# FARMWORKER FAMILIES:

## TOWARDS EQUITABLE AND ADEQUATE ENERGY PROVISION

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## DECLARATION

I declare that this dissertation is my own original work. It is being submitted to the University of Cape Town in fulfilment of the requirements for the degree of Master of Philosophy in Energy Studies. It has not previously been submitted at any other university for degree or examination purposes.

**I-M Hofmeyr**

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## ABSTRACT

Farmworker families that live and work on commercial farms are amongst the poorest people in South Africa. Poverty is experienced in several dimensions, including low cash income, poor access to services, isolation, intermittent and insecure employment, dependence on employers, and limited social, economic and political power to improve their conditions. This study investigates the worker households' access to and use of energy, in order to identify their domestic energy needs. An evaluation of energy supply, including all fuels used by workers, is undertaken. Guidelines for strategies to improve farmworker households' access to energy services are proposed.

The research relied on the analysis of empirical information from both primary and secondary sources and placed this in an integrated energy planning framework. Primary data included a national postal survey of farmers (3000 questionnaires were sent, 575 returned) and interviews with worker families in the West Cape. The research took place during 1993.

At present farmworker households' energy consumption patterns are constrained by limited access and choice. Nationally about 22% of farmworker houses are electrified - though 75% of farms have grid electricity. As a result of worker household poverty and practices by farmers which limit farmworker households' electricity use, electricity is generally only used for lighting, and to a lesser extent for television and radio. Fuelwood is relied on by the majority of households - with or without electricity. Though fuelwood is more abundant on commercial farms than in many other rural areas, in certain regions up to 40% of farmworkers experience shortages. Commercial hydrocarbon fuels appear less widely used than in other rural communities, partly reflecting access constraints.

However there are clear opportunities for improvements. The average connection cost of supplying 86% of farmworker houses on electrified farms with a 20 Amp supply was estimated to be R2300. Most farms have the potential for increased fuelwood production, through both the management of current on-farm resources and / or tree cultivation. Overcoming constraints on access to commercial hydrocarbon fuels is more complicated, requiring intervention from a number of sectors including farmers and fuel suppliers.

There are numerous barriers to improving the households' access to energy services. These include factors particular to farmworker families, such as their poverty and dependence on the farm-owner, as well as macro factors such as the lack of rural development policy and structures for service provision.

## TABLE OF CONTENTS

# LIST OF TABLES

# LIST OF FIGURES

# Chapter One
# INTRODUCTION and METHODS of ENQUIRY

## 1.1 Introduction

Farmworker households referred to in the chapters that follow are the regular, seasonal and domestic workers and their families that live and work on commercial farms in South Africa. They number about 5 million people, making up nearly a third of the rural population.

On the whole living and working conditions are poor, families experience extreme cash poverty, and their status is such that they have little control over their circumstances. Within this generalised description there are variations: these correspond to geographic regions (and by implication farming activities and bio-climatic zones), but more particularly to the socio-political stance and to a lesser degree the economic strength of their landlord and employer.

Service provision for farmworker households is in the hands of farm owners and energy provision is mostly in the form of fuelwood. Few worker houses are electrified, though most farms have grid electricity, and there are numerous constraints on households acquiring commercial fuels such as paraffin and LPG.

Energy is a critical aspect of the development process and vital for physical well being. The aim of this study is to determine the worker households' energy needs and problems experienced in fulfilling those needs, and to identify opportunities for improvement. The infrastructure already in place on farms (for example: the electricity grid, piped water and roads) could make energy service provision more easily achieved, and at a lower cost, than in the rural 'homelands'. The lack of power of workers and their dependence on the farm owner have, however, particular implications for potential improvements.

It is hoped that this work will result in an increased awareness of the farmworker households' situation; that data collected and analysed will be of use to national decision makers with regard to future energy planning; and that ultimately, through the setting of national goals of equitable and adequate access to energy services for all South Africans, the conditions of worker families will improve.

## 1.2 Research method

The research method relied on the analysis of empirical information from both primary and secondary sources and placed this in a conceptual framework of integrated energy planning.

### 1.2.1 Conceptual background

To improve farmworker households' access to energy services with a demand rather than supply-driven approach, would require considerable changes from current practices. Integrated energy planning (I.E.P) provides a methodology for energy policy research, an analytical framework for energy planning to achieve specified goals (Eberhard 1993), and as such is a valuable research tool for the task.

The nature of energy - for example its importance in household economy and welfare, in the economic sectors of industry and agriculture, and the provision services such as health care and education - indicates the need for energy planning to be integrated with overall economic planning as well as with the provision of other services. By implication, policy makers and other roleplayers in both the energy and other linked sectors need to be involved in the process.

I.E.P analysis involves an investigation of: energy end-use (in this case by farmworker households), the energy sector in relation to other economic sectors (e.g. agricultural), and linkages within the energy sector (e.g. demand / supply relationships and the interplay of a full range of energy supply options). For this purpose the following research was undertaken:

- an in-depth analysis of patterns of energy use by farmworker households, and the identification of socio-economic factors affecting energy use - particularly the role of the farmers and of cash poverty in the demand / supply relationship;
- the assessment of available energy resources;
- a technical and financial evaluation of supply options;

The overall aim was to develop demand-driven intervention strategies that meet the farmworker households' domestic energy needs in affordable and appropriate ways.

A further requirement, beyond the scope of this study, is that guidelines to address the needs of farmworker households should be integrated into a national framework which:

- offers equitable opportunities for all disadvantaged and disempowered communities;
- is cognisant of the environmental concerns associated with energy supply and consumption;
- facilitates the efficient and safe use of energy services;
- promotes sustainable development and productivity.

An integrated energy plan for farmworker households would require a totally new approach to service provision, a considerable amount of investment and financial support, and commitment and co-operation amongst the various roleplayers. It would also require support for changes in the circumstances of workers, particularly their economic and political status.

### 1.2.2 Data sources and methods of enquiry

The information incorporated in this study was obtained through an extensive search of available literature on South African farmworkers (both socio-economic and energy-specific), visits to farmworker related organisations and workshops, and primary data collection.

In the text, data from both primary and secondary sources has been incorporated and is often analysed side by side. This serves to extend the scope and coverage of available empirical information. However, the various sources of data differ in terms of regional coverage, comprehensiveness and the time at which the studies were conducted. Where possible, information from secondary sources has been presented in summary tables for comparative purposes. All tables and figures are referenced by source (including data from the authors' primary data collection). When data is only presented graphically, corresponding tables are provided in Appendix 4.

*Secondary data*

There are a substantial number of studies on the use of energy by rural people in South Africa, both in the homelands as well as on commercial farms. The first in the rural 'homelands' was in Ciskei by Marker et al (1978), and the first to include farmworkers was by Moller (1985). A database of rural energy use studies in homeland areas has recently been compiled. All but three of the 10 present homeland regions are covered 'by at least one, if not more, good reliable surveys' (Ward 1993:1).

The 'homelands' studies are regionally specific, and the value of the data varies. Shortcomings include 'the statistical linear approach characteristic of the engineering disciplines' (Ward,1993:1) and a predominant focus on electrification and fuelwood. In more recent studies energy use has been located within a broader socio-economic context, and there has been more emphasis on wider-ranging qualitative data.

The literature on South African farmworkers and to a lesser extent farmworker households, is fairly extensive. Seven previous studies have focused on farmworker household energy use. Most of these studies were based on sample surveys in two or more regions of the country, to improve representivity. Two of the studies were national.

The energy-specific information presented in the studies relates mainly to the consumption patterns of farmworker households, such as the percentage of households using different fuels for particular end-uses, the cost of fuels, and the amounts consumed. Similar to the studies in the 'homelands', the focus tends to be on electricity and fuelwood. Other energy-specific information includes the extent of electrification on farms and of farmworker houses. There is little qualitative information on workers' perception of energy needs or energy preferences - besides both worker and farmer attitudes to electricity. Few studies investigated worker households' access to energy services, or evaluated energy supply options to any significant extent. Contextual information concentrates on income. Some studies examined farmer-worker relationships, and impacts on farmworker household energy use.

A brief summary of the energy specific secondary data sources referred to is given below, followed by Table 1.1 showing report details and a summary of the energy specific information they contain.

The first published study which includes information on farmworkers and their use of energy was Moller (1985). The report aimed to assess the quality of life in South Africa and basic needs priorities of black people in various living circumstances. It was based on interviews with about 2400 people including 299 workers on commercial farms in Natal and the Pietersburg district of the

Transvaal. The report is mainly concerned with describing the different levels of consumption of goods such as food, clothing and fuel, and the level of service provision such as education and health. It examines the relationship between the level of basic needs provision and a sense of well-being. For the purposes of the study, quality of life was defined very broadly to embrace subjective reactions to day-to-day existence and perception of future life circumstances. Energy specific data is presented on farmworker households' access to fuelwood, and their use of various energy carriers for cooking, heating and lighting.

Eberhard (1986) undertook a study on energy consumption patterns in underdeveloped areas in South Africa which included a section on farmworkers. 1100 questionnaires were sent to white farmers in South Africa and at the time the report was written, 382 had been returned (23% in the winter rainfall area, 23% in the Eastern Cape, 11% in Natal, 28% in the Karoo, 1% in the Orange Free State, and 16% in the Transvaal). No qualitative data is presented and quantitative data is confined to the percentage of households using various energy carriers for particular end-uses.

As part of a degree in Electrical Engineering at the University of Cape Town, Lieberman (1987) undertook a study on farm employees' right to electricity. The study included information on the energy consumption patterns of farmworker households, the relationship between farmers and workers, relevant legislation, and general living standards experienced by farmworkers. The energy consumption data was derived from 50 interviews with farmers, and 40 interviews with farmworker communities in the western OFS, eastern and central Natal, the southern Transvaal and western Cape. The study aimed to investigate the economic viability of extending electricity supplies to farmworker houses.

A study by Jooste and Nortje (1987) on the potential electricity demand of a group of farmworkers and township residents in the Orange Free State was commissioned by Eskom. Results are presented from 530 interviews with farmworkers, none of whom had access to electricity. The study set out to obtain background data on the demographics and living conditions of farmworkers, establish current consumption patterns, and assess workers' attitude to electrification.

Lieberman and Dingley (1988) published an interim report containing information from the first Lieberman study and energy consumption data from 200 postal questionnaire returns from the E-OFS, N-Cape, Natal coast and S-Transvaal.

Tobich and Dingley (1989) investigated the supply of electricity to farms and farmworker houses, based on a postal questionnaire to the west, north and east Cape, east and central Natal, the PWV and the eastern Transvaal, and 28 interviews with farmers and farmworkers in the underdeveloped farming areas of the Karoo. 100 questionnaire returns were received. Interviews material was presented as anecdotal information.

The most comprehensive information on energy consumption patterns and access to energy services of farmworker households is a study by Gandar (1991). It includes data on on-farm fuelwood resources, the source of 'transitional fuels' and the role of the farmer in the provision of energy to farmworkers. The report also includes information about the general circumstances of farmworkers, and identifies some constraints and opportunities for improving the availability of domestic energy for farmworker households. The data presented is derived from 642 postal questionnaires from Natal (return rate 37%), 306 postal questionnaires from the East and West areas of the Transvaal (return rate 20%), and 44 direct interviews with farmers and farmworkers.

Kotze and Wolhuter (1992) undertook a study for Eskom which assessed farmworker attitudes to electricity, and the affordability of electrical appliances and electricity supply. Background information presented concentrates on the type of housing and the economic status of workers. Interviews were conducted with 34 workers on a farm in the Barkley-West district, none of whom had access to electricity.

**TABLE 1.1: Secondary data sources**

| Study | Year | Regions | Data source | | Respondent | Energy Specific Data |
|---|---|---|---|---|---|---|
| | | | P-Qs | Interv | | |
| Moller | 1985 | Natal<br>NE-Tvl | none | 299 | Fworkers | % hshs using fuels for cooking, heating and lighting; access to fuelwood. |
| Eberhard | 1986 | National | 382 | none | Farmers | % hshs using fuels for cooking, heating and lighting; amount of fuelwood used / hshold |
| Lieberman | 1987 | W-OFS<br>E/C-Natal<br>S-Tvl<br>W-Cape | none | 50<br>40 | Fworkers<br>Farmers | % hshs using fuels for cooking, heating and lighting; stoves used; details of farm elect; |
| Jooste & Nortje | 1987 | OFS | none | 530 | Fworkers | % hshs using fuels for cooking, heating and lighting |
| Lieberman & Dingley | 1988 | E.OFS<br>N.Cape<br>Natal Cst<br>S.Tvl | 200 | none | Farmers | % hshs using fuels for cooking, heating and lighting; extent of farm electrification. |
| Tobich & Dingley | 1989 | W/N/E-Cpe<br>W/E-Natal<br>E/S+C-Tvl | 100 | none | Farmers | % hshs using fuels for cooking, heating and lighting; access to and use of electricity. |
| | | Karoo | none | 20 | Fworkers | 'anecdotal' information |
| Gandar | 1991 | Natal-Mid<br>Natal Cst<br>W/E.Tvl | 642<br><br>306 | <br>44 | Fworkers & Farmers | % hshs using fuels; amounts used; energy cost to hshs; fuelwood resource assessment. |
| Kotze & Wolhuter | 1992 | Barkley-West | none | 34 | Fworkers | attitude to elect.; appliance prefenences. |

An internal questionnaire sent by the Rural Foundation[1] to all member farms, the results of which were made available to the author, contained extensive questions on the circumstances of workers such as type of housing, proximity to facilities such as schools and the level of education of the head of the household. Energy specific information was confined to the percentage of farmworker households that have access to electricity and the percentage ownership of various electrical and other appliances. General information on the status of electrification of workers' houses on commercial farms in South Africa was made available by Eskom, and data on employment and wage levels of workers by the Centre for Rural Legal Studies.

The studies summarised above do not follow a uniform methodology or report format. Some are national, others regional, some distinguish between respondents that do or do not have electricity, and not all studies report comprehensively on fuel use. They were also undertaken over a number of years, during which time changes have occurred that prevent direct comparison.

In analysing data from secondary sources, it has been necessary to take account of their respective study area/s, sample sizes and date, and whether respondents were farmers speaking on behalf of workers, or the farmworkers themselves.

***Primary data sources***

Primary data collection was undertaken in two phases: a national postal questionnaire was sent to farmers followed by visits to farms in the W/SW-Cape to talk to farmworkers and their families.

The intention of the postal survey (Appendix 1) was to assess farmworker households' access to energy services, the farmers' role in supplying energy and support for improving the worker households' access to energy services. To assist in evaluating potential energy supply options, detailed questions were also asked on the spatial layout of worker dwellings and their distance to the electricity grid with the aim of costing the electrification of farmworker houses. It was decided to avoid asking farmers questions on what workers do or think. To encourage a high response rate, the questionnaire was kept as short and impersonal as

[1] The Rural Foundation: a national NGO established by farmers, to which farmers belong. Support services are provided to farmworker families on member farms.

possible. Only one open-ended question - that regarding the benefits of electrification - and a space for comments were included.

In preparation a pilot postal survey of farmers was undertaken. The region selected was the W-Cape and the sample was drawn from members of the W-Cape South African Agricultural Union (SAAU). One hundred questionnaires were sent, a third of which were returned. The value of the pilot was in assisting the final questionnaire design, in overcoming problems of getting usable spatial layout data, and learning the importance of being precise and correct.

Initially it was decided that the postal survey should be national and cover both farms with and without grid electricity. Various strategies to obtain a sample of farms were considered. A breakthrough came when Eskom offered assistance and provided lists of customers paying their agricultural tariff. The SAAU, a potential route to farms without electricity, were not quite as forthcoming and subsequent time constraints resulted in the postal questionnaire being addressed only to farmers with Eskom electricity.

It was decided not to send out the questionnaires on a simple randomised basis but rather to incorporate a level of stratification with the aim of ensuring that farmers in each bio-climatic zone and involved in the main farming activities of South Africa were reached. This should increase representivity, compared with unstratified random sampling. A map which approximates the regions selected is shown in Appendix 2. Eskom were provided with a list of regions and approximate sub-sample size for each region, and in turn provided a list of names and addresses that was randomly drawn from customers paying the agricultural tariff. The number of questionnaires dispatched to each region was calculated (using the Central Statistical Services Agricultural Statistics 1991) as a proportion of the number of farms in the region. Because of the small number of farms sampled in the S-Cape this area has been included in the greater SW-Cape region. In total about 3000 questionnaire were sent. The number of farms in the designated areas, comprising the sample frame, was estimated to be approximately 25 700 - about 40% of the total number of commercial farms in South Africa. Questionnaires were sent to approximately 10% of farms in each selected area.

575 questionnaires were returned. Of these 505 (87%) were useful, i.e. were returned from productive farms with farmworker families residing on the farm.

Based on CSS data, these returns represent some 29 000 farmworkers and family members. Table 1.2 summarises return rates, and sub-sample size by region.

**TABLE 1.2: Effective sample size, number and % returned**

| Region Sampled | Region | Sample size | Num. returned | % Returned |
|---|---|---|---|---|
| South West/South Cape | SW-C | 300 | 65 | 22 |
| West Cape | W-C | 100 | 21 | 21 |
| Karoo | C-K | 100 | 42 | 42 |
| North Cape | N-C | 190 | 33 | 17 |
| East Cape | E-C | 190 | 54 | 28 |
| South & West OFS | S&W-OFS | 230 | 59 | 26 |
| North OFS | N-OFS | 130 | 24 | 18 |
| East OFS | E-OFS | 110 | 28 | 25 |
| North Natal | N-Ntl | 220 | 24 | 11 |
| South & Central Natal | S&C-Ntl | 255 | 39 | 15 |
| Eastern Transvaal | E-Tvl | 230 | 25 | 11 |
| North Transvaal | N-Tvl | 230 | 26 | 11 |
| South & Central Tvl | S&C-Tvl | 70 | 7 | 10 |
| Western Transvaal | W-Tvl | 200 | 28 | 14 |
| - | Unknown | - | 30 | - |
| **Total** | | **2620** | **505** | **Weighted Avg 24** |

The weighted average was calculated by averaging the return rate multiplied by the total number of farms, for each region.

Though the reasons are unclear, the average return rate from the Cape and the OFS was higher than from Transvaal and Natal. There were a number of noneffective responses from pensioners no longer farming, and from smallholders with no workers, particularly from Natal. There were few returns from farms where workers are housed in compounds - a situation particularly applicable to Natal.

Because of the low effective sample size from the S&C-Tvl., this region has not been included in further analyses.

Aside from the lack of information from farms where workers are housed in compounds, demographic data regarding the number of workers and family members was in many cases incomplete, or inconclusive. As a result the survey has not been used to estimate the size of the farmworker family population in South Africa.

Another limitation of the survey was that only questions regarding the worker households' domestic energy were asked. There is currently little information on the energy use or energy needs of community facilities used by farmworkers and it is unfortunate that these were not included in the postal questionnaire.

There is almost certainly a bias in the results from the postal survey. Farmers who are concerned about their workers' welfare are more likely than others to reply to a survey concerning farmworker households. This could result in the appearance that conditions are better than in reality. For example, the survey returns may over-represent farmers who have electrified workers' houses. Similarly, the degree of support expressed by farmers for improving workers' conditions may be exaggerated. This should be kept in mind by the reader.

Data from the postal questionnaire was coded, processed and analysed using Quattro Pro for Windows spreadsheets. The data responded with consistency and no major incongruities were discovered.

Analysis was performed on both a regional and national basis. Where national weighted averages are presented, regional figures were weighted according to the corresponding number of regular workers represented in the CSS agricultural statistics. The regions presented in Figures and Tables that follow, relate to the specific areas sampled - Appendix 2, and not to the greater region, and the survey can be considered national within this qualification.

When the spacial layout data was employed to estimate the cost of electrifying worker houses, the regional breakdown was lost (due to the method of data preparation). In retrospect this was unfortunate. However the usefulness of the pooled estimates for all regions combined is sufficient for the oversight to be tolerated.

It would have been satisfying to follow the postal survey with a substantial interview programme. However visits to farms were subject to a number of constraints, not the least of which was lack of time, as all interviews were conducted personally. Access to workers and their families was through personal contacts, and through approaching farmers who had responded to a postal survey previously undertaken. In total 36 workers or family members were spoken to, all in the W/SW-Cape: some individuals, a couple of family groups, a group of male workers, a group of female and male workers, and a group of women workers and wives. Though it was not my intention, all the workers and family members interviewed had access to electricity.

Farmworkers' conditions in the W/SW-Cape are on the whole above the national average - particularly in relation to and as a result of the farmer-worker relationship. This became apparent from the postal survey results, and the interview respondents were undoubtedly amongst the better off. Because of the limited number of interviews, the particular region visited, and the fact that all interviewees had access to electricity, the value of the results is specifically related to these workers' response to and use of electricity.

## 1.3 Overview of Paper

A brief description of the historical background to the current farm labour system and general circumstances of farmworker households is given in Chapter Two. Chapter Three presents a comprehensive assessment of farmworker households' current access to energy services and patterns of energy use and Chapter Four investigates energy supply options in some detail. The final chapter develops potential intervention strategies aimed at improving farmworker households' access to energy services and discusses implications of the conditions and status of farmworkers for possible interventions.

# Chapter Two

# FARMWORKER FAMILIES : a socio-economic profile

'The roots of apartheid are to be found not in the white cities, nor even in the endless tunnels of the gold mines of the Rand. They are buried deep within the white-owned farms, where for some two hundred years, before ever South Africa became an urban industrial economy and the word apartheid was thought of, relationships were being forged between white-masters and black servants.' (Ainslie1977:7)

## 2.1 Demographics

From the statistics available it is difficult to establish the number of farmworker families, or the total size of the farmworker community resident on commercial farms in South Africa.

The number of regular employees from the Central Statistical Services (CSS) Agricultural statistics 1990 is estimated to be 10 226 619, housed in 583 975 dwellings on 67 000 farming units. The Rural Foundation estimates the number of commercial farms in South Africa to be 60 000 (Annual report 1992-1993:6) and Gandar (1991:i) estimated the size of the farming community to be between 4 and 5 million people. For the purposes of this study the number of farmworkers and family members is taken as 5 million people in total, the number of households as 900 000, housed in 900 000 dwellings - assuming there is a single household per dwelling. The 583 975 dwellings of the CSS included 27 698 hostels. These have been counted as an arbitrary 10 to 11 households per hostel.

Whichever estimation is considered however, farmworkers and their families make up a significant proportion of the rural population and, largely because of their location and relationship with employers, are an identifiable sector with their own particular physical and social circumstances.

## 2.2 Development of the farm labour system

The current farm labour system is a consequence of the systematic control over land and black people in South Africa. Initially this was achieved through a series of wars and land appropriations, later through land and labour parliamentary acts.

In the early years land was seized, allocated for European tenure, or sold to speculators and Africans were increasingly confined to reserves or white-owned farms. The first legislation that limited the land ownership by Africans took place towards the end of the 19th century with the 1894 Glen Grey Act which restricted land ownership within the Glen Grey district. At about the same time Africans were forbidden from owning land in the OFS, the Transvaal and later in 40% of Zululand - Natal (Kassier, Groenewald 1992:334). The apparent aim of these measures was to create a labour pool for the commercial agricultural and mining sectors. Consequences included overcrowding in the reserves and squatting on white-owned farms. This was summarily dealt with by the enactment of the anti-squatting law limiting the number of African families allowed to live on white-owned farms. By the time of the Union of South Africa (1910), most of the agricultural land was in the hands of white farmers with African labourers, tenants, and labour tenants.

