 2 No. 2, August.

Escom/Evkom. Databank News 1986, vol. 2 No. 3, July.

Feldstein, M S 1964. The Social Time Preference Discount Rate in Cost-Benefit Analysis. Economic Journal vol. 74, pp. 361-379.

Fisher, A C 1973. Environmental Externalities and the Arrow-Lind Theorem. American Economic Review vol. 63, September.

Gandar, M V 1984. The Poor Man's Energy Crisis: Domestic Energy in KwaZulu. Carnegie Conference Paper No. 156, Cape Town.

Georgi, H 1973. Cost-Benefit Analysis and Public Investment in Transport: A Survey. London: The Butterworth Group.

Gerold-Scheepers, T J F A and Van Binsbergen, W M J 1978. Marxist and Non-Marxist Approaches to Migration in Tropical Africa. African Perspectives vol. 1.

Gittinger, J P 1982. Economic Analysis of Agricultural Projects. Baltimore and London: The Johns Hopkins University Press.

Ghai, D P et al. 1980. Planning For Basic Needs in Kenya: Performance, Policies and Prospects. International Labour Organisation.

Goldstein, S J 1985. Basic Human Needs: The Plateau Curve. World Development vol. 13 No. 5, pp. 595-609.

Graham, A D 1981. Cost-Benefit Analysis Under Uncertainty. The American Economic Review vol. 71 No. 4, September, pp. 715-724.

Gramlich, E M 1981. Benefit-Cost Analysis of Government Programs. Engelwood Cliffs, New Jersey: Prentice-Hall Inc.

Grut, M 1975. Cost-Benefit Analysis in the Forestry Sector. The South African Journal of Economics vol. 43 No. 2, pp. 187-204.

Henderson, P D 1965. Notes on Public Investment Criteria in the United Kingdom. Bulletin of the Oxford University Institute of Economics and Statistics vol. 27.

Henderson, P D 1968. Investment Criteria for Public Enterprises, in Turvey, R (Ed.) Public Enterprise, Selected Reading. Harmondsworth: Penguin Books.

Herrmann, G F K 1974. Electricity Tariffs: The Principles Underlying their Design and Structure with Some Preference to Conditions in Southern Africa. Unpublished D.Comm. Thesis, University of Stellenbosch, March.

Hicks, N L 1980. Is there a Trade-Off Between Growth and Basic Needs? Finance and Development vol. 17 No. 2, June, pp. 17-20.

Hirshleifer, J et al. 1966. Water Supply: Economics, Technology and Policy. Chicago Press.

Hirshleifer, J 1980. Price Theory and Applications. 2nd Edition. London: Prentice-Hall International Inc.

Hirshman, A O 1967. Development Projects Observed. Washington: The Brookings Institution.

Hosking, S G 1983. Some Theoretical Considerations in Applying Cost-Benefit Analysis to Black Education in South Africa. Unpublished M.Comm. Thesis, Rhodes University, Grahamstown, January.

Hotelling, H 1938. The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates. Economica vol. I.

Jansen, B A 1988. New Approach to Electrification. South African Energy News vol. 3 No. 1, July.

Kahn, A E 1970. The Economics of Regulation: Principles and Institutions. 2 Volumes, Wiley Inc.

Keeton, G R 1984. An Analysis of the Basic Needs Approach in its Application to Regional Economic Development - With Specific Reference to Ciskei. Unpublished Ph.D. Thesis, Rhodes University, Grahamstown, December.

Koutsoyiannis, A 1979. Modern Microeconomics. 2nd Edition. The MacMillan Press Ltd.

Krutilla, J V and Eckstein, O 1958. Multiple Purpose River Development Studies in Applied Economic Analysis. University Press Baltimore.

Laker, M C 1980. Development, A Few of its Characteristics and Mechanisms. Development Studies Southern Africa vol. 2 No. 1, April, pp. 98-105.

Layard, R (Ed.) 1976. Cost-Benefit Analysis: Selected Readings. Richard Clay The Chaucer Press Ltd.

Lee, E 1980. Changing Approaches to Rural Development. International Labour Review vol. 119 No. 1.

Leibenstein, H 1978. General X-efficiency Theory and Economic Development.New York: Oxford Economic Press.

Leibenstein, H 1966. Allocative Efficiency v/s X-efficiency. American Economic Review vol. 56, June, pp. 392-415.

Lewis, W S 1955. The Theory of Economic Growth. London: George Allen and Unwin.

Lipton, M 1977. Why Poor People Stay Poor: A Study of Urban Bias in World Development. London: Maurice Temple Smith Ltd.

Little, I M D and Mirrlees, J A 1968. Manual of Industrial Project Analysis in Developing Countries vol. II. Social Cost-Benefit Analysis, OECD Development Centre, Paris.

Little, I M D and Mirrlees, J A 1974. Project Appraisal and Planning for Developing Countries. Heinemann Ed. Books.