The beginning of the end for the remaining African farmers in the 'common' areas of South Africa, both as tenants and owner-operators, was the Natives' Land Act of 1913. 'Natives' were prohibited from owning, renting or acquiring land outside the reserves without the permission of the Governor General. Further control was introduced with the Native Trust and Land Act of 1936, which made the Governor-General the trustee of land tenure arrangements within the reserves. The Group Areas Act of 1956, which defined areas outside the reserves as controlled areas forbidden to ownership by Africans, was the culmination of the process. The result was the categorisation of rural areas outside the reserves as white-owned farms with dependent African labourers and their families.

Wilson et al. (1977) characterised the process in the following way:

> 'With the support of the state, landlords transformed the mass of land-occupying peasants into landless tenants and labour tenants and then squeezed the tenants out of agricultural production.'

In more recent times labour practices have developed which favour only regular, more skilled workers remaining on commercial farms and casual or seasonal workers being drawn from their families or from the local town. As a result the numbers of blacks living on farmland outside the homelands continued to be reduced: Surplus Peoples Project estimate that between 1960-1982, over 1.1 million farmworkers were expelled from their homes on white farms - a third of all relocations of black people during this period (Platsky and Walker 1985).

At the same time the status of white commercial farmers was strengthened by the restructuring of the agricultural sector, in which the government played a significant role. In the early 1960s, to prevent 'blackening the platteland' and an exodus of whites from rural areas, a number of incentives were offered to encourage mechanisation and bring about the concentration of larger tracts of land in the hands of fewer individuals. Agricultural co-operatives, monopoly control boards, and soft credit options from the Land Bank were established exclusively for white farmers.

These measures favoured wealthier and more developed farms, as a consequence, by 1983, 30% of commercial farms in South Africa produced 75% of the country's agricultural output (Davies 1990:8). In response to the postal questionnaire, a marginalised farmer complained bitterly about the farms that have been 'beautified at the tax-payer's expense' while he could not afford to provide electricity for his workers.

## 2.3 Current circumstances of farmworker families

Until 1993 there have been no statutory provisions for regulating the conditions of farmworker's employment, wages or the enforcement of contracts. Although workers are nominally protected by common law, contracts are seldom negotiated and workers are entirely dependent on their employers for conditions of employment. More recently workers have been included in labour legislation, but details still need to be developed and it will be some time before workers and their family members benefit from such inclusion.

As a result of the farmworkers' reliance on common law and the current farmworker-farmer relationship, which is for the most part quasi-feudal - riddled with patriarchal and racist values, both conditions of employment and living conditions for workers and their families are on the whole inadequate.

From the study by Moller (1985) it is apparent that, in terms of quality of life and basic needs fulfilment, farmworkers see themselves as worse off than people in the rural homelands, Figure 2.1. (Details of the Moller report and the criteria on which the points in Figure 2.1 are based, are in Chapter One, Section 1.2.2)

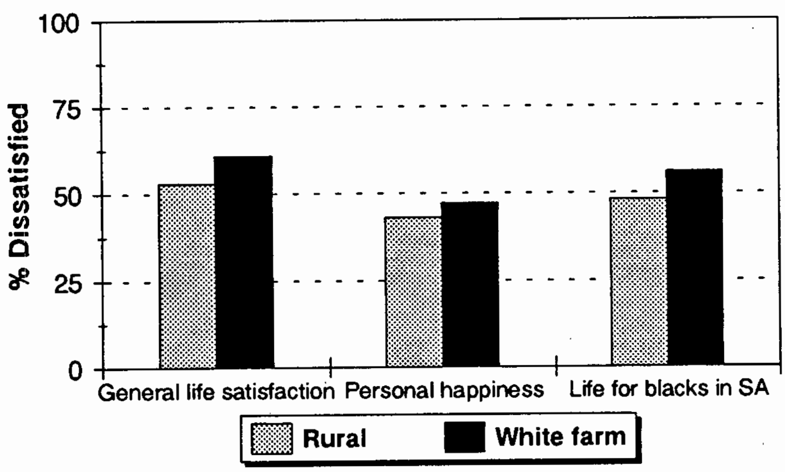



**FIGURE 2.1: Indicators of well-being**
*Source: Moller (1985:14)*

### *Housing*

Housing can range from a three-bedroomed brick house to a mud hut, a place in a shed or nothing. Less than 50 % of farmworker dwellings have piped water inside or on stand outside the dwelling, Figure 2.2, and Moller's study (1985:23) indicated that the level of sanitation for farmworkers is lower than that of other rural communities, Figure 2.3.

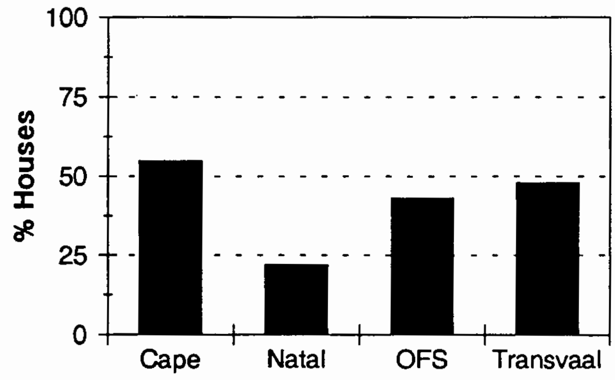



**FIGURE 2.2: Percentage of farmworker houses with piped water**
*Source: Author (1993)*

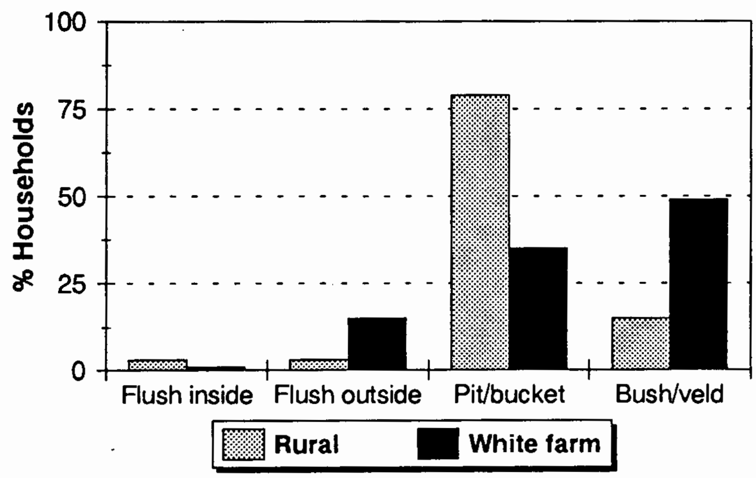



**FIGURE 2.3: Percentage of households using different types of toilets**
*Source: Moller (1985:23)*

Farmworkers have no security of tenure, housing is directly tied to employment and dismissal is automatically accompanied by eviction. As a result the current worker-housing relationship is fraught with conflicting interests: as easily as one worker may leave the farm in the quest for their 'own' home, another may join the farm as the quickest and safest way to house a family.

### *Health and safety*

For a number of reasons including: insufficient nutritious food, unhygienic conditions, the high cost of transport associated with rural health-care and the workers' reliance on the farmer for health-care support, the general level of health of farmworkers and their families is very low. Moller (1985:24) reported that 23% of workers travel to health care facilities in a private car, the rest walk or rely on public transport. The situation regarding workers' safety is similarly neglected. Mechanisation without sufficient training has resulted in a high incidence of accidents. In the 1980s about 2000 cases of permanent disablement in accidents were reported every year (Davies 1990:17). Where safety regulations nominally apply to farmworkers, as in the use of pesticides, farmers are advised rather than forced to comply.

### *Education*

There is currently no law requiring rural African children to attend schools and coloured children are required to attend school only if resident within three kilometres of a school. Workers therefore tend to be highly reliant on the farmer for the amount of schooling their children receive: about 40% of the 1.5 million black children on farms have no school to go to at all, of the remainder only 2.5% have access to school beyond standard 5 (Margo 1991:46). The incidence of farm children of school going-age not attending school is reported by Moller (1985:25) as 30%, and the reasons given in 51% of cases are related to financial constraints. Literacy amongst farmworkers and family members is in the region of one in eight (Margo 1991:46).

### *Wages*

The tradition of remunerating farmworkers with payment in kind (which puts a value on housing, food rations and support for health-care and schooling) is a system open to abuse and has undoubtedly been used as an excuse for low wages. This, together with the general practice of preventing workers or family members from working off the farm, has left farmworkers in a particularly weak economic position.

The monthly cash incomes of farmworkers depend on amongst others, the extent of workers' skill, the value of payments in kind and the type of ownership and profitability of the farm. Moller's (1985) estimates show median cash income for farmworkers are substantially lower than other groups, Figure 2.4. Though no indication is given in the Moller study of the household size, the extent to which workers receive payments in kind, or whether 'per capita' refers only to adult wage earners or includes children, the cash income of farmworker families is known to be particularly meagre.

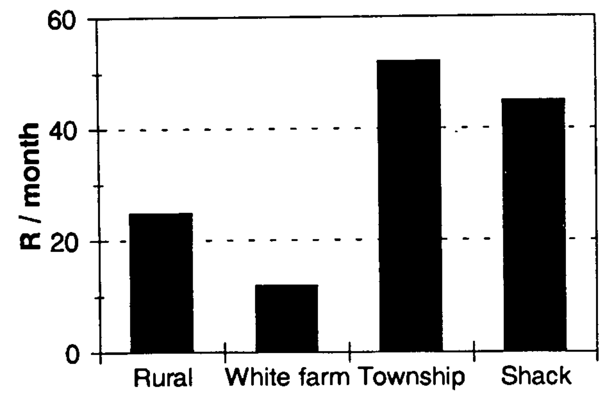



**FIGURE 2.4: Estimated median per capita income per month**
*Source: Moller (1985:25)*

Figure 2.5 shows the wages in rand per month received by farmworker households. The mean income is slightly higher than the median because of the effect of the few particularly high earners. Both the mean and the median are considerably closer to the lowest than highest income, for more than 75% of farmworker households earn less than R500 per month.

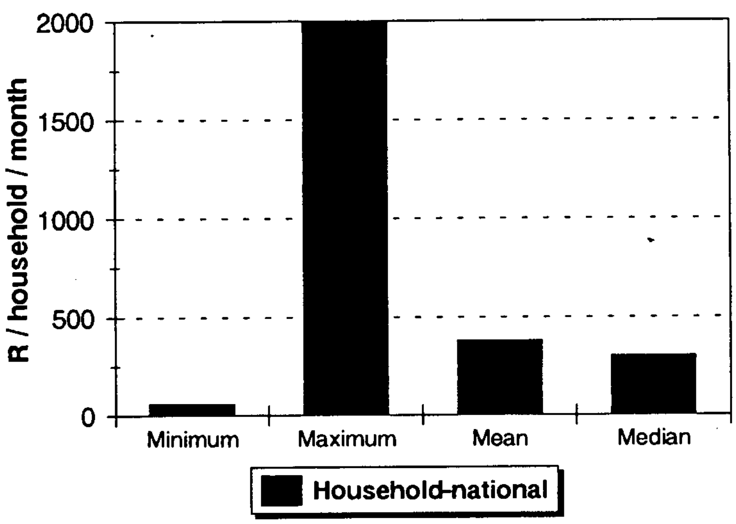



**FIGURE 2.5: Minimum, maximum, mean and median cash income of farmworker households.** *Source: Author (1993)*

Farmworker households will quite often have more than one wage earner, particularly during periods of high activity, for example during the harvest season, when women and in some cases children, will be employed on the farm. Appendix Three has further information on the incomes of farmworkers from a number of sources.

### *Regional variations in circumstances*

Because of the lack of protective legislation in the past and the total dependence of workers on their employers there is a tremendous diversity of conditions between different areas of the country. Figure 2.6 reflects the average household and per capita income, and Figure 2.7 the different level in access to electricity and water, and the extent of farmers' support for the electrification of worker dwellings in two areas of the Cape Province.

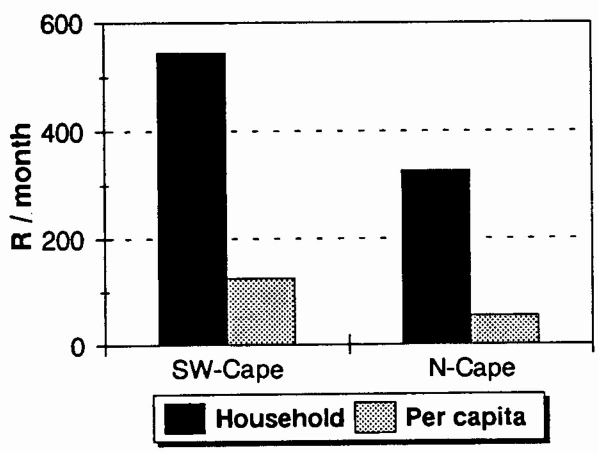



**FIGURE 2.6: Regional variation in per capita and farmworker household cash income.** *Source: Author (1993)*

Farmers' attitudes to farm workers are shaped by both economical and socio-political forces. Broadly speaking, conditions of farmworkers are directly related to the economic health and political 'liberalism' associated with a particular area. The SW-Cape is one of the more wealthy farming areas of the country and it is the region where workers receive the highest wages and have a higher level of service provision. It is also the region where farmers have developed incentives to improve the farmworkers' situation. The level of service provision and household incomes for farmworkers in the N-Cape are generally below the national average. However the fact that there is a much greater difference in the extent of provision of electricity than the extent of support for providing workers with electricity (Figure 2.7) perhaps indicates the economic constraints faced by farmers.

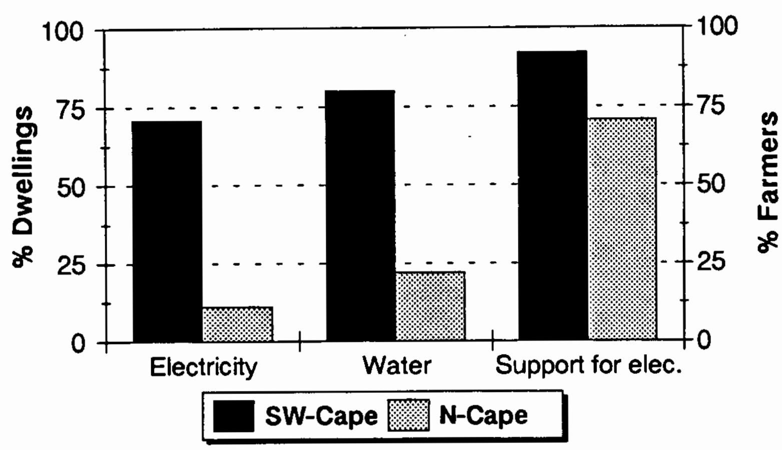



**FIGURE 2.7: Access to electricity and water and the extent farmer support for electrification.** *Source: Author (1993)*

## 2.4 Implications of current situation and potential for change

Farmworkers and their families live and work on the farm. Their household income is directly tied to on-farm employment and even when employment conditions are reasonable, they are always in the position of losing everything if they lose their job. More than almost all other categories of labour, farmworkers are economically and politically powerless and vulnerable to exploitation.

Abuse of child labour and violence against workers of all ages and both sexes are commonplace; the consequence of dis-empowerment is painfully experienced by farmworker families where women and children, who suffer the same lack of status and inadequate conditions as the men, endure further physical and psychological abuse at the hands of men who have been stripped of dignity and are unable to take control of their lives.

The farmers' violence against workers is often a result of personal fears, as Segal (1989:29) suggests:

> 'Behind this world in which these people live is a great fear that their world is disappearing'.

In recent times the agricultural lobby has lost much of its previous influence. Amongst the farmers who benefitted from the previous restructuring of the agricultural sector, there is a very real fear of losing land through monopoly interests or economic failure. There is also a growing fear of the implications of the changes in the political power structure of South Africa and more directly the introduction of labour regulations.

The changes in South Africa will have a fundamental impact on the agricultural sector in particular the re-integration of the homelands and land reform. The effect of such changes on the farmworker community is uncertain. There will be situations where farmworkers and their families may have legitimate historical land claims or access to land as a result of new land-rights. Some farmers are already involved in changing labour relations, for example share options and 99-year lease options on housing.

Nevertheless, the existing relations of power, class and ownership in the commercial farming sector will not change overnight. To improve the quality of life of the most marginalised will take considerable time and investment.

# Chapter Three
# FARMWORKER HOUSEHOLDS' ACCESS TO AND USE OF ENERGY SERVICES

## 3.1 Introduction

The poverty of farmworker households and the fact that they live on farms has an overriding effect on their patterns of energy use. Fuelwood is generally freely available and is extensively used as a cooking and heating fuel. Electricity is sometimes available and often free. The extent to which other fuels are used is largely dependent on the availability of these two energy carriers.

The aims of this chapter are to:

- assess farmworker households' access to energy services;
- present a general summary of current consumption patterns;
- identify constraints experienced;
- identify the rationale behind patterns of energy use;
- assess the physical, social and environmental implications of current patterns of energy use.

The information presented is derived from previous surveys of farmworker household energy use, a questionnaire sent by the Rural Foundation to all member farms (Chapter One, Section 1.2.2) and the authors' primary data collection.

Data has been analysed according to region, farming activity, electrification status, and household income.

It is difficult to gauge the accuracy of the consumption data presented because of the varying formats and research methodologies of the studies consulted, and because in many cases farmers provided information on behalf of farmworkers. Nevertheless, taking into account previous qualifications, this chapter provides an indication of the consumption patterns of farmworker households and circumstances regarding access to, and the supply of, energy services.

## 3.2 Farmworker households' use of energy carriers

There is a considerable amount of information on the proportion of farmworker households using particular fuels for cooking, heating and lighting purposes: these are presented separately for comparison, as well as to give an overall picture of household fuel use. More detailed information on end-uses, quantities consumed, appliances used, and problems associated with fuel use are presented in the sections that follow.

Table 3.1 and Table 3.2 give consumption data from seven previous reports. Table 3.1 gives the percentage of farmworker households using particular energy carrier for cooking and heating. A single figure for both uses is given as fuels used for cooking are generally also used for heating and when wood, coal and farmwaste are used, a single fire often serves both purposes. Table 3.2 gives the percentage of households using particular energy carriers for lighting. The percentage of households using fuels adds to more than a hundred where households use more than one energy source for the same function. (It is possible that commercial fuels are used when there is available cash or transport and households revert to fuelwood or farmwaste when cash resources have run out.)

**TABLE 3.1: The farmworker household: use of fuels for cooking and heating**

| Report | Sample | | Percentage of households | | | | | |
|---|---|---|---|---|---|---|---|---|
| Source | Size | Region | Flwd | Frmw | Coal | Parff | LPG | Elect |
| Moller | 299 | NE-Tvl Natal | 88 | 34 | 17 | 42 | 2 | 2 |
| Eberhard | 382 | National | 97 | 4 | 5 | 19 | 9 | 4 |
| Lieberman | 45 | W-OFS E/C-Ntl S-Tvl W-Cape | 88 | 8 | 8 | 25 | - | 6 |
| Jooste & Nortje | 530 | W-OFS | 86 | 59 | 8 | 9 | 1 | 0 |
| Lieberman & Dingley | 200 | E-OFS S-Tvl N-Cape Ntl-Cst | 88 | 9 | 8 | 25 | - | 8 |
| Tobich & Dingley | 100 | W/N/E-Cape W/E-Ntl S&C-Tvl | 73 | 0 | 14 | - | - | - |
| Gandar | 948 | W/E-Tvl Natal | 96 | 4 | 0 | - | - | - |

**TABLE 3.2: The farmworker household: use of fuels for lighting**

| Report | Sample | | Percentage of households | | | | |
|---|---|---|---|---|---|---|---|
| **Author** | **Size** | **Region** | **Candles** | **Parff** | **LPG** | **Elect** | **Flwd** |
| Moller | 299 | NE-Tvl Natal | 90 | 67 | 2 | 10 | 5 |
| Eberhard | 382 | National | 14 | 65 | 3 | 14 | - |
| Lieberman | 45 | W-OFS E/C-Ntl S-Tvl W-Cape | 46 | 37 | - | 25 | - |
| Jooste & Nortje | 530 | W-OFS | 91 | 68 | - | - | 5 |
| Lieberman & Dingley | 200 | E-OFS S-Tvl N-Cape Natal-Cst | 56 | 37 | - | 35 | - |
| Tobich & Dingley | 100 | W/N/E-Cape W/E-Ntl S&C-Tvl | 25 | | | 22 | 6 |
| Gandar | 948 | W/E-Tvl Natal | 96 | 0 | - | 27 | - |

The figures for fuelwood use are relatively consistent and fuelwood is, by a significant margin the main energy source used by farmworker households for cooking and heating. This is not surprising: workers are often situated on farms with natural woodland or woodlots, fuelwood is generally free, and can be used without a stove - an appliance which is often not affordable. Fuelwood use showed the least regional variation of the fuels despite the fact that the availability of wood is related to regional factors such as farming activity and bio-climatic zone. The regions where fuelwood seemed to be least used are the SW-Cape, W-OFS and the E-Transvaal. In the SW-Cape this is possibly because of the extent of electrification of worker houses, and the use of LPG, both of which are highest in this region. The W-OFS is where farmwaste is more extensively used and the E-Transvaal is the region where the most coal is used, and where Gandar (1991:19) reported fuelwood harvesting to be 'opportunistic' with workers often relying on residues from activities such as fruit and vegetable cultivation.

The use of farmwastes[1] for cooking and heating is inefficient and unpopular and is considered by farmworkers as an unpleasant fuel. Dung was said to burn slowly and not to liberate enough heat, while crop residues were said to burn too quickly (Lieberman 1987:29). The extent to which farmwaste is used is likely to depend on the availability of fuelwood and the suitability of the waste produced by the particular farming activity. As a result the use of farmwaste shows considerable region specificity being confined mainly to the OFS and to a lesser extent Natal. Lieberman noted that 42% farmworker households used cobs in the OFS, while 8% was the average use among his entire sample. Jooste (1987), whose sample was from the OFS, reported a much higher figure for farmwaste use than any of the other studies.

There is some uncertainty in the extent to which coal is used but its use does appear to be region specific and higher in the E-Transvaal - probably because of the proximity of coalfields and accessibility of distribution depots.

Paraffin is the most commonly-used commercial fuel for cooking and heating purposes. The fact that paraffin can be obtained in small quantities, with little cash outlay, almost certainly affects the extent to which it is used - possibly making it the popular next best option when fuelwood is scarce, the electricity supply (where applicable) is restricted, or when workers have access to town. Where electricity is unavailable, paraffin is also widely used for lighting. The percentage of farmworker households using paraffin for both cooking and lighting was given as 36% and 59% by Tobich and Gandar respectively.

LPG is the least used fuel for cooking, heating and lighting. Probable constraints are the capital outlay required for the gas cylinder and appliances, and the difficulties associated with the refill process such as the availability and cost of transport - particularly over distances. The only region where gas is used to any significant extent is in the W/SW-Cape. One reason could be that this is an area of high-density farming and where community stores are easier to reach. Respondents to interviews in the W/SW-Cape found LPG a 'cleaner' and more efficient fuel than paraffin.

Candles were reported as the most frequently used energy carrier for lighting in all studies bar that of Eberhard (1986), where the majority of farmworker

[1]Farmwaste for the purpose of this study refers to dung and cobs and does not include waste wood from fruit tree prunings.

households used paraffin (65%). The extensive use of candles is not surprising for candles can be bought with relatively small cash amounts and are used without the need of an appliance. However, the studies consulted show large variations in their estimates of candle usage and though the reasons are unclear, there appear to be regional variations in the extent to which paraffin and candles are used for lighting. More households use paraffin for lighting in Natal and the Transvaal compared to the OFS and Cape where candles are more common.

Most studies reported that farmworkers whose dwellings are electrified used electricity for lighting. But the use of electricity for cooking and heating is generally low. Lieberman (1987) compared fuel use by respondents with and without electricity. Figure 3.1 illustrates the difference between these two groups.

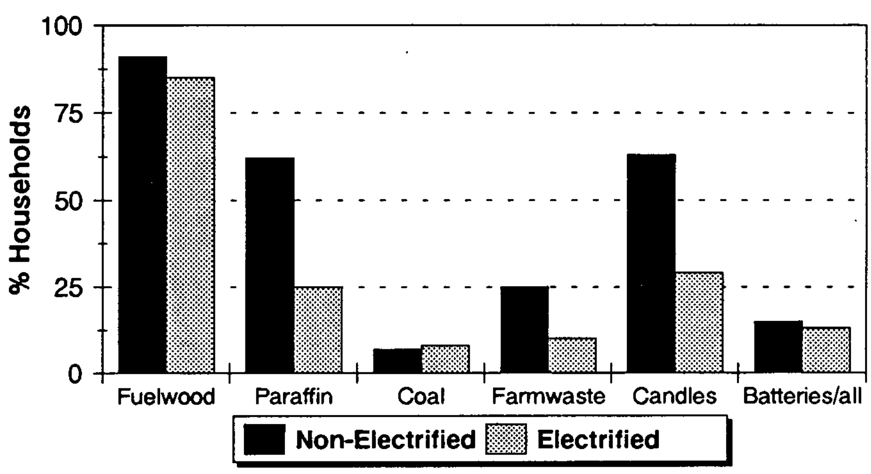



**FIGURE 3.1: Comparative fuel use in electrified and non-electrified dwellings.** *Source: Lieberman (1987:28)*

Access to electricity appears to have little impact on fuelwood use. One reason could be the extent to which worker households with electricity continue to use fuelwood for cooking purposes. (Farmers responding to the Rural Foundation questionnaire indicated that only 8% of farmworker households use an electric stove.) Farmwaste, paraffin and candles show the most change. The reduction in the use of candles and paraffin probably reflects the fact that most electrified worker dwellings use electricity for lighting. The practice of farmers placing a time-limit on electricity use, or an unreliable electricity supply, could be factors in explaining why more than 25% of workers with electricity still use candles.

The use of farmwaste, for cooking and heating, was substantially lower in electrified households - despite the low stove ownership, possibly reflecting the unpopularity of burning farmwaste and the better living standards associated with access to electricity.

## 3.3 Electricity

### 3.3.1 Current extent of farmworker house electrification

There are varying reports of the extent to which both farms and farmworker houses are connected to the grid. Table 3.3 gives results from previous studies.

**TABLE 3.3: Percentage of farms and farmworker dwellings connected to the grid**

| Source | Sample | | Eskom electricity | |
|---|---|---|---|---|
| | Size | Region | % Farms | % Worker houses |
| Moller (1985) | 299 | NE-Tvl Natal | - | 10 |
| Eberhard (1986) | 382 | National | 57 | 14 |
| Lieberman (1987) | 45 | W-OFS E/C-Ntl S-Tvl W-Cape | 71 | 25 |
| Lieberman & Dingley (1988) | 200 | E-OFS S-Tvl N-Cape Ntl-Cst | 69 | 35 |
| Tobich & Dingley (1989) | 100 | W/N/E-Cape W/E-Ntl S&C-Tvl | 77 | 22 |
| Gandar (1991) | 948 | W/E-Tvl Natal | - | 27 |
| Eskom (1992)[2] | - | National | - | 21 |

Nationally, somewhere between 70% and 75% of commercial farms in South Africa have access to grid electricity. Figures for the percentage of worker dwellings with access to electricity relate to dwellings on these farms. (No

[2] Pers. com., I. v Gass, Eskom, unpublished data.

estimate of the number of farms with electricity was given in the Moller, Gandar or Eskom studies).

Figures 3.2 and 3.3 give an indication of the proportion of electrified worker houses on farms with grid electricity according to region, and farming activity. Further disaggregation of regional data shows significant variations within the same regions, for example access to electricity by worker households in Natal ranges from 5% to 19% and in the OFS from 11% to 38%.

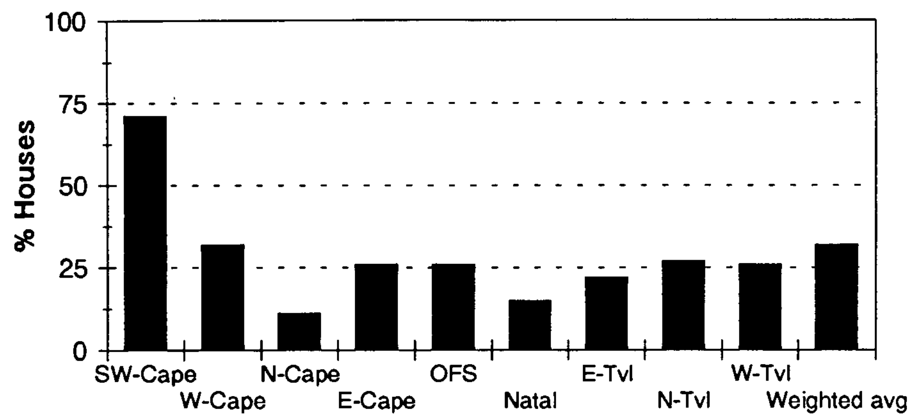



**FIGURE 3.2: Electrification of farmworker houses according to region.** *Source: Author (1993)*

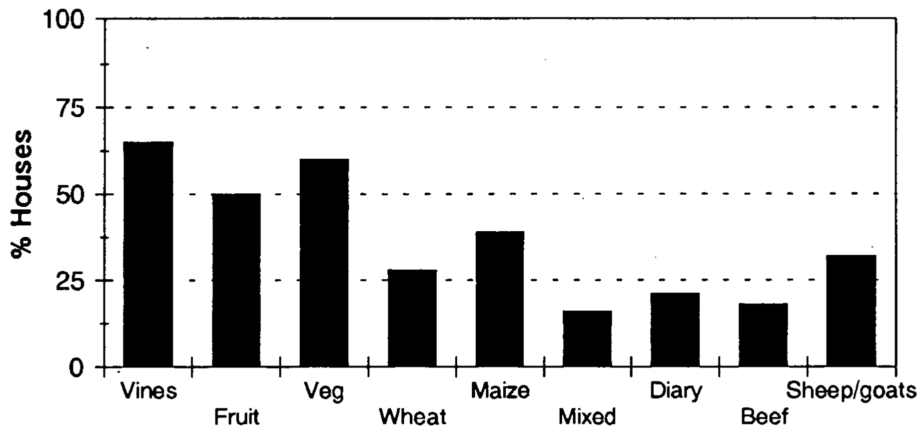



**FIGURE 3.3: Electrification of farmworker houses according to farming activity.** *Source: Author (1993)*

Because the study sample did not include workers' houses on non-electrified farms, and more farmers who have provided electricity are likely to have responded to the questionnaire, the actual percentage of houses electrified is probably lower than the figures suggest. Assuming 75% of farms are electrification, the estimated average percentage electrification of farmworker houses on all farms (electrified and not) was calculated to be approximately 23%.

Considering the farming activities associated with different regions, there is a general correlation between the variations in the extent of electrification reflected in Figures 3.2 and 3.3. The extent of electrification of farmworker houses appears to be influenced by the general wealth of the area, the economic health of the farming activity and the attitude of farmers to their workers. In the SW-Cape, where farmers are known for their 'progressive' approach to farmworker needs, more worker households have access to electricity by a significant margin.

It is possible that the spatial layout of dwellings is also significant. On smaller fruit and vegetables farms, where for reasons of land availability worker houses are grouped or closer to farm homesteads, they are perhaps more likely to be electrified than on larger livestock or cereal farms. Gandar (1991:32) found that a greater proportion of farms with timber and sugar supplied workers with electricity than farms without, and farms with cereals and livestock are the least likely to have supplied workers with electricity. Similar results were reported by Lieberman (1988:7) where 18% and 15% of workers' houses had electricity on cattle and maize farms respectively, compared to 66% on sugar farms.

The number of supply points on a farm - which is related to the electricity demand of the farm, may also impact on the farmworkers' access to electricity. The high degree of electrification on sugar farms could be related to the fact that workers are often housed in compound type accommodation which makes electrification easier.

Figure 3.4 shows the percentage of farms where some, all, or none of the worker dwellings have been electrified. On about 36% of farms in this sample, some worker households have access to electricity. On almost 50% of farms where electricity is made available to farmworkers, only some houses are electrified. The fact that farmers are responsible for the electrification of worker dwellings - decide whether to electrify and pay most of the cost - clearly affects the degree of access.

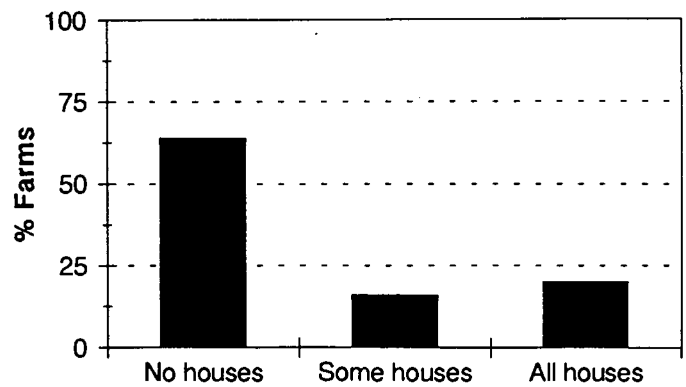



**FIGURE 3.4: Percentage of farms where all, some, and no worker houses are electrified.** *Source: Author (1993)*

That only some houses on a particular farm are electrified appears to be related to the status of workers and the farmers' attitudes to workers, as well as to the distance of dwellings from the grid. Gandar (1991:35) reported that some farmers think of workers as being too 'raw and unsophisticated' to appreciate electricity but that the main constraint on supplying electricity was the cost of connection.

Figure 3.5 and Figure 3.6 demonstrate the difference in the extent of electrification of worker dwellings according to farmworker household income and the building material from which dwellings are constructed.

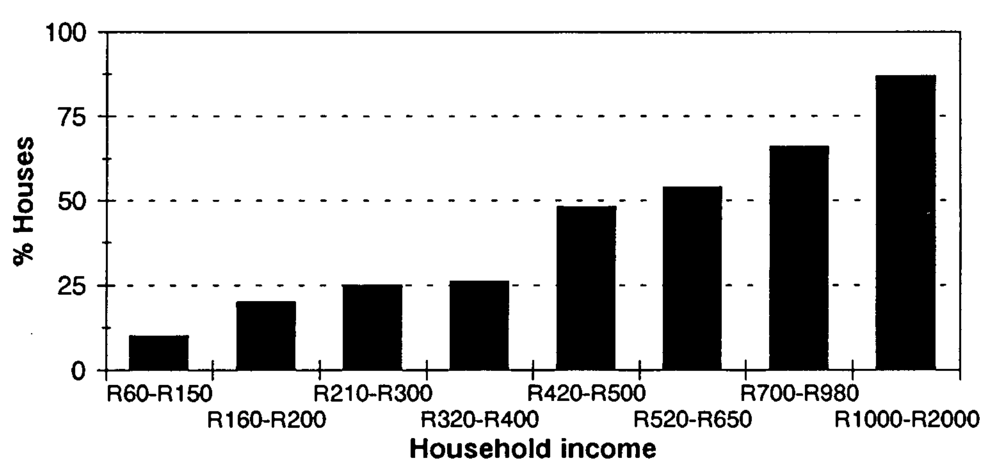



**FIGURE 3.5: Electrification of farmworker houses according to farmworker household income.** *Source: Author (1993)*

There is a clear indication from Figure 3.5 that the extent of electrification has direct correspondence with the estimated monthly farmworker household income. The higher the household income the more likely they are to have electricity. Considering the fact that farmers are responsible for, and generally pay for connecting worker houses to the grid, electricity is more likely to be provided on better-off farms, and it is also on these farms that workers' wages are likely to be higher. The relationship between workers' wages and their access to electricity therefore relates to the wealth of the farm and attitude of the farmer to the work force rather than the workers' ability to afford electricity.

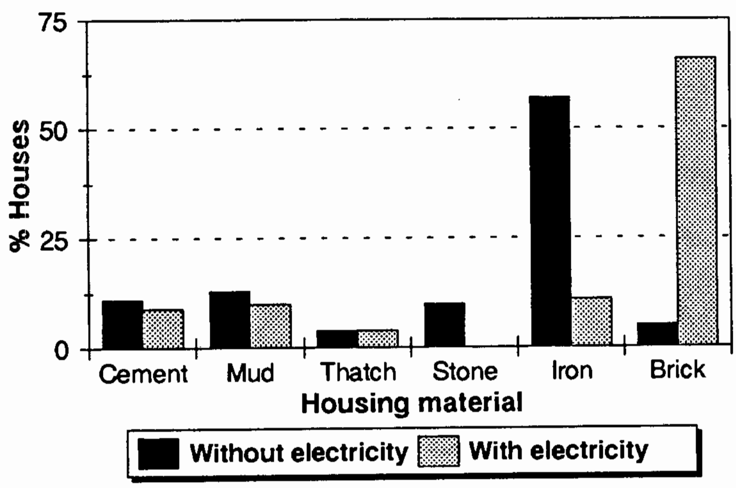



**FIGURE 3.6: Electrification of worker houses according to type of housing material.** *Source: Lieberman (1987:27)*

From Figure 3.6, it can be seen that brick houses are much more likely to be electrified and iron houses least. The fact that there is little difference in the extent of electrification of houses built from other materials, possibly associates access to electricity to the overall living standards of workers rather than a particular housing material. Again it is likely that the improved living standards - and therefore type of housing - relate to the general wealth of the farm and attitude of the farmer.

### 3.3.2 Electricity end-uses and appliances used

Few households that are electrified use electricity for all their energy needs and multiple fuel use is common. The pattern and mix of fuel use will depend on the level of access to electricity and the extent of appliance ownership. Access depends on both availability and affordability. The use of electricity other than for lighting is often restricted by the farmer or the inability of workers to afford consumption costs and the cost of appliances.

Tables 3.1 and Table 3.2 gave the extent to which electricity is used for cooking, heating and lighting respectively. Table 3.5 gives more detail of electricity end-uses and the use of appliances by farmworker households.

**TABLE 3.5: Households' use of electricity for particular end-uses**

| **Region** | **End-Use %** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **Light** | **Cook** | **Kettle** | **Heat** | **Fridge** | **Geyser** | **Radio** | **TV** |
| SW-Cape | 100 | 80 | 80 | 34 | 57 | 42 | 71 | 54 |
| W-Cape | 88 | 54 | 62 | 8 | 25 | 8 | 67 | 29 |
| E-Cape | 100 | 33 | 53 | 4 | 27 | 7 | 63 | 58 |
| N-Cape | 100 | 15 | 16 | 0 | 15 | 0 | 50 | 40 |
| OFS | 100 | 54 | 48 | 5 | 11 | 5 | 84 | 40 |
| Natal | 100 | 28 | 28 | 1 | 12 | 0 | 80 | 43 |
| W-Tvl | 100 | 36 | 25 | 1 | 0 | 0 | 82 | 39 |
| N-Tvl | 98 | 32 | 38 | 0 | 5 | 0 | 62 | 13 |
| E-Tvl | 100 | 43 | 17 | 3 | 0 | 0 | 88 | 33 |
| Weighted average | 98 | 43 | 39 | 8 | 17 | 12 | 76 | 40 |

*Source:Author (1993)*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Lieberman** | 100 | 24 | - | - | 32 | 2 | 76 | - |
| **Tobich & Dingley** | 100 | 44 | 57 | 8 | 16 | 17 | 67 | 36 |
| **Gandar** | 100 | 28 | 11 | - | 6 | - | 44 | 17 |

Most worker households have the use of electricity for lights and media and more than a third for cooking, but the use of electricity for space or water heating is very limited. The overall figures from the postal survey are higher than those from other studies and weighted averages were pushed up by the figures from the SW-Cape which has higher access levels and a larger farmworker population.

There are similar regional trends in the use of electricity services by farmworker households and the extent of access. Worker households in areas which have more electrified dwellings e.g. the SW-Cape and OFS tend to use a wider range of electrical appliances, compared to the areas where fewer dwellings are electrified for example in Natal and the N-Cape.

The use of electricity for cooking (Table 3.5) does not indicate what appliance is used. From the Lieberman (1987:36) study, only 15% of the farmworker households that used electricity for cooking had a stove with an oven.

In many cases appliances used by worker households are owned by farmers. When workers buy appliances, cash is often borrowed from employers and deducted from wages. Workers I spoke to expressed gratitude - for access to a credit facility - but because of their low cash wages, cash loans are often difficult to repay and can result in a perpetual cycle of household debt.

From the limited number of interviews conducted with farmworkers in the W/SW-Cape, I found few workers who used an electric iron - old irons were heated on an electric stove. Similarly households used the stove, and not a kettle, to heat water for washing and for tea or coffee. Reasons given for this practice were the inability to afford an electric kettle or iron, that limiting the ownership and use of appliances would keep the cost of electricity down, and that there was as far as they could see no practical difference to using a stove or particular electrical appliance.

Fridge ownership amongst respondents interviewed was particularly high, and most households had the use of a fridge.

Few households interviewed used electric space-heaters (none of those who paid for their electricity consumption costs). When questioned on the use of electricity for space heating, users had either retained their woodstove or 'used blankets'. It is unclear to what extent the use of electricity for heating would replace fuelwood if the cost of the appliances and the electricity to use them were more affordable.

### 3.3.3 Amounts consumed

Because of the lack of individual metering and the use of communal facilities such as kitchens or wash rooms, it is difficult to gauge the amount of electricity consumed by worker households. Consumption level estimates provided by farmers in response to the postal survey are shown in Figure 3.7. These are considerably higher than those reported by Gandar (1991:33), which range from 22 to 200 kWh (averaging at about 89 kWh) per household per month. This reflects the same trend between the two studies in the extent to which electricity is used. Possibly because of the different regions represented in the sample and questionnaire returns. Practices by farmers that affect the extent to which workers use electricity are: limits on the type of appliances households may use; restricting the number of hours per day that workers have access to electricity; limiting the number of units a household may use before they are charged; and where pre-payment meters are installed, giving workers a monthly ration of meter cards.

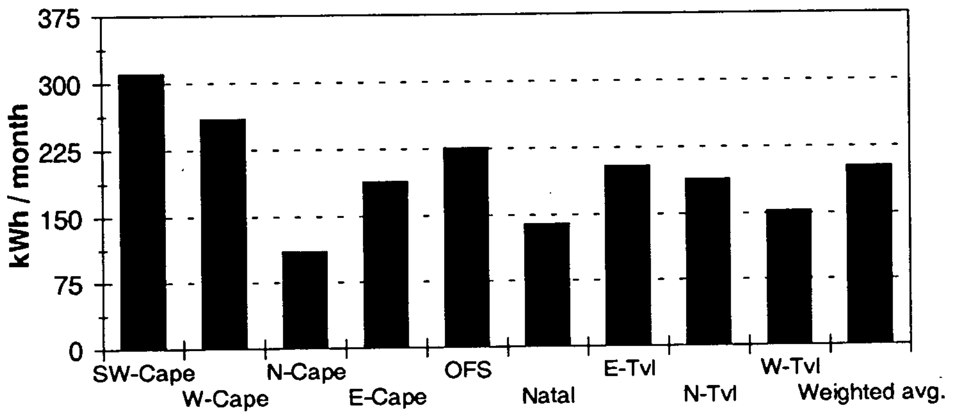



**FIGURE 3.7: Electricity consumption levels of farmworker households.** *Source: Author (1993)*

Where farmworker households pay for their electricity, they are limited by both the cost of appliances and the cost of the electricity to use them. It is unclear to what extent current consumption levels reflect demand or whether these would increase if electricity and electrical appliances were more affordable.

The regional variation in the use of electrical appliances corresponds with the amount of electricity consumed. Areas where more households use a range of electrical appliances, such as the W-Cape and the OFS, are also those where more electricity is consumed, and the lowest consumption levels are found in the N-Cape and Natal where power intensive appliances are least used.

Figure 3.8 reflects the farmworker household income with respect to consumption categories. The relationship is not direct for in most cases farmers pay for the electricity their workers consume.

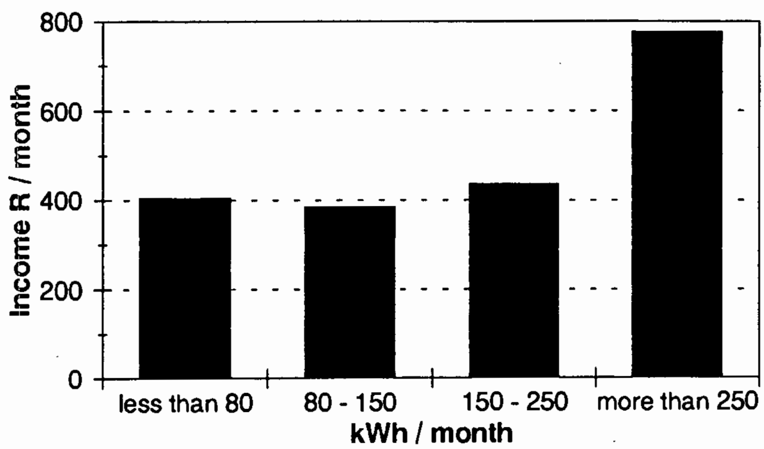



**FIGURE 3.8: Farmworker households' average monthly income and electricity consumption.** *Source: Author (1993)*

There is no significant difference in mean household income up to a consumption level of 250 kWh per month. However households consuming more than 250 kWh per month have considerably higher mean income.

### 3.3.4 Consumption cost

The mean cost of farmworker households' electricity consumption ranges from R16 per month in the N-Cape to R42 per month in the W/SW-Cape with a weighted average of approximately R28 per month (Author 1993).

The practice of farmers paying for the cost of the electricity used by worker households is widespread. Figure 3.9 gives the extent to which farmers and workers contribute to the cost of farmworker households' electricity consumption.

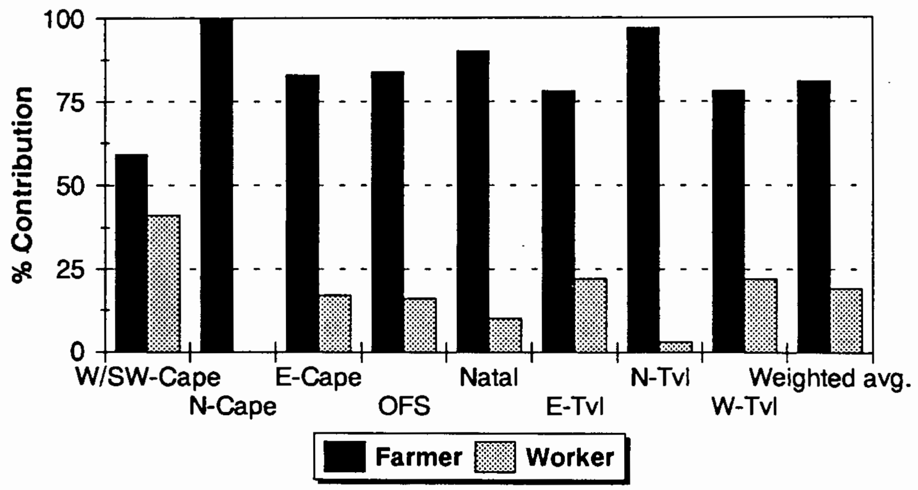



**FIGURE 3.9: Farmer and worker contributions to the households' electricity consumption cost.** *Source: Author (1993)*

On average about 92% of farmers and 30% of workers contribute to the cost of the electricity used by worker households. Farmers pay approximately 83% and workers 17%. The two regions where workers contribute most and least to the cost of electricity, the W-Cape and N-Cape, are also the regions where there are highest and lowest consumption levels and where the highest and lowest wages are paid. This correspondence could relate to better-off farmers placing fewer, or no limits on their workers' consumption, as well as electricity and appliances being more affordable to households with a higher income. In general workers who have access to a wider range of electricity services appear to contribute more to the cost of their electricity consumption.