Little, I M D et al. 1970. Industry and Trade in Some Developing Countries: A Comparative Study. London: Oxford University Press Ltd.

Louw, S J H 1981. An Introduction to Cost-Benefit Analysis as an Element in Project Evaluation. Development Studies Southern Africa vol. 3 No. 2, January, pp. 115-137.

Maass, A 1966. Benefit-Cost Analysis: Its Relevance to Public Investment Decisions. The Quarterly Journal of Economics, pp. 209-226.

Mansfield, E 1979. Microeconomics: Theory and Applications. 3rd Edition. USA: Norton and Company Inc.

Marglin, S A 1963. The Opportunity Costs of Public Investments. Quarterly Journal of Economics vol. 77.

Marglin, S A 1967. Public Investment Criteria: Benefit-Cost Analysis for Planned Economic Growth. London: George Allen and Unwin Ltd.

Margolis, J 1957. Secondary Benefits, External Economies and the Justification of Public Investment. The Review of Economics and Statistics vol. 39, pp. 284-291.

McKean, R N 1958. Efficiency in Government Through Systems Analysis. New York: John Wiley.

McGuire, M C and Garn, H A 1969. The Integration of Equity and Efficiency Criteria in Public Project Selection. The Economic Journal, December, pp. 882-893.

Meek, R L 1963. The Bulk Supply Tariff for Electricity. Oxford Economic Papers vol. 15.

Meier, G M 1976 1976. Leading Issues in Economic Development. 3rd Edition. Oxford University Press Inc.

Menges, G 1974. Economic Decision-Making, Basic Concepts and models. London: Longman.

Mishan, E J 1971. Cost-Benefit Analysis. London: George Allen and Unwin.

Mishan, E J 1967. What is Producers' Surplus? American Economic Review 58, December.

Moser, C A and Kalton, G 1986. Survey Methods in Social Investigation. 2nd Edition. USA: Gower Publishing Company.

Musgrave, R A 1958. The Theory of Public Finance. New York: McGraw Hill.

Myrdal, G 1963. Economic Theory and Underdeveloped Regions. London: Methuen and Company Ltd.

Nattras, J 1980. Southern African Economic Development and the Basic Needs Strategy. Development Studies Southern Africa vol. 2 No. 1, April, pp. 58-64.

Nkuhlu, W L 1985. Constraints to the Economic Development of the Republic of Transkei. Development Southern Africa vol. 2 No. 4, November.

Nurkse, R 1953. Problems of Capital Formation in Underdeveloped Countries. New York: Basil Blackwell and Mott Ltd.

Peacock, A 1984. The Regulation Game: How British and West German Companies Bargain with Government. New York: Basil Blackwell Inc.

Pearce, D W 1983. Cost-Benefit Analysis. 2nd Edition. London: MacMillan Press.

Pearce, D W and Nash, C A 1981. The Social Appraisal of Projects. A Text in Cost-Benefit Analysis. London: MacMillan Press.

Peek, P 1982. Agrarian Change and Rural Emigration in Balan, J (Ed.) Why People Move. Paris: The Unesco Press.

Pigou, A C 1980. The Economics of Welfare. 5th Edition. London: MacMillan Press.

Portes, A 1978. Migration and Underdevelopment. Politics and Society vol. 8.

Posner, R A 1975. The Social Costs of Monopoly and Regulation. Journal of Political Economy 83, pp. 807-827.

Prest, A R and Turvey, R 1965. Cost-Benefit Analysis: A Survey. Economic Journal vol. 75, December, pp. 683-736.

Preston-White, E 1982. Why Questionnaires Are Not The Answer: Comments and Suggestions Based on a Pilot Study of the Rural Informal Sector in KwaZulu. Saldru Working Paper No. 38, September, pp. 42-53.

Prinsloo, J 1982. The Questionnaire as a Tool in Social Research: Preliminary Guidelines. Saldru Working Paper No. 48, September, pp. 14-18.

Prinsloo, J 1982. Construction of a Questionnaire on Poverty: Lessons from an Urban Survey. Saldru Working Paper No. 48, September, pp. 29-42.

Rady, M H 1977. Cost-Benefit Analysis as an Element in Project Evaluation. Economics vol. 16, pp. 63-72.

Rees, R 1984. Public Enterprise Economics. 2nd Edition. London: Weidenfeld and Nicolson.

Rivett-Carnac, J L 1979. A Strategy for Electrification of the Black Townships in and Around Durban and its Impact on the Energy Situation in South Africa. The Urban Foundation, Durban.

Rogers, A and Williamson, J G 1982. Migration, Urbanisation and Third World Development: An Overview. Economic Development and Cultural Change vol. 30.

Rosenstein-Rodan, P 1961. International Aid for Underdeveloped Countries. Review of Economics and Statistics vol. 43 No. 2, pp. 393-401.

Sadik, A T 1978. A Note on Some Practical Limitations of Social Cost-Benefit Analysis Measures. World Development vol. 6 No. 2, pp. 221-225.