The percentage of workers' household income spent on electricity by workers who contributed towards their consumption costs, was calculated to be between 1% and 3%. Because farmers pay for much of worker households electricity consumption these figures are not a true reflection of the percent of income that would be spent if the full cost of consumption was borne by the worker household. Of the 21 households interviewed in the W/SW-Cape, 10 paid for their electricity, those with geysers in the region of R50 per month, those without about R30 per month. This represents 8% and 5% of their income respectively. Respondents spoken to were well aware of the relative cost of electricity uses.

### 3.3.5 Workers' response to electrification

Both Lieberman (1987) and Gandar (1991) reported that electricity was not an important factor in choosing a job. Movement of workers between farms is probably more related to the attitude of the 'baas'[3] than the living conditions of workers (Waltman 1993). Figure 3.10 illustrates the attitude of workers to electricity as reported by Gandar (1991). Those who said that electricity is important were the more senior workers who had fewer restrictions on their use of electricity and, because they were better paid, were able to experience more benefits of electricity.

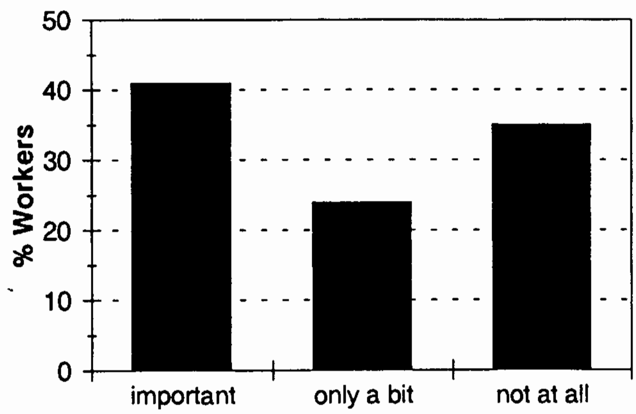



**FIGURE 3.10: Farmworkers' attitude to electricity.**
*Source: Gandar (1991:34)*

The response to electrification among the households I interviewed was positive; most said electricity was 'important' along with housing. However those interviewed had a wide range of electricity uses, received higher than average cash wages, contributed the most to their consumption cost and had a greater control over their use of electricity, compared with more typical circumstances in other parts of the country.

Reasons given for finding electricity important related to affordability, convenience, reliability and safety: 'always being there, never running out' - 'no open flames'- 'instant light when arriving home in the dark'.

[3]'Baas' is the Afrikaans word for boss.

Fridge owners referred to cold storage potential. Some typical responses were: 'can buy meat on a special and keep' - 'now some food immediate, before not' - 'wonder how I ever did without'.

For TV users electricity made significant savings, for example: 'pay R2 a month towards the TV, used to pay R14 for batteries.'

Electricity was said to be faster and better and to make everything easier. None of the families I interviewed considered abandoning electricity and going back to previous fuels used for any task. Aside from fuelwood for space heating no other fuel was used preferentially, and the only instance of the use of other energy carriers out of necessity was the respondent who used batteries for his radio.

When asked 'If you had electricity for one function what would it be?', respondents who had electricity for light, cooking and media uses, had difficulty choosing, and needed to be encouraged by rephrasing the question to 'which electricity use would you be most loath to give up?'. Only four end-uses were mentioned. Electricity for cooking and lighting competed for first place (surprisingly even amongst some men), TV and fridge for second and third place.

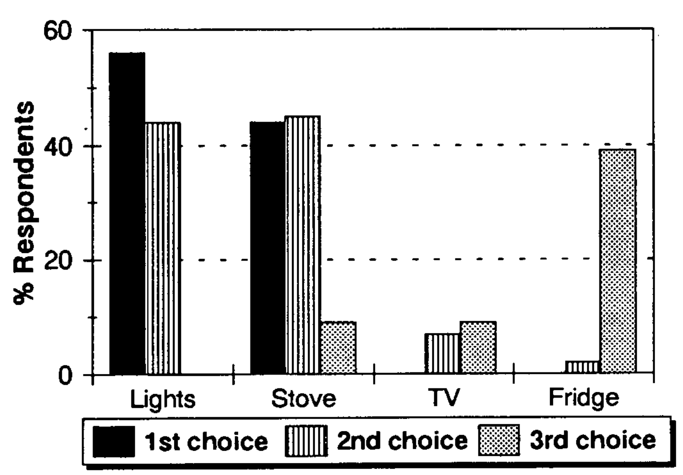



**FIGURE 3.11 Interviewees expressing appliances/fittings preferences**
*Source: Author (1993)*

A study to gauge the potential demand and willingness to pay for electricity amongst a community of 34 workers who did not have access was undertaken for Eskom by Kotze and Wolhuter (1992) in the Barkley-West district. Some of the results are presented in Figure 3.12. All the workers spoken to said they would like to have access to electricity.

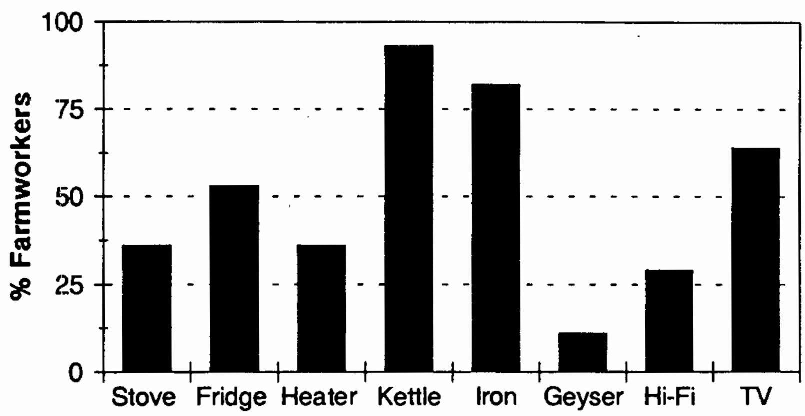
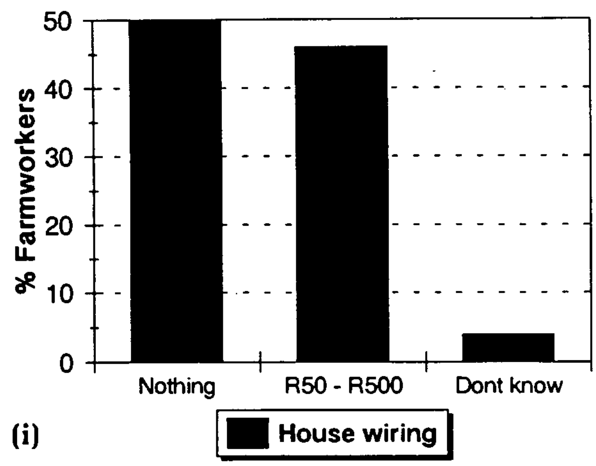



**FIGURE 3.12: Farmworkers that would like to buy/have the use of particular electrical appliances.** *Source: Kotze and Wolhuter (1992)*

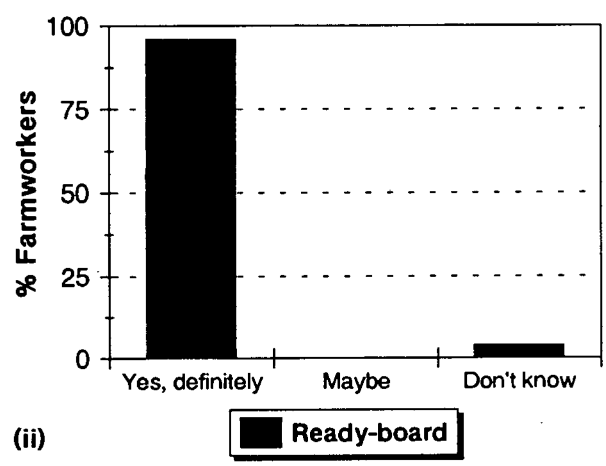
The two appliances worker households most wanted to buy by a significant margin were a kettle and an iron. Next, a TV and a fridge. The fact that a stove is of less importance perhaps indicates that some households already own a stove and use other fuels such as fuelwood or farmwaste. The fact that a kettle is so high on the list, perhaps indicates the need for a quick water heating facility, and that few workers use paraffin or gas stoves.

It should be noted that the choice of appliances/fittings for those already using electricity vary considerably from those without the use of electricity. Also that the choice of appliances would depend on particular household circumstances - whether the male worker or the woman home keeper is questioned and then whether the woman home keeper has a young baby or a school going teenager. The information in Figures 3.11 and 3.12 should not be seen as generally representative. Further information from the Kotze and Wolhuter study (1992) on workers attitudes to electrification is shown in Figure 3.13.

The particularly positive response to the ready-board could be because workers were questioned about making contributions to house wiring, had no experience of using electricity and could therefore not differentiate between the two options, or that the value of electricity meant more to them than the way it was delivered.




(i)




(ii)

**FIGURE 3.13: (i) How much workers are willing to pay for house wiring and (ii) how willing workers are to use a ready-board.** *Source: Kotze and Wolhuter (1992)*

The response to electricity by farmworker households has not been universally favourable. Newly electrified homes have been reported to used electricity until the first prepayment card or light bulb was depleted. One farmer, in response to the postal survey, said workers used candles for lighting despite electricity being available.

### 3.3.6 Farmers' response to worker house electrification

Various studies have listed farmers expressing benefits as a result of worker households having access to electricity. In response to my postal survey where farmers were asked about the impact farmworker houses electrification, a total of 90% of farmers said the outcome was positive, 7% said there was no difference and 3% said conditions were worse. The main benefits of electrification and the percent of farmers who mentioned these are presented in Table 3.5. Other reasons related to health and safety and fuelwood shortages on the farm.

The negative responses from farmers related to the lack of access to electricity in the region, 'now relatives and friends 'flock' to the farm' - 'those without are dissatisfied' and the cost, 'was too much and not worth it' .

**TABLE 3.5: Benefits of Worker House Electrification**

| Benefits from the electrification of workers houses | % Farmers |
|---|---|
| Improved conditions, quality of life and environment | 33 |
| Improved attitude to work and better labour relations | 21 |
| Saved time and money | 17 |
| Happier and more stable workforce | 11 |
| Improved workers self-esteem | 6 |

*Source: Author (1993)*

More than half the farmers questioned by Lieberman (1987:54), did not notice any change as a result of worker house electrification. Farmers that did, listed similar benefits to those of the postal survey, such as improved quality of lifestyle (32%), workers worked harder (20%), and the electrification of workers' houses 'attracted a better quality of worker' (18%). Gandar (1991) noted that electrification of workers' houses was not seen by farmers in hard financial terms but rather as part of the process of upgrading workers' conditions.

### 3.3.7 Problems relating to electricity consumption

Problems associated with the use of electricity by worker households relate to the farmer and household poverty limiting the utility value of the electricity supply. Also to the negative social impact of only some worker dwellings on a farm or in a district being electrified. None relate directly to electricity. From responses to interviews, there is little doubt that those with access appreciate electricity and are willing to consume and pay to the extent that they find it affordable.

Access to electricity which appears to be largely dependent on the viability of the farm and the attitude of the farmer to workers, is associated with higher household incomes, improved housing and better working relationships. One interviewee enthusiastically responded that conditions were 'getting better step by step, together with farming operations our conditions improve'.

## 3.4 Fuelwood

### 3.4.1 Farmworker households' access to fuelwood

The percentage of farmers who 'provide' their farmworker households with fuelwood is shown in Figure 3.14. Provide, for the most part, means workers are given permission to collect wood on the premises and to use farm equipment to prepare and transport it. In some cases wood is collected or delivered from neighbouring farms.

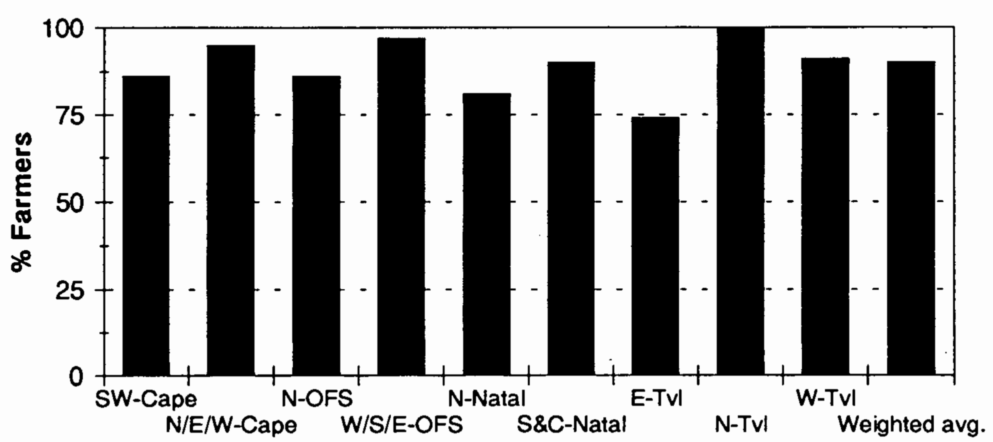



**FIGURE 3.14: Percentage of farmers who provide farmworkers with fuelwood.** *Source: Author (1993)*

The extent to which farmers provide worker households with fuelwood is high throughout the country and does not appear to be affected by differences in bio-climatic zones or farming activities. From the survey data however, there is no indication of how much of the fuelwood actually used by worker households is provided by the farmer, or how far the fuelwood provided goes towards fulfilling the households' needs.

Within the limitations of the respective sample regions, the study by Moller (1986:24) indicated that fuelwood is more readily available on commercial farms than in other rural areas, as summarised in Figure 3.15.

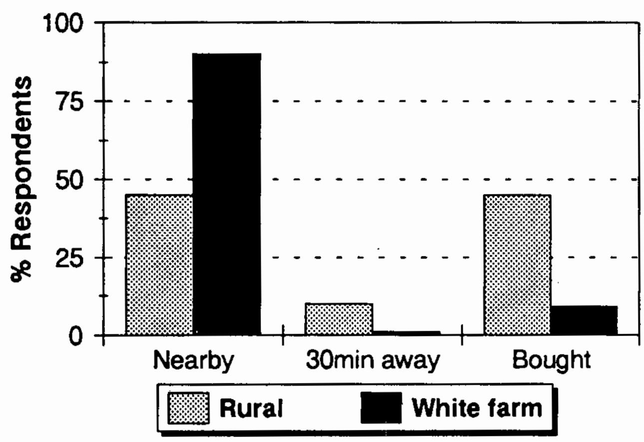



**FIGURE 3.15: Availability of fuelwood to farmworkers compared to other rural dwellers.** *Source: Moller (1986)*

Gandar's (1991) study investigated farmers' and farmworkers' perceptions about the availability of fuelwood (Figure 3.16 and Figure 3.17).

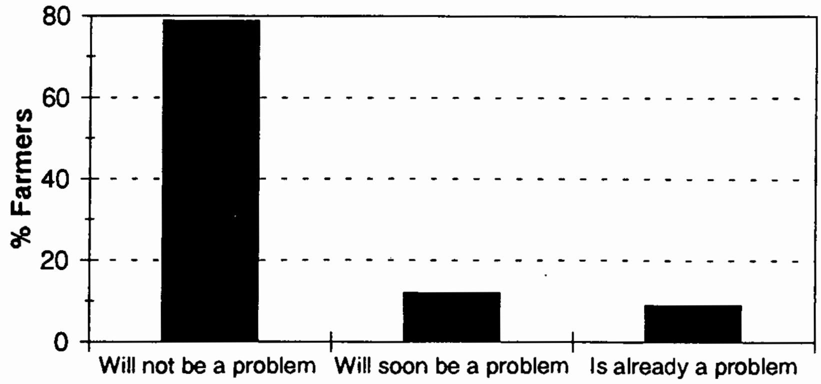



**FIGURE 3.16: Farmer perceptions of fuelwood availability**
*Source: Gandar (1991:24)*

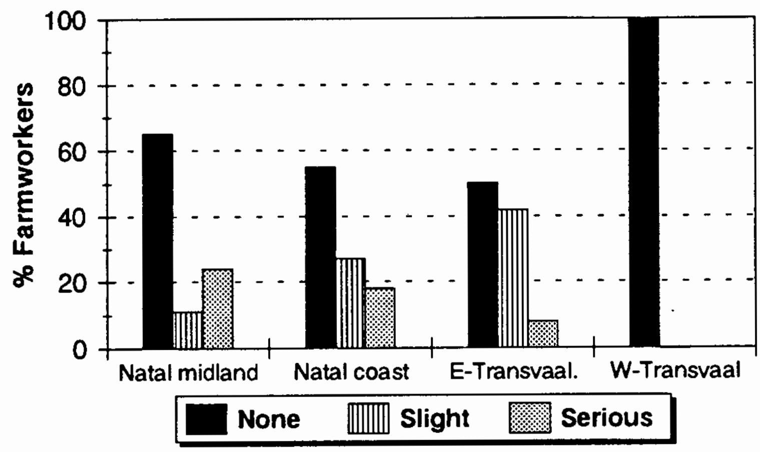



**FIGURE 3.17: Farmworker perceptions of fuelwood availability**
*Source: Gandar (1991:24)*

In Natal and the E-Transvaal between 35% and 50% of farmworkers experience some fuelwood shortages while only 7% of farmers recognise there is a problem. Constraints on availability reported by Gandar (1991) were farmers regulating and managing their workers' harvesting of indigenous species by allowing only dead wood to be cut or specifying harvesting areas, and the farmer's own need for wood, for example for fencing poles. To what extent shortages reflected in Figure 3.17 are as a result of restricted access, or reflect the extent or the fuelwood resource, is uncertain.

While none of the workers I spoke to in the W/SW-Cape had trouble obtaining fuelwood, Gandar's report clearly indicates areas of fuelwood shortages. Comparing the figures on the availability of fuelwood from Figures 3.16 and 3.17 it appears that some farmers may not be fully aware of their workers' fuelwood needs or have an unrealistic impression of their role in fulfilling these needs.

> 'In one instance labourers said it was necessary to steal from a neighbouring farm in order to provide fuelwood for the winter fires in the farmer's own home. That particular farmer assured me there was no shortage of fuelwood on his farm' (Gandar 1991:27).

In general it seems that farmworkers often have reasonably good access to fuelwood but there are no doubt many instances where fuelwood is in short supply.

### 3.4.2 Fuelwood use by farmworker households

Lieberman reported that some farmworker households use fuelwood for other than cooking and heating, reasons of tradition (9%), habit (6%), and for prayer (1%) were given. From the Lieberman study, the manner in which worker burn fuelwood, is illustrated in Figure 3.18.

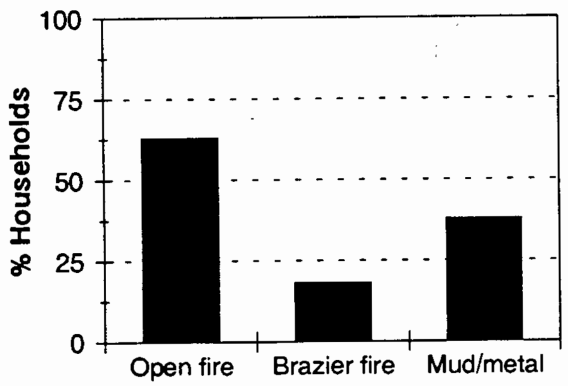



**FIGURE 3.18: Fires and stoves used for wood burning**
*Source: Lieberman (1987:34)*

Gandar (1991:17) found that in Natal 53% of respondents had wood-burning stoves compared to only 8% in the Transvaal. Workers in houses that had been upgraded were often provided with stoves, while those in self-built houses were generally without a stove. The Dover and the Burnell wood burning stoves are actively promoted in the farming sector and farmers have expressed pros and cons regarding the use of both. For example, in favour of the Burnell are lower cost and simple inexpensive extras for water heating. One farmer however found them less durable than the Dover (Gandar 1991:17).

Though most workers interviewed in the W/SW-Cape had electric stoves, many had retained their wood-stoves for water heating and cooking and to double up as space heaters during the winter months, particularly those respondents who paid all or part of their electricity costs. A farmer replying to the postal survey commented that though workers had the use of electricity for cooking, they 'used their wood stoves daily to bake bread in the traditional manner'.

### 3.4.3 Amounts of fuelwood consumed

Two studies reported on the amount of fuelwood consumed by farmworkers. These are summarised in Figure 3.19. The national figure was calculated from fifty-four farmers who estimated the annual fuelwood consumption of all workers on the farm in response to the Eberhard survey (1986:104). Regional figures are from the study by Gandar (1991:14-15).

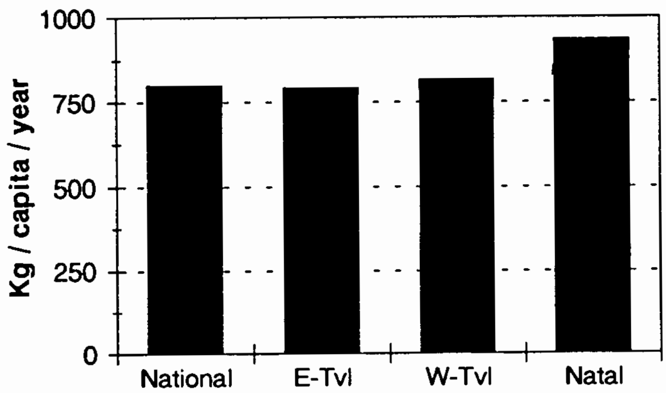



**FIGURE 3.19: Per capita fuelwood consumption by farmworkers and their families.** *Source: Gandar (1991:14)*

Though the use of compound kitchens and the informal movement of fuelwood between farms makes the estimation of per capita wood consumption difficult, there appears to be a correspondence between the regional figures presented by Gandar and the national figure of Eberhard. Despite the fact that Eberhard's estimates were from a postal questionnaire to farmers and Gandar's from interviews with workers.

The total amount of fuelwood consumed by farmworkers and their families in Natal and the E/W-Transvaal was estimated at 560 000 tonnes per year and 1 630 000 tonnes per year respectively (Gandar 1991:15,16).

These amounts are relatively high compared to estimates of consumption in other rural areas which range between 300 and 750 kilograms per capita per year (Gandar 1991:15). This may reflect the availability of fuelwood on commercial farms compared to homeland regions where over-population has resulted in over-use and the degradation of the biomass resource.

### 3.4.4 Cost of fuelwood

Farmworkers were reported to obtain fuelwood free except in the study by Moller (1986:24) where 9% of farmworkers said they paid for fuelwood.

The percentage of farmers who attached a cost to providing workers with fuelwood and the average amount spent per household per month are given in Figure 3.20 and 3.21.

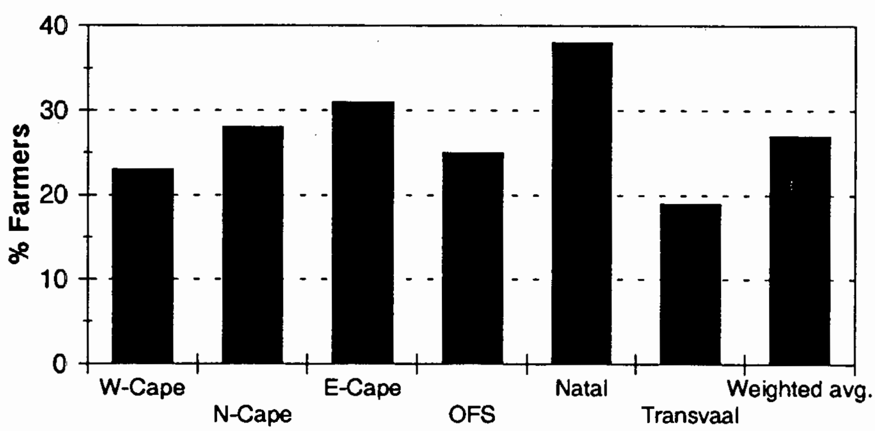



**FIGURE 3.20: Farmers who attached a cost to providing fuelwood**
*Source: Author (1993)*

Although 90% of farmers 'supply' fuelwood, on average only 27% estimated that there are costs involved.

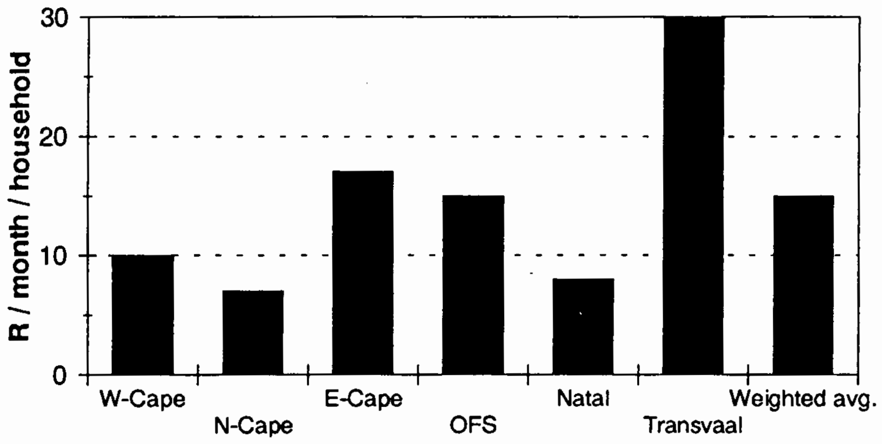



**FIGURE 3.21: Amounts spent by farmers on fuelwood**
*Source: Author (1993)*

It is unclear how much of these estimations relate to the cost of purchased wood or the cost of harvesting and preparing wood for use, such as petrol or diesel for transport and wear and tear on vehicles and saws.

Gandar (1991:27,29) reports one farmer estimating the cost of cutting and delivering a 3 tonne load to the compound as about R100, another said he preferred to buy wood at the cost of R35 / tonne than have the 'hassle' of using and maintaining farm equipment. The opportunity cost of land was also given as a reason for buying fuelwood rather than planting trees.

### 3.4.5 Problems associated with the use of fuelwood

Farmworkers are probably better off than many other rural, urban or peri-urban fuelwood users. Fuelwood is generally available, cost is not a significant constraint, and some workers have the use of farm equipment for collection and processing. Nevertheless the extent of fuelwood use and the near-total reliance on fuelwood for an essential energy end-uses such as cooking, has repercussions.

One of the main problems experienced by fuelwood consumers relates to the time and effort required when collecting, processing and using. Time spent collecting fuelwood by workers from the study by Jooste and Nortje (1987:55) are given in Figure 3.22.

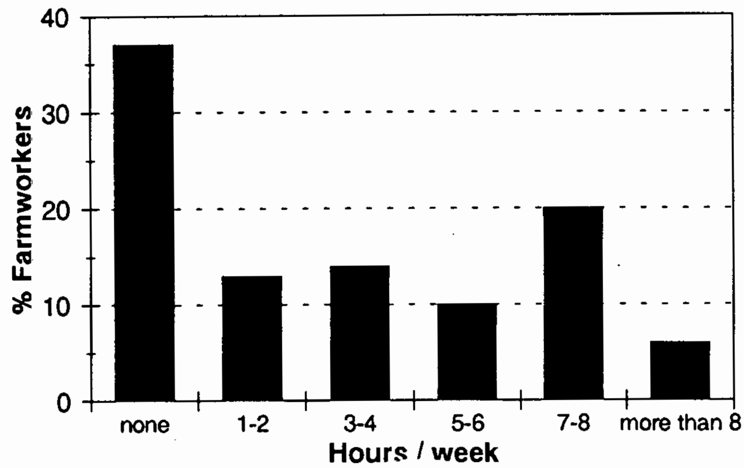



**FIGURE 3.22: Time spent by farmworkers collecting wood**
*Source: Jooste and Nortje (1987)*

Fuelwood is generally collected by women, children or unemployed family members - collection by employees, is generally done so outside working hours. In the Jooste and Nortje (1987) report there was no indication whether, in order to supply the household, family members other than the worker also spent time collecting wood. In the W/SW-Cape where shortages were not experienced, a head-load a day was collected to fulfil the needs of a household that did not use electricity for cooking. In areas of fuelwood scarcity collection problems are exacerbated as distances covered and time spent, increase. Lieberman (1987:29) interviewed two women who 'spent up to eight hours a day walking the koppies to collect wood'.

Besides collecting time, fires still have to be made and there is further waiting before cooking can commence, or hot water is available for washing. Among interviewees in the W/SW-Cape, time saved was one of the main reasons for preferring electricity to wood for cooking and water heating.

The other particular problem associated with using fuelwood relate to the exposure to pollutants released into the atmosphere during fuelwood combustion which are known to contribute to a variety of respiratory illnesses, among other ailments. Levels of respirable suspended particulates have been reported to be in the region of 3500 $\mu gm^{-3}$ to 4000 $\mu gm^{-3}$ during the average seven hour period that households were using fires. These are considerably higher than the World Health Organisation recommendations of 100 $\mu gm^{-3}$ to 150 $\mu gm^{-3}$ with an average time of 24 hours (Van Horen 1994a). From the stove-use information presented earlier it appears that many farmworker households use fuelwood without a stove. Together with bad ventilation, the pollution levels experienced by these households probably put users at considerable risk, particularly the more vulnerable, such as the very young and the elderly.

## 3.5 Other fuels used by farmworker households

### 3.5.1 Use of paraffin, LPG, coal and candles

Paraffin and candles are used widely by farmworker households; there are conflicting reports on the extent to which coal is used; and LPG is little used. The use of paraffin, gas, and coal for cooking is largely related to access to fuelwood and to the isolation and poverty of many worker households. Nationally on average between 5% and 10% of workers own a car (Rural Foundation 1989).

Table 3.6 shows the number of farmworker households in Natal and the NE-Transvaal that use these fuels compared with other rural areas.

**TABLE 3.6: The use of paraffin, LPG, coal and candles on commercial farms and other rural areas**

| Fuel | % Households using fuels | | | | | |
|---|---|---|---|---|---|---|
| | Lighting | | Cooking | | Heating | |
| | Rural | Farm | Rural | Farm | Rural | Farm |
| Paraffin | 74 | 67 | 70 | 52 | 48 | 33 |
| LPG | 4 | 2 | 6 | 2 | 4 | 1 |
| Coal | 1 | 0 | 52 | 19 | 51 | 16 |
| Candles | 94 | 90 | | | | |

*Source: Moller (1986:23)*

From the same study, 10% of farmworker households use electricity for lighting compared to 3% of other rural dwellers, 2% of both groups use electricity for cooking.

That farms are often more remote than rural villages will affect the use of these fuels compared to other rural areas. Gandar (1991:40) reported that 59% of farmworker households use paraffin, this figure is considerably lower than that for the rural homeland areas sampled by Eberhard (1986), where paraffin was consumed by most (85% to 100%) of the households surveyed. On farms where fuelwood was abundant, Gandar (1991) found that no paraffin was used. Coal was not used by workers on any of the farms he visited.

The extent to which paraffin is used by a particular household for cooking is possibly influenced by the number of household members working on the farm. Where most of the household members are employed on the farm there is less time available for collecting wood, and paraffin is perhaps more affordable because the household income is possibly higher. This corresponds with the fact that families using paraffin tend to be smaller, 5.73 persons compared to 7.95 persons (Gandar 1991:40). The use of paraffin for cooking was reported to replace fuelwood among younger 'less traditional' households (Gandar 1991:40).

The number of households that use paraffin and candles for lighting is similar, about 20% (Table 3.2). The extent to which all lighting fuels are used is affected by access to electricity, since most electrified workers dwellings have light fittings. Constraints to obtaining and using lighting fuels are the same except that candles are used without the need for an appliance and the associated expense.

There is not much information on the utilisation and ownership of appliances used with paraffin, coal or LPG. From the Lieberman study (1987:34), 31% of workers use a gas or paraffin stove and 26% a coal stove. The use of paraffin and gas stoves corresponds closely with the sum of paraffin and LPG users (28%), while the use of coal stoves is considerably higher than the estimation of the number of coal users, possibly indicating that in some cases a coal stove is used for burning wood or perhaps farmwaste. Unlike coal, paraffin and LPG can only be used with the appropriate appliances.

### 3.5.2 Farmworker households' access to paraffin and candles

The extent to which fuels are purchased from different supply stores is given in Figure 3.23.

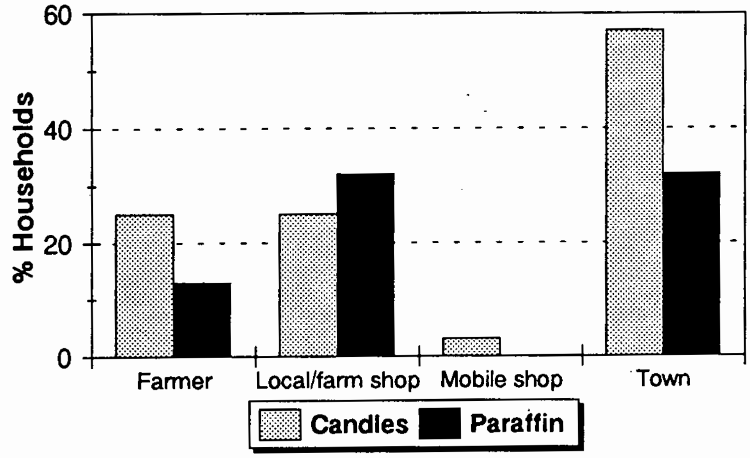



**FIGURE 3.23: Source of paraffin and candles**
*Source: Gandar (1991:42)*

Gandar (1991) found that the prices of paraffin and candles varied greatly between rural shops and shops in the nearest towns, and that workers did without or borrowed rather than purchase from rural shops. This implies that both the cost of fuel and the lack of transport are constraints and the extent to which these fuels are used will depend on the local price as well as the availability of transport. The attitude of the farmer to workers - how regularly they get transport into town - is also likely to affect the use of fuels that are preferably bought in town.

The number of farmers who provide workers with these fuels is given in Figure 3.24. Figures are presented not percentages because of the small sample size.

There is a large variation (between 3% and 33%) in the extent to which farmers provide their workers with these fuels and there appears to be a broad correlation between the numbers of farmers providing these fuels and the percentage households using them (Table 3.1). Areas which have a higher use of a particular fuel, are also those where farmers provide that fuel.

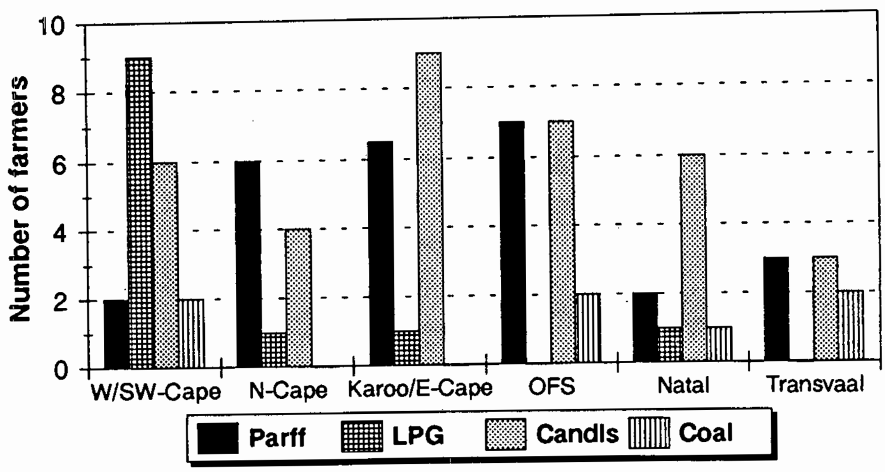



**FIGURE 3.24: Number of farmers who provide fuels used**
*Source: Author (1993)*

The most commonly provided fuels are paraffin and candles, except in the W-Cape, where LPG rather than paraffin is provided. In general more farmers in the Cape and Natal support farmworkers' use of these fuels than in the Orange Free State and the Transvaal.

### 03.5.3 Cost of paraffin and candles

The amount spent by worker households on paraffin and candles from the Gandar (1991:13) and Kotze and Wolhuter (1992:6) studies is given in Figure 3.25.

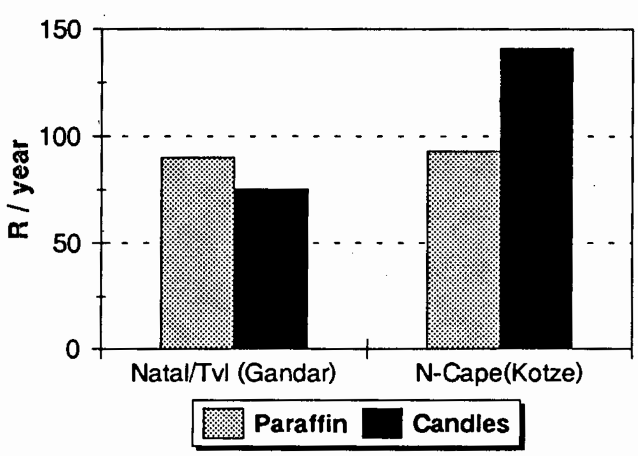



**FIGURE 3.25: Farmworker household expenditure on paraffin and candles.** *Source: Kotze and Wolhuter (1992), Gandar (1991)*

The generally higher figures from the Kotze and Wolhuter could relate to the fact that the surveys for the two studies were undertaken in different areas, the fact that no respondents in the Kotze and Wolhuter survey had electricity, and that the Gandar study was undertaken in 1991 and the Kotze study in 1992. The farmworker households' total energy expenditure given by Gandar (1991:13) was R270 per year. Therefore, in this study, paraffin and candles account for some 60% of total household energy expenditure.

Jooste's (1987) study in the Orange Free State provided estimates of expenditure on all fuels used by farmworkers households without electricity, Figure 3.26.

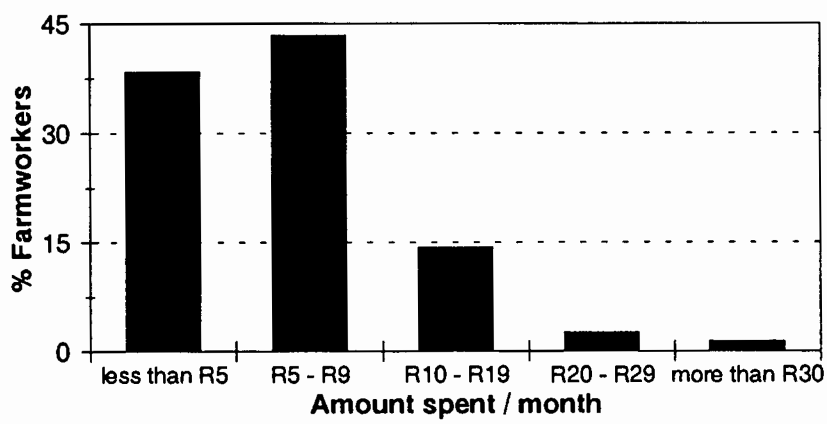



**FIGURE 3.26: Expenditure by worker households on all fuels - other than electricity.** *Source: Jooste and Nortje (1987)*

Here, less than R100 per year is spent on energy by some 80% of farmworkers, substantially lower than Gandar's estimates. This could partly reflect inflation (four years separated the two studies), but also the different fuels used by the two study samples. The Jooste and Nortje study did not include batteries as one of the fuels used by farmworker households, while Gandar's study indicated that about a third of household energy expenditure went on batteries.

The cost to farmers of paraffin, candles, LPG and coal supplied to worker households with these fuels is shown in Figure 3.27.

There are large differences in the amount spent by farmers on providing a household with a particular fuel. This could be partly due to differences in household size, and may also indicate that some farmers subsidise part and others all of the cost of the fuel.

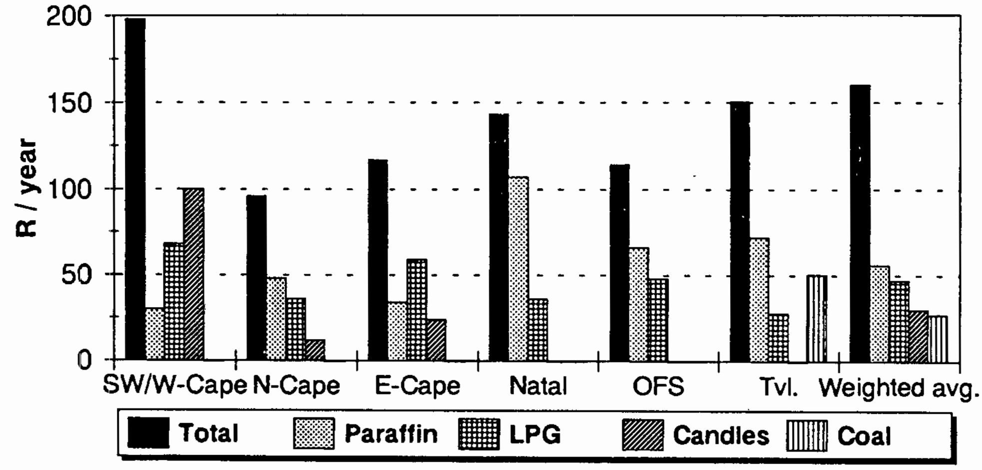



**FIGURE 3.27: Amount spent by farmers on fuels for worker households**
*Source: Author (1993)*

### 3.5.3 Quantities of paraffin and candles consumed

Some indication of the quantities of paraffin consumed by farmworker households is given by Gandar (1991:13), Figure 3.28.

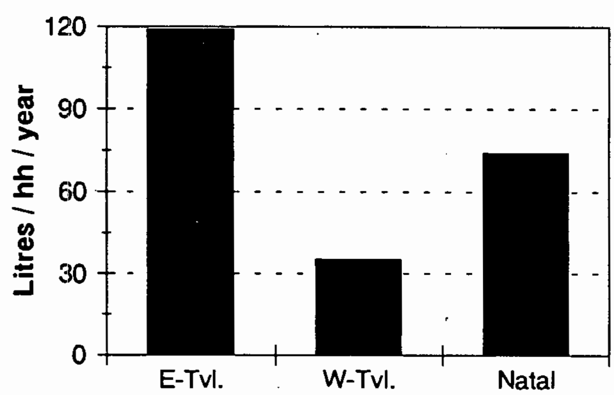



**FIGURE 3.28: Paraffin consumption**
*Source: Gandar (1991)*

There is a correspondence between the regional trend in the use of paraffin and the availability of fuelwood. The least paraffin is used in the W-Transvaal where fuelwood was found to be abundant, the most in the E-Transvaal where fuelwood gathering was reported as opportunistic.

### 3.5.4 Problems associated with paraffin, gas, coal and candles use

The use of all these fuels is inconvenient when compared with electricity. There are often problems in obtaining these fuels in rural areas if there is no ready access to transport. Affordability problems arise from the expense of fuels, the appliances to use them and where applicable, the cost of transport to an outlet. Environmental problems and hazards may be associated with using fuels with an open flame, fuels that release fumes, and in the case of paraffin, a fuel which is a poisoning hazard to children. Interview respondents in the W-Cape, who used paraffin prior to access to electricity, were very pleased to be rid of it.

## 3.6 The use of batteries

Not many reports have provided information on the use of batteries. Dry cell batteries are used widely by farmworker households, mainly for radios and on 10% of farms visited by Gandar (1991:41) at least one worker used a rechargeable battery. The worker households' reliance on batteries for radios can be seen by comparing the extent of radio ownership, with access to electricity. Nationally about 70% of farmworker households have been estimated to own a radio (Rural Foundation 1989) and the national estimate for the percentage of worker houses that are electrified is in the region of 23%.

Batteries are a particularly expensive energy carrier, especially when compared to the cost of grid electricity for media purposes. Considering the cash poverty of worker households, affordability is probably a considerable constraint on their use and aside from affordability, farmworker households will experience similar constraints on access to batteries as with other fuels not provided on the farm. The proportion of workers buying batteries from various sources from the Gandar report is given in Figure 3.29 and the number of farmers who subsidised their workers' use of batteries (though it is not clear from the data whether the batteries referred to are car or dry-cell) are given in Figure 3.30.

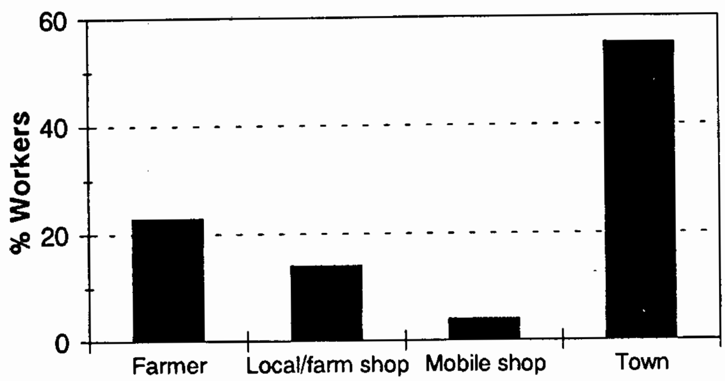



**FIGURE 3.29: Source of batteries**
*Source: Gandar (1991:42)*

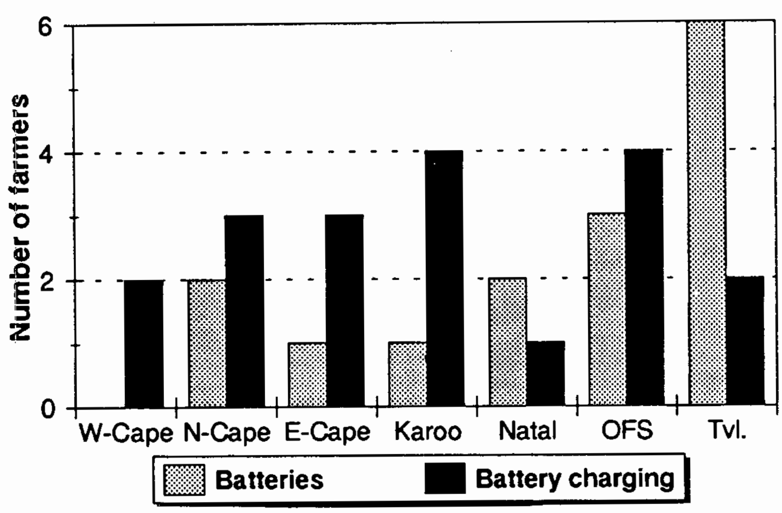



**FIGURE 3.30: Farmers who subsidise their workers' use of batteries**
*Source: Author (1993)*

In the SW/W-Cape no farmers supplied their workers with batteries. Perhaps this relates in part to the extent that electricity is available in this region. Aside from the Transvaal, where a relatively high number of farmers provide workers with batteries, provision is on average about 10%, considerably less than the percentage of farmers providing workers with paraffin and candles. Similarly, few farmers offer their workers battery charging facilities.

The cost of batteries to farmworker households from the Gandar (1991:13) and Kotze and Wolhuter (1992:6) studies is shown in Figure 3.31. The amount spent on batteries and battery charging facilities by farmers is shown in Figure 3.32.