Sassone, P G and Schaffer, W A 1978. Cost-Benefit Analysis: A Handbook. London: Academic Press.

Schoner, B and Uhl, K P 1976. Marketing Research: A Short Course for Professionals. New York: John Wiley and Sons.

Scitovsky, T 1941. A Note on Welfare Propositions in Economics. Review of Economics and Statistics vol. 36 No. 4, November.

Scott, M F G 1974. How to Use and Estimate Shadow Exchange Rates. Oxford Economic Papers, July, pp. 170-183.

Sewell, W R D et al. 1961. Guide to Benefit-Cost Analysis. Resources for Tomorrow Conference. Montreal, October.

Shepherd, W G and Gies, T G 1966. Utility Regulation - New Directions in Theory and Policy. New York: Random House.

Shrestha, N R 1987. Institutional Policies and Migration Behaviour: A Selective Review. World Development vol. 15 No. 3, March.

Slabbert, T J C 1984. Appropriate Technology for the Basic Needs of South Africa. Institute for Planning Research, University of Port Elizabeth, Research Report No. 28, January.

Stack, O 1982. Research on Rural to Urban Migration in LDCs: The Confusion Frontier and Why we Should Pause to Rethink Afresh. World Development vol. 10 No. 1.

Steiner, P O 1974. "Public Expenditure Budgeting" in Blinder et al.: The Economics of Public Finance, Washington D.C.: Brookings Institution.

Stewart, F 1985. Planning to Meet Basic Needs. Hong Kong: The MacMillan Press Ltd.

Stewart, F 1978. Social Cost-Benefit Analysis in Practice: Some reflections in the light of case studies using Little-Mirrlees techniques. World Development vol. 6 No. 2, pp. 153-165.

Stigler, G J and Friedland, C 1982. What can Regulators Regulate? The Case of Electricity. The Journal of Law and Economics vol. V, October.

Streeten, P 1979. From Growth to Basic Needs. Finance and Development vol. 16 No. 2, June, pp. 28-31.

Streeten, P 1981. First Things First: Meeting Basic Human Needs in the Developing Countries. Oxford University Press.

Sugden, R and Williams, A 1979. The Principles of Practical Cost-Benefit Analysis. Oxford University Press.

Thirlwall, A P 1983. Growth and Development. 3rd Edition. The MacMillan Press Ltd.

Thompson, M A 1980. Benefit-Cost Analysis for Program Evaluation. London: Sage Publications, Beverley Hills.

Tisdell, C A 1972. Microeconomics: The Theory of Economic Allocation. John Wiley and Sons Australasia Pty. Ltd.

Tisdell, C 1985. Project Evaluation and Social Cost-Benefit Analysis in LDCs: Awkward Issues for a Useful Approach. Development Southern Africa vol. 2 No. 1, February.

Todaro, M P 1969. A Model of Labour Migration and Urban Unemployment in Less Developed Countries. American Economic Review vol. 59.

Todaro, M 1977. Economics for a Developing World: An Introduction to Principles, Problems and Policies for Development. London: Longman Group Ltd.

Troxell, E 1947. Economics of Public Utilities. London: Rinehart and Company Inc.

Truu, M L 1973. Some Effects of regional Migration. The South African Journal of Economics vol. 41.

Truu, M L 1988. Economics of Privatisation. The South African Journal of Economics vol. 56 No. 4, December, pp. 251-270.

Tull, D S and Hawkins, D I 1984. Marketing Research: Measurement and Method. 3rd Edition. MacMillan Publishing Company.

Tullock, G 1978. The Welfare Costs of Tariffs, Monopolies and Theft. Western Economic Journal vol. 5 No. 2, pp. 224-232.

Turvey, R and Anderson, D 1977. Electricity Economics: Essays and Case Studies. London: World Bank.

Ul Hag, M 1982. An International Perspective on Basic Needs. Development Studies Southern Africa vol. 4 No. 1, pp. 135-142.

Van Wyk, L A. Priorities for Basic Needs in Economic Development. Development Studies Southern Africa vol. 4 No. 2, pp. 142-158.

Venda Electricity Corporation (VEC). Report on the Year 1987. Thohoyandou, Venda.

Venda (Republic of) 1981. Electricifaction Masterplan. Department of Transport, Works and Communications, Sibasa, Venda.

Wallis, J L 1983. Public Utility Pricing and Industrial Decentralisation in South Africa. Unpublished D.Comm. dissertation, Rhodes University, Grahamstown, December.

Weiss, T G and Jennings, A 1983. What are the Least Developed Countries and What Benefits May Result From the Paris Conference? World Development vol. 11 No. 4, April, pp. 341-357.

Williamson, J 1965. Regional Inequality and the Process of National Development: A Description of the Patterns. Economic Development and Cultural Change vol. 13 No. 4, July, pp. 3-9.

World Bank. World Development Report 1981/82/83/84/85/86.