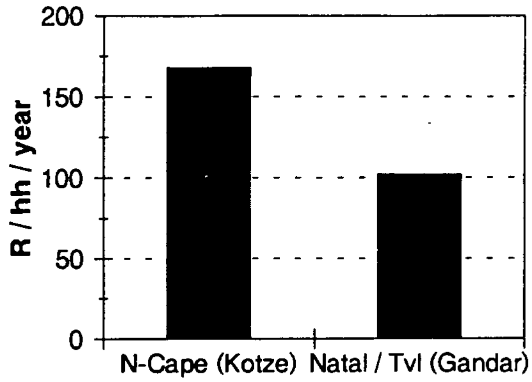



**FIGURE 3.31: Average household expenditure on batteries**
*Source: Kotze and Wolhuter (1992), Gandar (1991)*

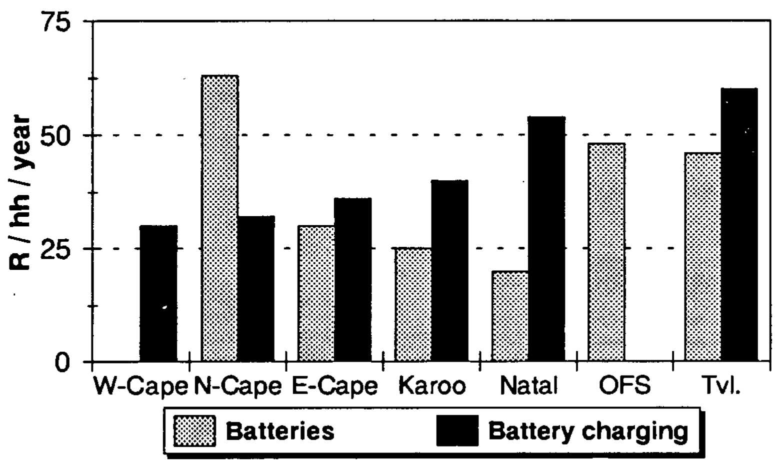



**FIGURE 3.32: Amounts spent by farmers on providing batteries**
*Source: Author (1993)*

The total annual cost of paraffin, candles, and batteries to farmworker households is estimated by Kotze and Wolhuter (1992) and Gandar to be about R402 and R270 respectively. Farmworker households therefore spend more on batteries than either paraffin or candles, and batteries account for more than a third of the households' expenditure on purchased fuels. The amount spent by the farmers on batteries for worker households is considerably less than the estimated cost to worker households. (Figure 3.31). Though the cost of buying batteries (both rechargeable and dry-cell) is substantially more than the cost of recharging batteries, there is a similar range in the annual amount spent by farmers on providing farmworker households with both batteries and battery charging facilities. Aside from farmworkers who pay for a relatively wide range of electricity uses, the most expensive energy carrier to farmworker households are batteries.

## 3.7 The use of farmwaste

Farmwaste, reported by users as an unpleasant fuel, is generally only used as a replacement when fuelwood is not available. The wastes used are mainly dung and maize cobs, and the area where there is the highest reported use is the OFS. Figure 3.33 shows the time spent by workers collecting farmwastes in Jooste's study in the Orange Free State. The responsibility for collecting farmwaste is probably similar to that of fuelwood.

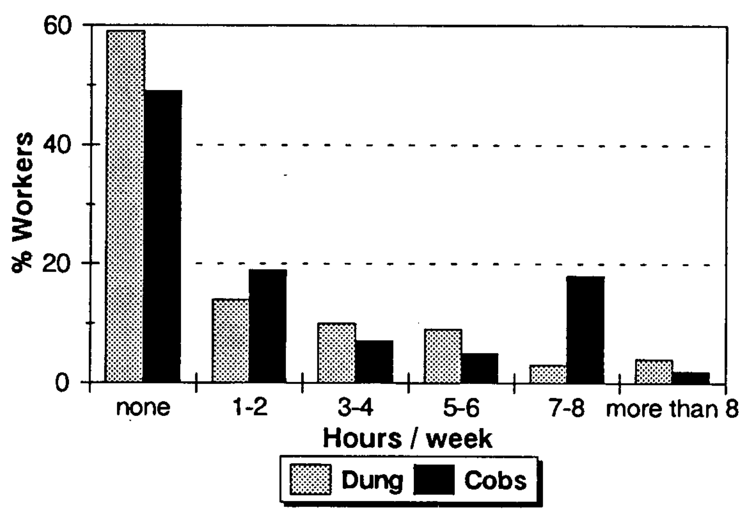



**FIGURE 3.33: Time spent by workers collecting farmwaste**
*Source: Jooste and Nortje (1987:55)*

## 3.8 Solar

From the postal survey, there was no use of photovoltaics found among farmworkers, and the use of solar water heaters is not widespread. The only area where solar water heaters are used to any extent is the SW-Cape, Figure 3.34. Solar water heaters were used by some of the worker households on two farms visited, the rest of the households had geysers. Those who had solar water heaters reported being satisfied and obtained water from a neighbour with the geyser when they were without.

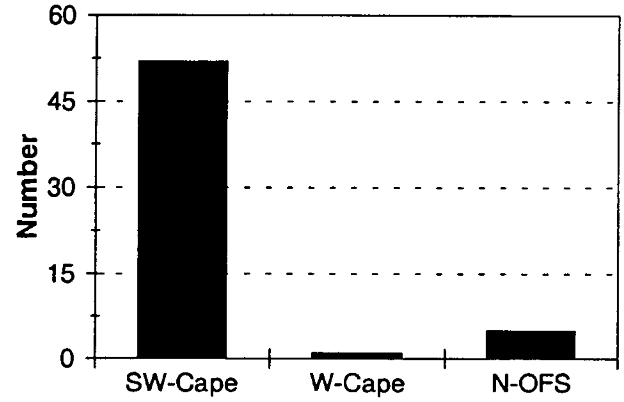



**FIGURE 3.34: Regional distribution of solar water heater use by worker households.** *Source: Author (1993)*

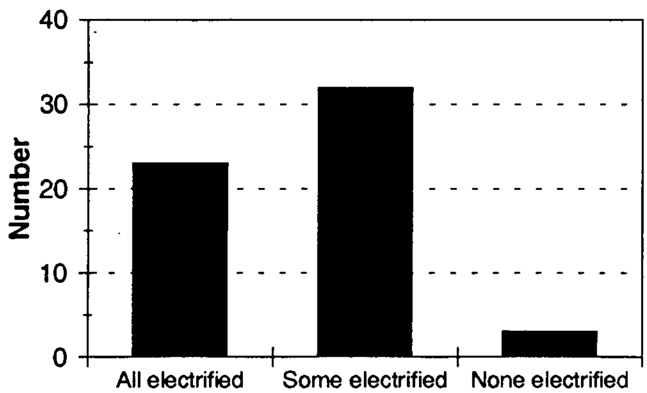



**FIGURE 3.35: Electrification status of worker houses where solar water heaters are used by worker households.** *Source: Author (1993)*

Nearly half of the farms where workers use solar water heaters, all the worker houses on the farm have access to electricity. In no cases where solar water heaters were used was electricity also used for water heating, except on the farm with the largest number of solar water heaters There were 27 households, one had electricity with a geyser the others all had solar water heaters and no electricity.

Gandar (1991:44) reports that on none of the farms surveyed in the Transvaal (by post or a visit) was either form of solar energy used by farmworker households. In Natal 19 out of 260 farms used solar water heaters and 2 used PV systems.

## 3.10 Conclusions

Farmworker households' energy consumption patterns are dictated by their access to energy services - there is little indication of choice.

On a macro level the farmworker households' access to and use of energy is in line with other historically disadvantaged population groups of South Africa. Low levels of electrification mean that households rely on energy carriers that are unsafe, inconvenient, and for the most part more expensive - most of the fuels used burn with an open flame.

On a micro level, particular circumstances that impact on the farmworker households' access to energy services, relate mainly to farmers' role in both the availability and affordability of the fuels used.

### 3.10.1 Access to and use of energy - a summary

Few worker households have access to electricity (about 22% on all farms, and 36% on farms with electricity), although most commercial farms in South Africa (75%) are already serviced by the grid. Where available electricity is generally used for lighting and to a lesser extent media. Access to electricity appears to be associated with improved living conditions, higher wages, the wealth of the farming region and farmers' attitudes to workers.

The majority of farmworker households, with or without electricity, are reliant on fuelwood. Most of the fuelwood used comes from the farm and from natural sources (e.g. woodland and invasive species), about 20% is derived form tree cultivation activities such as woodlots or fruit farming. Nationally between a third and a half of farmworker households experience fuelwood shortages, substantially more than the approximately 15% of farmers who expressed concern over the availability of the resource.

Access to commercial fuels is constrained by the remoteness of workers and the lack of public or personal transport, and a low cash income. Nevertheless candles are widely used - reportedly by 90% of households in the Moller study, and by 30% despite electricity in the Lieberman study. Between 40% to 70% use paraffin. As a cooking fuel, paraffin use is probably related to fuelwood availability and to paraffin access routes. Paraffin for lighting is probably related to the availability of electricity and the cost of using paraffin compared to candles.

The use of coal, LPG and farmwaste (the lesser-used fuels), are all region specific: reflecting amongst other factors, availability of fuelwood and type of farming activity, size of the farming district and availability of transport, and in the case of coal, the proximity to coal mines. Despite the remoteness of many farmworker households, solar energy for water heating or electricity (PV systems) are rarely used.

Households without electricity (88%) are heavily reliant on batteries for media - mainly for radio which are widely used by farmworker households. Gandar (1991) reported these to be the single largest component of average energy expenditure.

### 3.10.2 Determinants of energy use

On the whole the consumption patterns of farmworker families are similar to those of rural 'homeland' regions, where low levels of service provision and the burden of poverty are reflected in:

- a reliance on fuelwood, despite the problems inherent in its use - which are often exacerbated by scarcities and when used without a stove;
- the widespread use of candles, despite there low light quality and expense;
- limited use of LPG, a cleaner but more expensive fuel;
- where available, electricity is generally used for low power intensive applications.

The numerous physical, social and environmental effects of the consumption patterns of energy-poor households, are directly experienced by the energy users themselves (unlike the environmental consequences of "First World" energy use.

The available data also indicates differences in the broad consumption patterns of farmworker households compared with the rural 'homelands'. On average fuelwood consumption appears to be about 30% higher, and paraffin consumption about 30% lower. This may reflect generally better availability of fuelwood on farms compared with many rural 'homeland' areas, and the particular isolation, cash poverty and dependence of farmworker households.

The main influence on farmworker households access to and use of energy services, particular to their circumstances, is the role played by farm-owners - both practically and financially. The extent of electrification of farmworker houses and of electricity use by farmworker households, depends on the farmer. The degree to which commercial fuels are used is affected by the cash income of workers and farmers' support in the form of transport to town or running a farm shop. Some farmers allow the use of farm equipment to harvest, prepare and transport fuelwood.

Because of contributions by farmers, which are largely uncosted, it is not possible to make reliable estimates of overall expenditure on energy used by farmworker households, and it is likely that average energy expenditures are generally lower than for households in the 'homelands'. Similarly, the percentage of cash income that worker households spend on energy, despite poor cash income levels, is likely to be lower.

Farmers contributions are integral to the economics of worker households' energy use. However, a number of problems can arise in this relationship, including regional and individual variations in farmers' support, the dangers of increased cash poverty (and reduced choice) if payments in kind are deducted from cash wages, and the increased dependency and vulnerability of worker households reliant on farm-owners.

All the studies reviewed in this chapter have shown that farmworker households clearly have inadequate access to energy services. But most reside on farms with grid electricity, and with the potential for improved fuelwood production. There are therefore particularly favourable opportunities for improving this situation.

## Chapter Four
## ENERGY SUPPLY OPTIONS

### 4.1 Introduction

The factors that affect farmworker households' patterns of energy use - remoteness, poverty and dependence - also impact on possible supply options. Few worker households can afford to spend much on fuels or transport and the cost of connection to the grid is out of the question; currently it is the farmer who provides.

The physical location of most farmworker households - at least 70% are on farms with grid electricity and most are situated on land with a potential for fuelwood production - does however create energy supply possibilities.

In evaluating supply options all energy carriers (including candles, paraffin, LPG and stand-alone power supplies for small electrical loads in remote areas), need to be considered. In many instances improving the worker households access to energy services will involve a combination of supply options and different end-uses will most appropriately be met by different energy carriers. Gandar estimated that for farmworkers to use electricity for cooking and heating, would cost in the region of 17% of their current income (pers.com., 1993), and there will always be households too remote for grid electricity to be cost effective. Many workers therefore will probably continue to use fuelwood for some time.

In this chapter the energy carriers are investigated, technology options evaluated and costs estimations of various supply options are made. In Chapter Five supply options are discussed in terms of equity and household needs, and other issues that have implications for intervention strategies, such as affordability and farmworker household dependence, are examined.

## 4.2 Electrification

There are many advantages for households with access to electricity, particularly those in remote areas. Electricity, which is delivered into the dwelling without the inconvenience and effort of collecting wood or travelling to town to purchase paraffin, can be made available through the grid or an off-grid option such as photovoltaic systems (PVs) or gensets. Grid electricity offers the household a convenient, safe and in many cases cheaper energy source for a wide range of services. For households where the cost of connection to the grid is prohibitive, a PV off-grid electricity supply offers a more convenient and safer source of energy for lights and media than those currently used.

## 4.3 Grid electricity

Nationally 70% to 75% of commercial farms are serviced by the gird. Figure 4.1 illustrates the farmworker households' access to electricity on these farms.

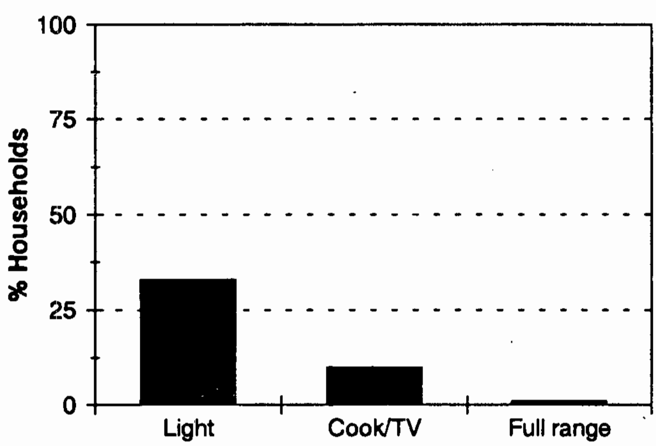



**FIGURE 4.1: Access to electricity services by worker households on farms with grid electricity.** *Source: Author (1993)*

There is considerable potential for improving worker households' access to energy services on these farms by expanding the number of electricity connections and/or upgrading the electricity service available to those who currently have a limited supply.

### 4.3.1 Current process of worker house electrification

The responsibility for the electrification of workers houses lies primarily with the farmer and the electricity supplier. The capital cost of the electrification of farmworker houses is paid for by the farmer, with varying degrees of subsidisation by Eskom - depending on the circumstances. A small contribution is available from the state.

Eskom, who undertake most farm electrification, offer four methods of supplying worker houses with electricity (Barnard 1991). In all cases the farmer remains the Eskom customer and the workers are consumers .

In methods one and two, worker households are consumers via a customer - the farmer. There is no independent metering, the electricity used by workers registers on the farmer's meter. The farmer pays the total monthly electricity bill, at the Eskom D Tariff or, if the supply capacity is in excess of 100 kVA, the Eskom A tariff. For methods three and four, workers become direct consumers with independent metering. The farmer still remains the customer and is responsible for paying for the electricity used by workers, but the metered units are paid at Eskom's Tariff S1, currently 22.38 c / kWh.

Financing the initial cost of electrifying worker dwellings for method one is entirely the farmer's responsibility. For methods two, three and four Eskom covers some of the connection costs if certain conditions are met. Method two: Eskom will contribute R300 towards low voltage network costs per house, and R100 toward electrical appliances per household on condition the capacity per worker house electrified is at least 30 Amps and Eskom is allowed to market electricity. Method three: Eskom invests R700 towards connection costs and R100 for appliances per dwelling on condition that between 10 and 50 houses are supplied with 30 Amps and the farmer (customer) signs a support agreement. Method four is applicable if more than fifty houses are electrified, R700 per dwelling is offered and the farmer need not sign a support agreement. These options, originally valid until the end of 1993, have been extended.

The state currently offers a subsidy of R300 per farmworker dwelling regardless of which option is applied, the initial cost of supplying electricity, or the level of service provided.

The rural D Tariff[1], paid by most farmers, entails a demand related fixed charge ranging from R58..59 / month to R119.80 / month - depending on the capacity of the supply point transformer and up to a maximum of 100 kVA, a grid extension charge (where applicable), and an energy charge which at present is 24.86c / kWh for the first 1000 kWh / month and 14.38c / kWh thereafter.

Tariff A is designed for high consumption customers with a demand of 100 kVA or higher. There is a basic charge (R119.80 per month) plus a demand related charge and an energy charge of 4.98 c / kWh.

The S1 tariff (paid for worker dwellings with independent metering), is designed to recover the capital cost of supplying electricity to worker houses from the farm's supply point. It does not relate to the amount paid by the farmer for the farm's supply, or consumption .

The grid extension charge paid by some farmers relates to a farmer scheme where a high voltage grid extension to farming regions has been undertaken. Each scheme has a particular monthly fee that is paid by farmers serviced by the extension. The amount paid is designed to insure capital costs are recovered over a 20 year period and depends on the initial cost of the extension and the revenue generated from electricity sales. For farmers who received electricity more than 10 years ago the amount paid is now close to zero. For those electrified in the last 5 years the average amount paid is between R100 and R200 per month, except for the more remote schemes, for example in the N-Cape and N-Transvaal, where amounts in excess of R350 per month are paid and will to be for most of the recovery period (pers.com. H. Barnard, Eskom, 1993).

It is up to the farmer to apply to Eskom for workers' houses to be electrified, and to apply for the state subsidy. Though one of the main reasons given by farmers for not providing workers with electricity is the cost of connection, in the postal survey 64% of farmers were not aware of the availability of financial assistance. On farms where only some workers' houses are electrified, it is apparent that in many cases the houses closer to the grid have been electrified and those further away not. Farmers have also been known to complain about the bureaucracy involved in obtaining state subsidies for upgrading the conditions of their workers.

[1] Tariff details are from Eskoms' 1993 book of tariffs. The energy and fixed charges are likely to be adjusted for 1994, the tariff structures should remain the same.

### 4.3.2 Technology options

*Supply point*

Workers' houses, on farms with electricity, are supplied from the farmer's existing supply point. At present the average load factor on farms has been informally estimated to be about 20% to 25% (pers. com., N. Jansen v Rensburg, Distribution Technology, Eskom, 1993), and in most cases there is sufficient capacity to provide worker households with electricity. Where not, the farm's transformer can be upgraded at a fixed charge, currently R800, and the monthly fee that relates to the supply point transformer capacity will increase accordingly. If the upgrade results in the capacity of the farm's transformer being in excess of 100 kVA then electricity will be payed for via the A tariff.

*Reticulation system*

There are three potential reticulation/transmission options suitable for extending the grid to farmworker houses: direct single or three phase, or the use of an intermediate voltage system. Which system will be suitable will depend on the number of, and distance between worker houses, the distance from houses to the electricity source and the level of supply to be installed.

Direct single and three phase from the farmer's supply (low voltage, typically stepped down at the farm from rural 22 or 11 kV transmission lines), can be used when conditions are such that workers can be reached at normal voltages (220 V single phase, 380 V three phase) without significant voltage drops.

When larger distances need to be covered and cable losses would result in the required end-use level of supply not being met, there is the option to use intermediate voltage transmission (typically 1900 V single phase or 3.3 kV three phase), with step-up and step-down transformers at either end. Transformers for intermediate voltage transmission typically range from 5 kVA (single phase or three phase) to 100 kVA (three phase). Compared with low voltage reticulation, the extra cost of transformers can be justified if the use of intermediate voltage allows a reduction in cable diameters and therefore cable cost. In suitable conditions, cables can be buried in a ploughed trench. Most of the installation can be accomplished by farm equipment and labour, further reducing the cost.

### *Level of supply*

In the analyses which follows, three levels of supply are investigated: a 5 Amp, a 20 Amp and a 60 Amp supply. The most suitable will depend on the initial cost of the supply and the potential demand, which will largely depend on the affordability of electricity and electrical appliances.

A 5 Amp supply offers a maximum of 1 kW power at any one time. Though limited, this nevertheless allows the household to access a range of electricity services. 5 Amps should cover all the household's lighting and media needs, and allow for the use of a cooling system as well as small thermal applications such as a kettle, iron or single plate cooker. A 5 Amp supply will almost certainly not allow for an independent water heating facility and there would be limits on which thermal applications could be used at any one time.

A 20 Amp supply offers the household a maximum of 4 kW. A wide range of electricity services would be available with an inconvenience factor rather than severe limitations on potential use. 20 Amps should cover all the household's lighting and media needs, allow for the use of a cooling system and larger thermal applications such as a stove with an oven. A 20 Amp supply should also enable the household to have an independent water heating system but there would be a limit on the number and mix of appliances that could be used simultaneously. The more power intensive applications (for example cooking and water heating) would most likely not be possible at the same time. However, within this limitation, the household could meet all energy needs electrically.

For affordability reasons it is unlikely that many worker households could use more than 20 Amps. There might be cases however where a 60 Amp supply would be suitable for communal facilities - for example an ablution block with hot water or a work room that allows for the use of power tools.

### *Electricity delivery*

There are various options for the electricity delivery, metering and billing systems. The two main delivery systems are house wiring or a ready board. House wiring offers more convenience for using electricity in different rooms, but is considerably more expensive to install.

The main options for metering and billing are the conventional electricity dispenser, meter and an accompanying bill; a pre-payment meter; or an electricity dispenser with no metering and a fixed monthly charge.

The optimal technology mix - which system to use for reticulation, dispensing and billing - will depend on the required end-use level of supply and the arrangements for financing the cost of connection.

*Level of service*

This includes factors such as the level of maintenance, education facilities for electricity users, the ease of access to pre-payment meter cards (where applicable), and assisted access to appropriate appliances.

The level of service that will accompany the supply of electricity to farmworkers will depend on the costs involved, the amount of financial assistance made available and the will of the state, the utility, and the farmer to improve farmworker households' access to electricity.

As with all rural electricity supplies the cost of maintenance is an important consideration. Maintaining grid supplies to farms is known to be costly[2], however the reticulation to worker houses should be a relatively small proportion of existing maintenance.

### 4.3.3 Connection costs

In the following section the initial cost of electrifying workers houses, on farms with a grid supply, is estimated using spatial layout data from the author's survey (Appendix Two, section B.), in conjunction with a software package from Eskom Distribution Technology.

*Method*

The software package, GLOW, was written by Nico Jansen van Rensburg, Distribution Technology, Eskom, and kindly made available for these research calculations. GLOW is used for the 'compilation of estimates, quotes and customer information regarding intermediate and low voltage systems used in Eskom'. The principles, which have particular application for farmworker house

[2]An informal estimation of about R140 per month per farm was made by H. Barnard, Eskom, (pers. com., 1993)

electrification, are documented in Part 7 of the Electrification Standard, 'Intermediate Voltage Practices' Revision 2, April 1993, Eskom[3].

Glow contains a default database for the cost of materials commonly used in low and intermediate voltage reticulation on farms - which can be updated as required, and allows for specification of labour cost proportions and transport cost determinants. Based on the number of houses, their load requirements and distance from the existing point of supply, different reticulation options (such as single or three phase, low or intermediate voltage, underground or overhead cabling) can be investigated to determine the least cost electrification option.

The survey data provided information on the number of non-electrified worker houses on each farm: whether they were clustered or spread out, the average distance between houses in clusters, whether there was more than one cluster and if so the distance between them, and in all cases the distance from the closest grid supply. For the purpose of this analysis, houses were sorted into groups, ranging in number from one (individual houses) to 60. Where farms had more than one cluster of houses, the clusters were treated as (conservatively) separate groups. In total, 2063 worker dwellings, in 444 groups, and on 295 farms, were analysed. All farms sampled had an existing Eskom supply. Because the calculations are made on a group basis, and not farm by farm, the analysis assumes that more than one system may be appropriate on a single farm.

The Glow programme was used to determine the cheapest reticulation option. Three reticulation systems were considered: low voltage single phase, low voltage three phase and intermediate voltage, and the potential for supplying worker houses with a 5 A, 20 A and 60 A supply - from the farm's existing low voltage supply point, using these three systems, was tested on each group of houses. Late 1993 prices for cables and transformers were confirmed before applying the program.

Glow allows load estimations to be made and was used to compute total ADMD (after diversity maximum demand), for a 20 A and a 60 A supply, for each group of houses. Diversity assumes that not all appliances will operate simultaneously, even at times of peak demand. In the approach recommended in the Standard (Eskom, 1993:7.17-7.19), to estimate the probable contribution of each appliance

[3] Assistance in interpreting the GLOW programme and ensuring assumptions were sufficiently explained was provided by Bill Cowan, EDRC.

to peak load demand, the rated power consumption of appliances is multiplied by an appliance related coincidence factor (less than or equal to one). For a group of houses on the same supply, a group coincidence factor is applied. A typical appliance mix for a single house was developed to obtain a 20 A (and 60 A) peak demand. The program then applied coincidence factors according to the number of grouped houses to calculate total ADMD. Appliance related coincidence factors are taken as 1 for electric motor loads, and 0.9, 0.5 and 0.15 for appliances with a high, medium and low probability of operation at times of peak demand, respectively. Coincidence factors for groups of houses are indicated (Eskom, 1993:7.20) are as follows.

**TABLE 4.1: Coincidence factors for groups of houses**

| Number of houses | Coincidence factor |
|---|---|
| 1 | 1 |
| 2 | 0.68 |
| 5 | 0.5 |
| 10 | 0.46 |
| 20 | 0.42 |
| 50 | 0.39 |
| 100+ | 0.38 |

To estimate the ADMD for a 5 A supply, the diversity/coincidence factor was instead taken as equal to 1. There was uncertainty about the validity of using generalised methods for a relatively small number of households, with similar lifestyles and energy use patterns, that have access to a sharply limited electricity supply.

The resultant ADMD for a group of houses determines the transformer capacity ratings, selection of cable diameters, and the choice of single or three phase reticulation at either low or intermediate voltage.

The GLOW calculation method makes allowance for the designed ability of single phase intermediate voltage transformers to cope with an overload of 1.6 times their rating, for periods of up to 4 hours per 24 hour period. Since domestic peak loads are unlikely to persist for more than four hours, this has the effect of reducing transformer capacity requirements. Specifications for the allowable voltage drop between source transformer and receiver supply voltage are also somewhat relaxed in the interest of avoiding overcapitalisation. As a rough limit, a 40 V drop from a 240 V supply at maximum load is considered acceptable. Transformer tappings can partly compensate for voltage drops over cables, and virtually all domestic appliances are expected to operate satisfactorily under these conditions. The associated power losses as regarded as minor compared to the cost benefits of less expensive distribution technology. With respect to voltage drops, the Standard is more specific, allowing for a minimum receiving voltage at full load of 216 V, phase to neutral, or 375 V, phase to phase, when intermediate voltage systems are used.

The program allows for user settings to be made. The options chosen are shown in Table 4.2 and prices used in Table 4.3.

**TABLE 4.2: Options chosen for analysis**

| Option | Choice |
|---|---|
| Single or three phase | Varied, to find least cost |
| Low/intermediate voltage | Varied, to find least cost |
| Underground/overground cabling | Underground |
| Domestic/pump load | Domestic |
| Supply voltage | 240/420 V |
| Load power factor | 0.9 |
| Growth factor | 1 (no growth in demand) |
| Labour: Eskom/customer | Customer |
| Transport | Zeroed |
| Existing source transformer capacity | 25/50/100 kVA-increased as required |

Explanations:

- Underground cabling was selected since, though there may be situations where this is unsuitable, it is generally preferred due to lower costs, reduced complexity, that they can be laid without external contractors, and the vulnerability of overhead lines to lighting interference.
- No growth factor was included - the aim was to cost specific supply levels.
- By assuming on-farm labour connection costs are reduced. The program estimated on-farm labour as 10%, and contract labour as 60% of the material costs, respectively.
- The cost estimations excluded transport costs as the survey data did not provide information for estimating transport distances to farms.
- The typical spare capacity of existing transformer/s at the farmers' supply point was assumed to be 25 kVA. Where this was insufficient the transformer capacity was increased. The cost of upgrading was included in the overall costs.
- The assumption is also made that workers houses can be electrified without the need to reinforce the existing 11/22 kV rural transmission networks. There are probably cases where this assumption is incorrect, for example

in particularly remote farms at the edge of networks, but in the majority of situations across the country this assumption is expected to be valid.

**TABLE 4.3: Materials and material prices**

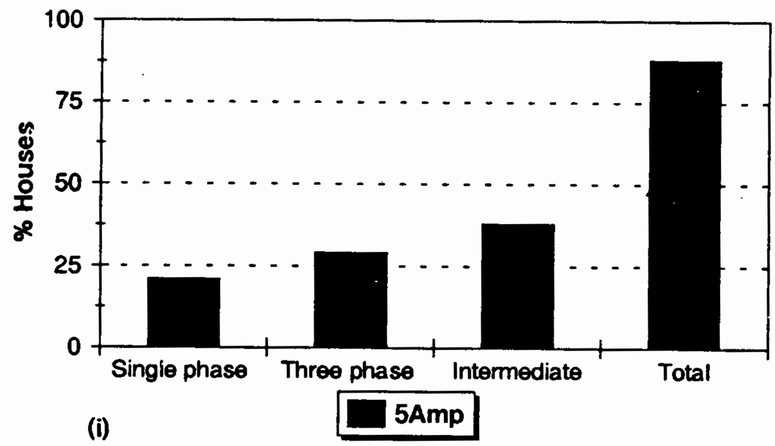
| Fixed cost | | Variable costs | |
|---|---|---|---|
| **Delivery/payment system** | **Cost R** | **Labour** | **Cost R** |
| Electricity dispenser | 350 | Farm | +10% material |
| ready board/pre-payment meter | 180 | Contractor | +60% material |
| source breaker | 25 | **Cable** | **R / metre** |
| **Intermediate voltage transformers** | | $16mm^2$ 2C PVC | 16.00 |
| | | $25mm^2$ 2C PVC | 20.00 |
| | | 35 $mm^2$ 2C PVC | 35.00 |
| Transformers x 2 (5kVA) | 2200 | $10mm^2$ 4C PVC | 9.00 |
| Transformers x 2 (15kVA) | 3000 | $16mm^2$ 4C PVC | 18.00 |
| Transformers x 2 (25kVA) | 5000 | $25mm^2$ 4C PVC | 25.00 |
| Transformers x 2 (50kVA) | 8000 | $35mm^2$ 4C PVC | 35.00 |
| Transformers x 2 (100kVA) | 12000 | $35mm^2$ ABC | 6.59 |
| | | $50mm^2$ ABC | 12.00 |
| | | $70mm^2$ ABC | 10.59 |

### *Results - technology options*

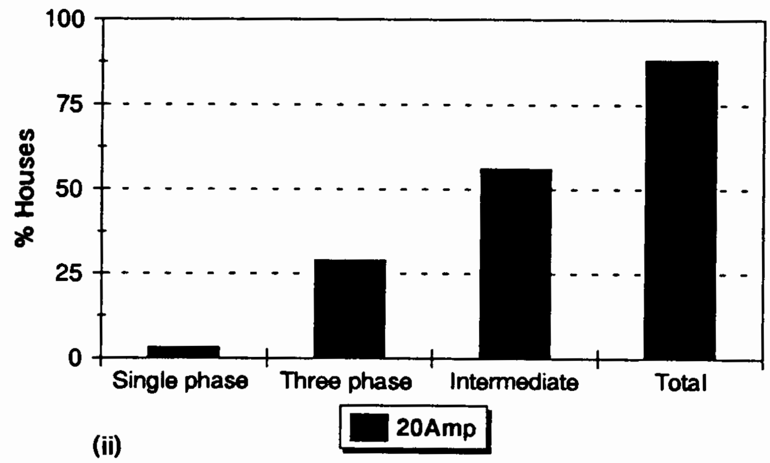
The costing analysis was conducted for each group of houses (where the total load of a group of houses was outside the load parameters of the program, for sub-groups of houses), up to a maximum cost ceiling of R5000 per house. A grid connection cost in excess of this amount is unlikely to be considered. The decision also took into account current debates (Van Horen 1994b) about a 'national maximum cost-of-connection' parameter. Table 4.4 and Figure 4.2 show the percentage of worker houses for which the different technology options are suitable to supply houses with (i) 5 Amps, (ii) 20 Amps and (iii) 60 Amps.

**TABLE 4.4: Technology options and levels of supply**

| Reticulation system | Level of supply | | |
|---|---|---|---|
| | 5 A | 20 A | 60 A |
| Low voltage single phase | 21 | 3 | 0 |
| Low voltage three phase | 29 | 29 | 7 |
| Intermediate voltage | 38 | 54 | 53 |
| Total % houses (<R5000) | 88 | 86 | 60 |




(i)




(ii)

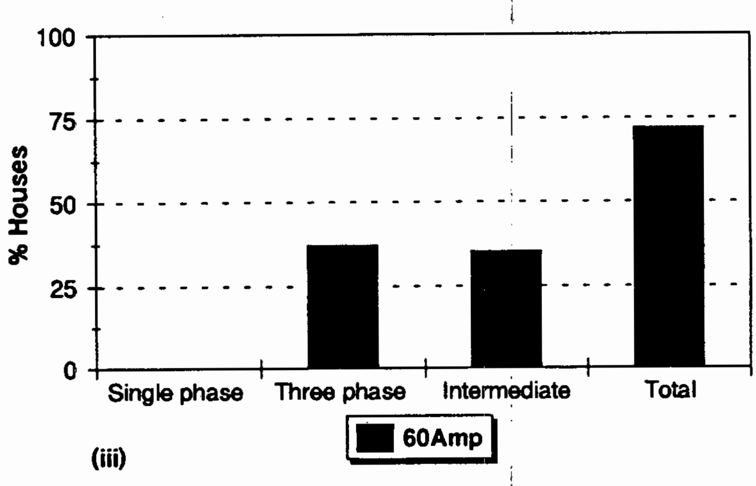



**FIGURE 4.2: Technologies for extending the grid to farmworker houses with a (i) 5 Amp, (ii) 20 Amp and (iii) 60 Amp supply**

The higher the level of supply the more call there is to use three phase and intermediate voltage systems. In general small groups of houses up to a maximum of 4 that are within a kilometre of the supply point, and larger groups up to 15 at a maximum distance of 300 meters can be supplied with 5 Amps using low voltage reticulation. For a 20 Amp supply the number of houses falls to a maximum of 4 at a distance of about 250 metres from the supply point. Where the same technologies are used to supply a 20 Amp and a 60 Amp supply, the required cable diameter was considerably greater for a 60 Amp supply.

The assumed spare capacity on the farm's transformer available for the electrification of worker houses had to be upgraded from 25 kVA for groups of 25 houses or more at 5 A, 15 or more at 20 A, and more than 2 houses at 60 A.

### *Results - cost of connection*

The delivery and payment systems costed comprise a ready board and pre-payment meter combination. The cost of connection includes the transformer upgrading costs but differences in the monthly capacity dependent levy are not reflected. Figure 4.3 shows the percentage of surveyed farmworker dwellings that can be supplied with (i) 5 Amps, (ii) 20 Amps and (iii) 60 Amps within particular cost ranges up to a maximum of R5 000.

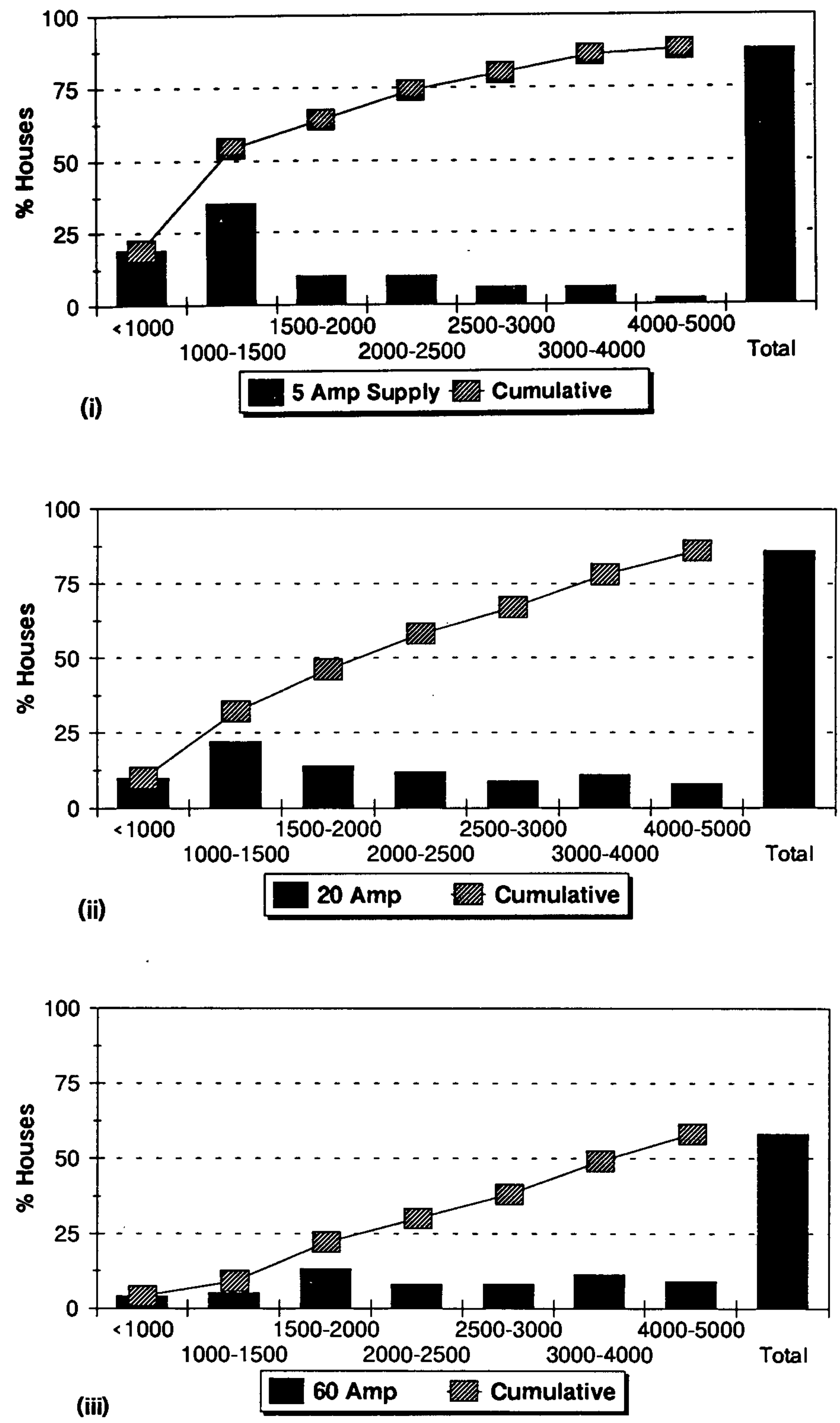



**FIGURE 4.3: Cost of connecting worker houses with a (i) 5 Amp, (ii) 20 Amp and (iii) 60 Amp electricity supply.**

For less than R5000, about 88%, 86%, and 60% of houses can be supplied with a 5 Amp, 20 Amp and 60 Amp supply respectively. The percentage of houses which could be connected within lower maximum ceilings can be read off the graphs from the cumulative percentage lines. For example, more than 60% of houses could receive a 5 Amp supply for a connection cost of less than R2000 per house, and more than 70% for under R2500. To supply 60% of houses with 20 Amps costs up to a maximum of R2500 and to supply 70% of houses the maximum goes up to nearly R4000. For a 60 Amp supply only 30% of houses cost less than R2500 and 60% are under the R5000 ceiling.

A maximum cost of connection parameter has been proposed (van Horen 1994b) as a guideline for equitable but financially sustainable broad electrification policies in South Africa. Setting such a parameter requires careful financial and economic appraisal, and when initial costs of connection exceed this parameter, the grid supply option would normally not be considered. However it is notable that in the case of farmworker house electrification, on farms already supplied by Eskom, a maximum ceiling of R5000 / house, would lead to quite moderate average per house connection costs. These are shown in Figure 4.4. Though the average cost of supplying 60 Amp is less than 10% more than 20 Amps, it is unlikely that this level of supply could be used by single worker households, but the moderate extra cost does make providing 60 Amps for communal use more feasible.

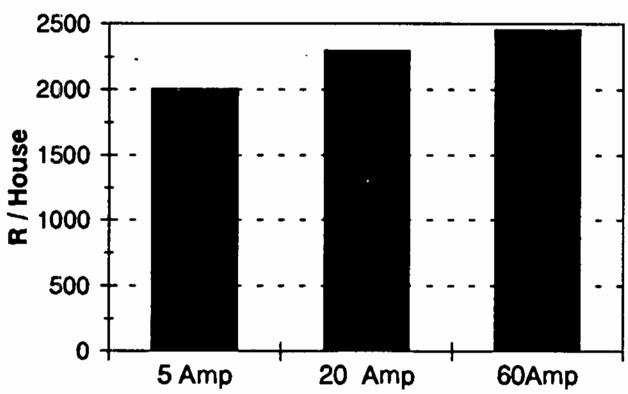



**FIGURE 4.4: Average per house cost of a 5 Amp, 20 Amp, and 60 Amp supply, within a R5000 cost-of-connection limit.**

The provision of a 5 Amp supply has particular application for single or small groups of two or three houses where providing 20 Amps requires the use of intermediate voltage transformers, resulting in an excessive per house cost.

The initial cost to farmers of past electrification of worker houses reported in the postal questionnaire, averaged out at about R1280 per house. However it is not clear when the electrification was undertaken or whether the amount includes any subsidies or farm labour or machinery costs. For electrification of farmworker dwellings currently being undertaken on the Cape West Coast, an informal estimation of the average cost for a 20 Amp supply with a pre-payment meter and ready-board system, was R1500 per house (pers.com., Dirk du Toit, Eskom, W-Cape Distributor, 1993).

The range of costs which have been calculated are based on cost-reducing technology, and the assumption that farm labour and equipment would be used in installation (resulting in overall costs about 30% lower than if contractors were used). A fixed per house cost of R555 was assumed for a ready-board and prepayment system - on average approximately 25% of the total initial cost of electrification per house. This is an important element in cost reduction. For the 30% of houses that can be supplied with 20 Amps for less than R1500, a reduction in the cost of the electricity delivery system would have a significant impact on the total cost.

### 4.3.4 Electricity tariff and finance implications

When considering the financial implications of large-scale farmworker house electrification, tariff options and the potential for cost-recovery need to be investigated

In view of their low incomes it is very unlikely that worker households will be able to make a significant financial contribution towards the capital cost of electrification, or to consume sufficient amounts of electricity for cost recovery via a tariff designed for that purpose such as Eskom's S1 tariff.

For poor households, the tariff level has direct implications on the extent to which electricity will be used, and therefore also on the potential for cost recovery. There has to be a balance between:

- affordability to the electricity consumer, to avoid the low-use trap and ensure that households have the opportunity to make optimal use of their electricity supply; and
- a level of cost recovery, compatible with overall financial viability of the electricity supply utility.

### *Flat rate tariff c / kWh*

The development of a single national flat rate (c / kWh) tariff for households has the advantage of minimising a potential conflict over tariffs - it is perhaps more equitable for domestic users across the country to pay a similar price for the electricity they consume - and offers the possibility of cross-subsidisation within the utility, from larger to smaller consumers, while maintaining overall viability.

Since worker households' cash incomes are low, and often irregular, it is unlikely that any tariff which included a fixed monthly charge would be suitable. A further advantage of a flat-rate tariff, coupled with a pre-payment meter system, is that it allows electricity consumption according to what households can afford at any one time.

The level at which such a national flat rate tariff were set would have to take into account overall new electrification targets and financial viability over time. Within this, cross subsidisation would be expected to benefit new low-income consumers, including farmworker households. The cross-subsidy requirement for farmworker electrification depends mainly on the initial cost of connection, the cost of maintenance, levels of consumption, and the tariff setting. The potential for cost contributions from other sources, including offers of financial support by farmers and the possibility of capital subsidies from electrification funds outside the utility, would also need to be considered.

### *Consumption levels*

It is difficult to estimate farmworker households' potential electricity consumption. Current levels (which are affected by both the affordability of electricity and electrical appliances, as well as the level of supply) are on the whole low, but how directly this relates to demand is uncertain because of practices by farmers that influence workers' electricity use. The highest consumption levels (nearing 300 kWh / month) are in the SW-Cape, which coincide with the workers having the most control over their electricity supply. In the Transvaal and Natal, Gandar (1991) reported the average consumption level to be about 89 kWh / month. Reported consumption levels of newly electrified farmworker homes in the W-Cape were less than 30 kWh / month, however, following Eskom-run advisory sessions with worker families, these have reached 150 kWh / month (pers.com., D. du Toit, Eskom, W-Cape Distributor, 1993).

### *Financial support from farmers*

Surveyed farmers (on electrified farms) expressed widespread support for workers' houses electrification - with a maximum of over 90% in the SW-Cape and a minimum of just under 70% in the E-Tvl. Willingness to pay towards the costs of connection and use and amounts pledged are shown in Figure 4.5 and Figure 4.6.

The reasons of farmers who do not support electricity for workers, are not established - they could be economic or attitudinal. It is uncertain whether these farmers would view electricity more favourably if they bore less responsibility for the process and cost. According to the postal survey, of the farmers who support worker house electrification about three-quarters indicated willingness to provide financial support.

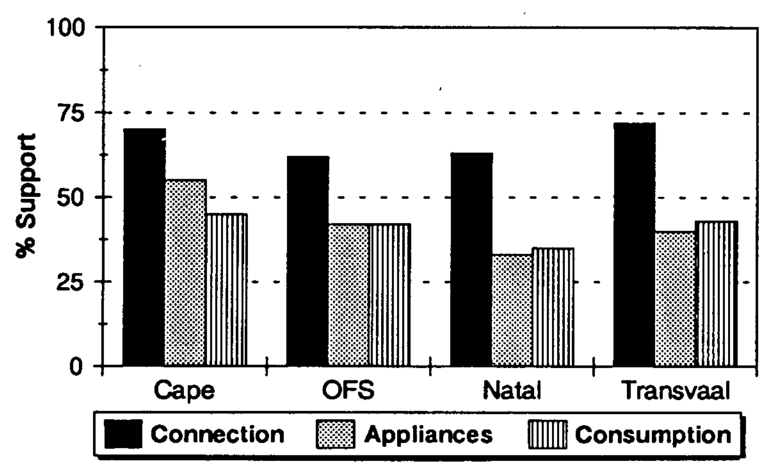



**FIGURE 4.5 Farmers support for the cost of electrification, consumption and appliances.** *Source: Author (1993)*

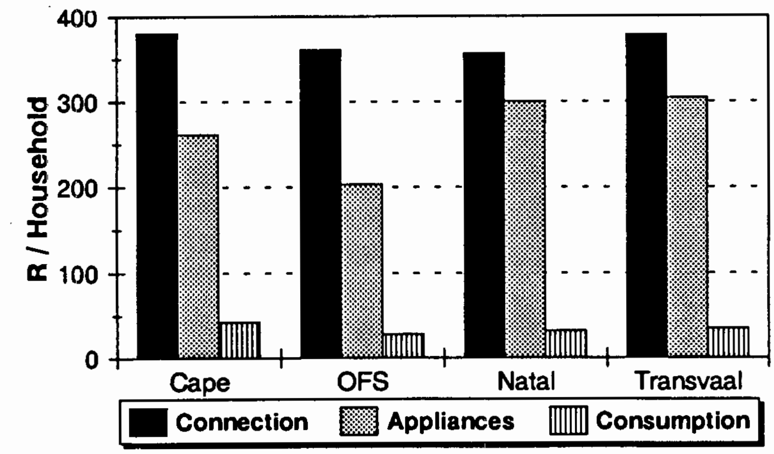



**FIGURE 4.6 Amounts offered for the cost of electrification, consumption and appliances.** *Source: Author (1993)*

More than 75% of farmers offered financial support for the cost of connection and between 30% and 50% for consumption and appliance costs. Contributions by farmers for the cost of connection could make an impact on the numbers of worker houses that fall within a cost of connection parameter, or by lowering the capital provided by the utility, reduce the subsidy requirement.

Farmers subsidising workers' electricity consumption costs or appliance purchase costs could have an important impact on the amount of electricity workers would consume and therefore on cost of connection recovery potential. There is however a trade-off between the value of support from farmers in improving the worker households' access to energy services and their resultant dependence.

*Financial implications*

Currently about 675 000 worker houses are on farms with a grid supply. Of these about 460 000 have no electricity. Ignoring possible contributions from farmers, extrapolation of the data from Figure 4.3 indicates that, up to a maximum connection cost of R5000, the total cost of supplying 88% of 460 000 houses (405 000 - 86% with 20 A and 2% with 5 A), would be approximately R930 million.

Based on the costs indicated above, a financial model developed by Van Horen (1994b) was used to estimate the financial implications of supplying 405 000 worker houses with electricity. Base case assumptions in making estimates were as follows:

- average consumption is initially 60 kWh / month, rising to a ceiling of 150 kWh / month (at a 25% annual rate of increase until the ceiling is reached)
- the monthly fixed cost, for maintenance and other overheads, is taken as R20 / month per household
- the operating cost, reflecting a national average cost of supplying a unit of electricity, is taken as 11.88 c / kWh
- the tariff is notionally set to 20 c / kWh (excluding VAT)
- connections are phased over a period of 17 years
- the real discount rate is taken as 3%

On these assumptions, the peak financing requirement of connecting 405 000 houses would be R1512 million, and the net present value R1190 million (deficit). This could be interpreted as an average subsidy per household of approximately R2300 at present value, over the seventeen year period. The subsidy reflects a subsidy on initial connection costs as well as a small operating cost subsidy component.

The estimates are highly sensitive to tariff and consumption levels. If consumption levels were instead in the range 60 to 300 kWh/month (again rising by an annual increment of 25% to the new ceiling) and other assumptions maintained, the net present value of the deficit would be about R1000 million, representing a subsidy per household of about R1840 at present value. From the current estimated consumption levels (Figure 3.7), and the experience in the W-Cape where levels increased substantially as a result of consumer education, it appears that there is the potential for reducing the per house subsidy through increased consumption.

Similarly if the tariff was set at 22 c / kWh the per house subsidy requirement would be reduced from R2300 to about R2000.

These amounts need to be viewed within a national context and the potential of cross-subsidisation from high-consumption user categories to low-consumption categories. At present it has been estimated that a tariff of 20 c / kWh would generate about R1 billion per year surplus from high-consumption customers.

Furthermore, due to the large existing customer base, a slight increase in the tariff can have major positive impact on the financing requirements for new electrification. A 10% tariff increase, to 22 c / kWh, could generate perhaps R1.3 billion surplus per year from high consumers, in addition to reducing the level of cross-subsidisation of low-consumption sectors.

Tariff setting is therefore of critical importance in ensuring overall financial viability of the electricity supply industry and the extent of electrification (on farms, as in urban areas) which can be achieved within this constraint.

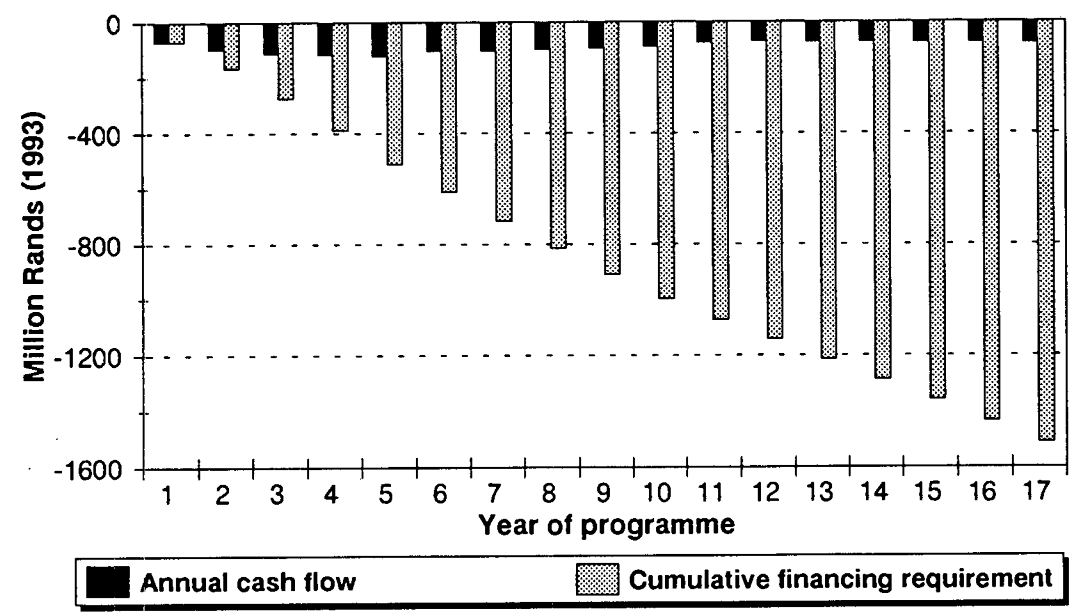



**FIGURE 4.7: Financial implications of a national farmworker house electrification programme.** *Source: Van Horen 1994b*

## 4.4 Off-grid electricity supply options[4]

The cost of connecting worker houses to an existing grid supply will depend on the technology used, cable distances, number of houses and level of supply. There will always be a portion of distant, isolated dwellings where grid connection costs would be considered excessive particularly for example in relation to worker families' other needs. From the postal survey of electrified farms, approximately 15% of households would require cable runs greater than 2 km, and about 5% are more than 4 km away. Households resident on non-electrified farms add some 225 000 to this category.

### 4.4.1 Photovoltaic systems

In these situations, a limited electricity supply sufficient for home lighting and media can be provided more cheaply by stand-alone photovoltaic/battery systems.

At present prices a small PV system providing about 100 Wh / day (12 volt, DC) can be supplied for R1500. This would allow the use of two electric fluorescent lights for five hours a day, or less use of lights and a limited surplus for radio or black and white TV. For about R2500, a system capable of 200 Wh / day can be installed. Installation costs will depend partly on the remoteness and numbers of houses supplied.

Recurrent costs for the reliable operation of these systems, which could last 15 to 20 years, include periodic battery replacements; routine and emergency maintenance; and the cost of replacing appliances such as high efficiency fluorescent lamps. For small systems battery replacements could cost about R150 every two years, and double this amount for a 200 Wh / day system.

Maintenance costs are difficult to predict in a generalised way, and depend partly on the various number of systems visited and distances travelled. Routine maintenance for 5 systems on a farm that requires a 200 km round trip per visit, could cost about R75 per year per system.

[4] Cost estimates for Remote Area Power Supply (RAPS) systems have been provided by Bill Cowan (pers. com.) based on methods documented in the EDRC RAPS manual, 1992.

The total cost of maintenance and battery replacement could amount to about R200 / year or R17 / month for a small 100 Wh / day system, and R280 / year or R23 / month for a 200 Wh / day system. The recurrent running cost would therefore be in the same order as the monthly bill of a grid connected household consuming 100 kWh / month on a flat rate tariff of 20c / kWh.

The level of supply is much lower, and PV electricity would not meet any thermal needs. However high value is commonly attached to the high-priority services of electric lights and media.

Eskom has formulated an off-grid R Tariff (Remote Area Power Supply) intended to cover initial cost and routine maintenance costs (but not battery replacements), at conventional internal rates of return on the investment and with a conservative evaluation of risks. At present, the user of a 100 Wh / day PV system would be charged approximately R65 / month on this tariff comprising capital repayments (over 5 years at 18% interest) and maintenance, in roughly equal parts. It is likely that more affordable financing mechanisms can be developed, an issue being explored within the Independent Development Trust's programme for assisting the electrification of rural institutions, such as schools and clinics. There are also proposals to establish a national Joint Maintenance Fund, of which user communities, utilities and grant/loan funders can become members, offering administration and supervision of maintenance contracts for Remote Area Power Supply systems. Farmworker households could benefit considerably from developments in this field.

Well designed and maintained PV systems can be reliable, durable, can power high value electrical services, and should be an element in expanding the access of isolated households to the benefits of electrification.

### 4.4.2 Batteries and battery charging

Batteries are an expensive energy source regardless of access, and in Gandar's survey (Table 3.33 and Table 3.37) represented the highest single energy expenditure by non-electrified farmworker households. Dry-cell batteries are widely used for appliances such as radios.

### *Battery charging*

Where rechargeable batteries are used, the cost of recharging batteries and replacing them can be a considerable burden on the farmworker household budget. The cost of car batteries to rural users, including transport costs, can be as high as R10 / kWh (Cowan 1992). The levelised unit energy costs from a PV/battery system are likely to be in the range of R3 to R6 / kWh. If the higher capital costs can be financed, PV systems provide a cheaper long-term battery charging solution.

There is probably also scope for rationalised on-farm battery charging facilities (both on electrified farms and off-grid farms operating diesel generators). User information about optimal battery selection and use could be of supplementary benefit.

## 4.4.3 Gensets

Few farmworkers are likely to operate diesel generators, due to the fairly high initial costs, and high operating and maintenance costs, especially when operated at low capacity factors.

Small petrol generators are more affordable, but in general have even higher operating and maintenance costs per kWh. Nonetheless they offer the option of intermittent electricity supply in the household. Combined with a battery to even out supply and demand, they may provide for modest electricity needs at a cost of about R5 to R10 / kWh.

Diesel generators are widely used by farmers on non-electrified farms. Provided on-farm maintenance can be performed at low cost, and that reasonably high capacity factors are attained, they provide a competitive option for larger electricity needs.

To extend an existing farm genset supply to farmworker households would entail reticulation similar to grid-connected reticulation; but the marginal cost per additional kWh consumed would be considerably higher than in the case of grid supply - perhaps R1 / kWh.

### 4.4.4 Other Remote Area Power Supply Options

Wind generators are probably of little application for farmworker household electricity. In certain areas around the coast wind generators might be cheaper than PV systems for household-level energy needs, but in the remainder of the country wind regimes are not favourable for stand alone generators.

In areas where farmers (on non-electrified farms) do incorporate wind generators in RAPS systems, the need for reticulation and high energy costs will reduce the competitiveness of extending such centralised RAPS systems to farmworker households, compared with modular PV options.

Micro-hydro is attractive for farms that have an adequate hydro resource. Distribution to farmworker households would require reticulation comparable with grid-supply options.

### 4.4.5 Solar water heaters

There is considerable potential for the use of solar water heaters by farm worker households on their own, in combination with a grid or an off-grid electricity supply. Currently the use of solar water heating on commercial farms (with Eskom electricity) is not widespread and, in the postal survey was found mainly in the SW-Cape.

There are various systems available: the simplest and cheapest system is a portable 50 litre batch system, where the heat collector is placed at the water source. Fixed systems requiring plumbed water may be integral units or two-component systems. Integrated units, which combine heat collection and water storage, are cheaper but lose heat during periods of low solar radiation and overnight. The two-component system has a separate heat collector unit and water storage tank and can retain more heat during periods of low solar radiation, and at night.

Capacities vary from the 50 litre batch system to the more standard 150 litre (or larger) integral or two-component systems.

The costs of the systems depend on their sophistication, materials, size and durability. The average cost of the systems currently used by workers (Authors survey) and of the systems discussed above are shown in Table 4.5.

**TABLE 4.5: Cost of solar water heaters**

| Region | Avg. Cost / hh R | System | Cost / R |
|---|---|---|---|
| SW-Cape | 540 | Batch | 500 |
| W-Cape | 1000 | Integral | 1500 |
| N-OFS | 600 | Two-component | 2000 to 8000 |

*Source:Author(1993)*

*Source: G. Morris, Energy and Development Group (pers.com.,1993)*

The estimated average cost of systems from the postal survey are considerably lower than current prices - possibly because a number were installed some time ago.

Where electricity is available, solar water heaters can be coupled with an electrical back-up system, either manual or automatic, at little extra cost. This improves the utility of the system considerably and has the added benefit of increasing the usefulness of a limited electricity supply. An automatic electrical back-up to a solar water heating system that came on after midnight could be used to ensure hot water in the morning, overcoming one of the main failures of the solar water heating system, as well as gaining more value from a limited electricity supply. It would also have the affect of increasing the households' electricity consumption level - possibly improving the cost-recovery potential of a grid supply.

## 4.5 Fuelwood resource assessment and supply

Most farmworker households use fuelwood, and it is likely that fuelwood will be relied on for cooking and heating for some time to come. In the short-term, improving the farmworker household's access to fuelwood, where there are shortages, is essential. In the longer term access to fuelwood will offer workers a choice of fuel for particular functions, the ability to continue using wood for 'traditional' purposes and in most cases, a cheaper source of energy than electricity, paraffin or LPG for cooking and heating.

### 4.5.1 Resource Assessment

Fuelwood can be harvested from natural woodland, clearing invasive species, commercial forestry residues, and multipurpose trees grown in agroforestry systems.

*On-farm fuelwood resource*

The two main current sources of fuelwood for farmworker households are on-farm trees and, to a substantially lesser extent, commercial forestry residues. Most farmers provide their workers with fuelwood (Figure 3.14). Figure 4.8 whether the fuelwood provided (from the farm), comes from natural woodland or cultivated sources.

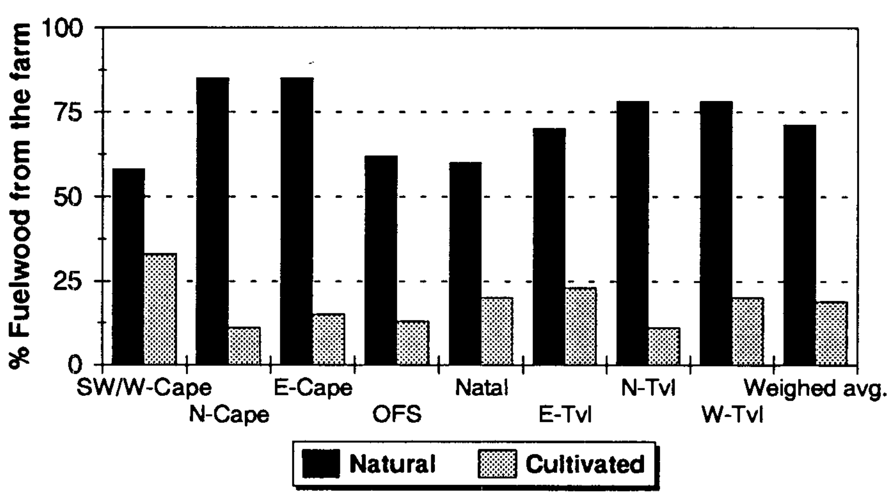



**FIGURE 4.8: Percentage of fuelwood from the farm and source.**
*Source: Author (1993)*

Most of the fuelwood provided by farmers is from the farm, with similar figures for all regions. However there are considerable regional variations in the extent to which the fuelwood from the farm is from natural, or cultivated sources. More detailed differentiation of the survey data shows even starker differences. The S-W Cape has the least and the Karoo the largest difference between the two sources with natural woodland and cultivation figures of 55% and 40%, and 93% and 7% respectively.

It was not clear, from the data available, whether cultivated sources relate only to woodlots or include fuelwood from agricultural residues that involved tree cultivation (for example fruit trees in the W-Cape). The fact that in many regions the percentages for natural woodland and cultivated sources of fuelwood do not add to one hundred perhaps indicates that where applicable, fuelwood from agricultural waste was excluded by some farmers. On average there is a shortfall os about 10%, with Natal showing the largest discrepancy of 25%. There is also no indication to what extent the cultivated source is specifically for fuelwood or whether fuelwood is simply a by-product.

Gandar (1991:26) reported that 33% of farms he surveyed have bushveld, but that bushveld alone accounted for 66% of the firewood resource used by workers. The on-farm fuelwood resources reported by Gandar (1991:20) are summarised in Figure 4.9.

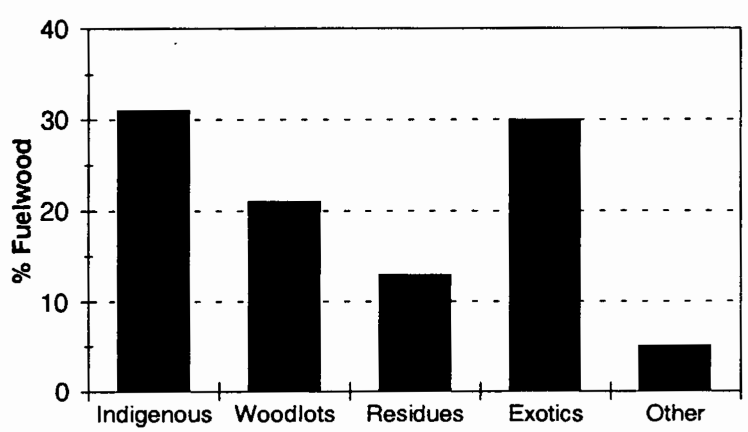



**FIGURE 4.9: Sources of fuelwood on farms.**
*Source: Gandar (1991:19)*

Gandar's figure for fuelwood being harvested from woodlots, is similar to the figure for cultivated wood sources from the authors' survey (Figure 4.9), and the percentage of residues similar to the shortfall of Figure 4.8.

The only report that gives details of on-farm fuelwood species (obtained from visiting farms), is that of Gandar (1991:18), as summarised below.

In the Natal Midlands, the main species is Black Wattle obtained from bush encroachment areas, old plantations or as a by-product of wattle bark or timber production. Other sources include Eucalyptus woodlots or plantation residues, waste from tree clearing, and pruning from Pecan and Macadamia orchards.

In the coastal areas most fuelwood was from indigenous woodland such as coastal bush and ravine thickets, but also from scattered or non-commercial patches of Eucalypt trees.

In the Western Transvaal the only source of firewood found by Gandar was mixed Acacia. The resource was described as ample - about 450 ha of woodland per farmworker household.

The main source of fuelwood, in the Eastern Transvaal, where fuelwood gathering was reported as being opportunistic, was waste from fruit and vegetable production such as pruning and old tomato stakes.

In assessing on-farm fuelwood resources, Gandar divided farms surveyed into five classes ranging from abundant to very deficient, and also in terms of how many farms had a fuelwood potential surplus and deficit, Figure 4.10 and 4.11.

On 12% of farms in Natal with a fuelwood deficit, no fuelwood was used at all. The only area where there is a much larger number of farms with potential deficits than surpluses is Zululand. Gandar (1991:22) found that, in general, farms with livestock had abundant or sustainable fuelwood resources, cereal farms had marginal or inadequate resources, while fruit and vegetable farms had inadequate or very deficient resources.

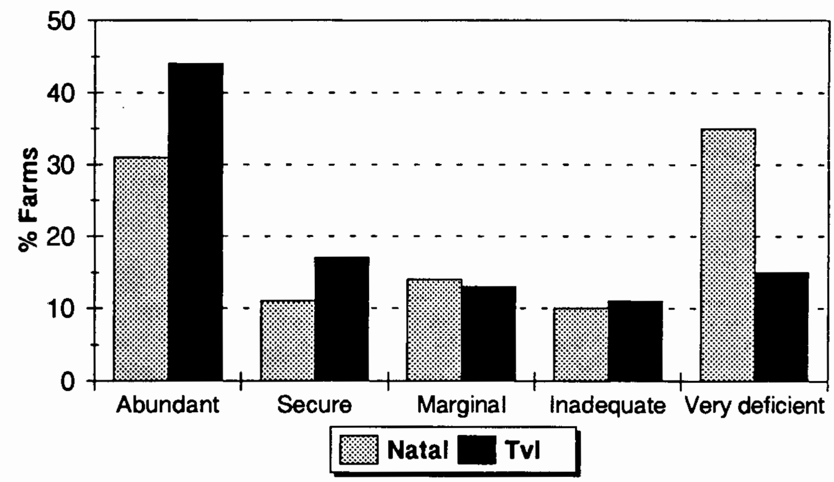



**FIGURE 4.10: Availability of fuelwood on commercial farms**
*Source: Gandar (1991:21)*

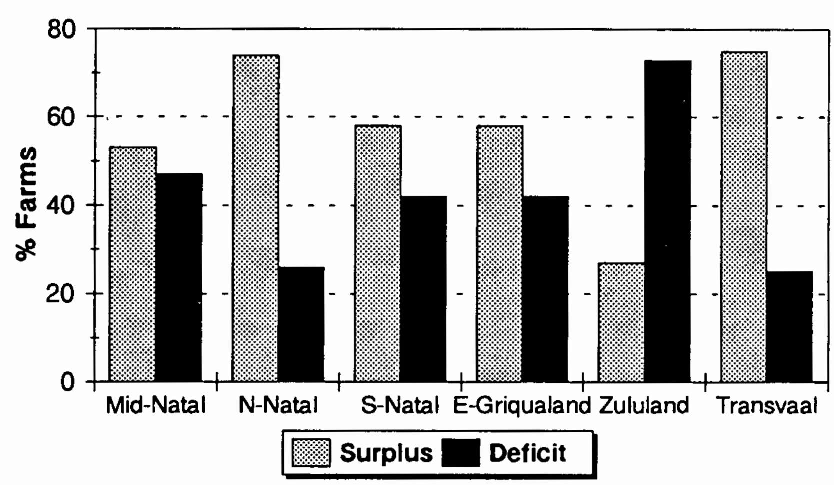



**FIGURE 4.11: Percentage of farms with a potential fuelwood deficit or surplus.** *Source: Gandar (1991:21)*

The fuelwood resources assessed in Figure 4.10 and 4.11 relate to on-farm woodlots, natural woodland and indigenous forests and do not include residues from farming activities that involve tree cultivation e.g. fruit trees, vineyards, bark and timber production. Agricultural residues, though not vast, and limited to certain types of farms, are an important resource. On a fruit farm in the W-Cape, a farmer commented that there was no room for a woodlot programme and that residues from fruit farming were sufficient to supply farmworker households. Their role in making up for fuelwood deficits is illustrated by the fact that, of the farms with an apparent deficit of fuelwood resources, 30% have some form of commercial timber operation. (Gandar 1991:21). It is not clear however, to what extent farmworker households are gaining access to this potential fuelwood resource. Figure 4.10 and Figure 4.11 give an indication of the availability of fuelwood from on-farm sources but do not indicate actual access.

On the assumption that the yields of fuelwood from on-farm sources are as represented in Figure 4.12, Gandar estimated the total potential sustainable yield of firewood per farm surveyed to be 218 tons per year, roughly three times the average farm demand (1991:20). Though the figure masks shortages that would be apparent if fuelwood availability was considered on a farm by farm basis, there is clearly an overall on-farm fuelwood surplus.

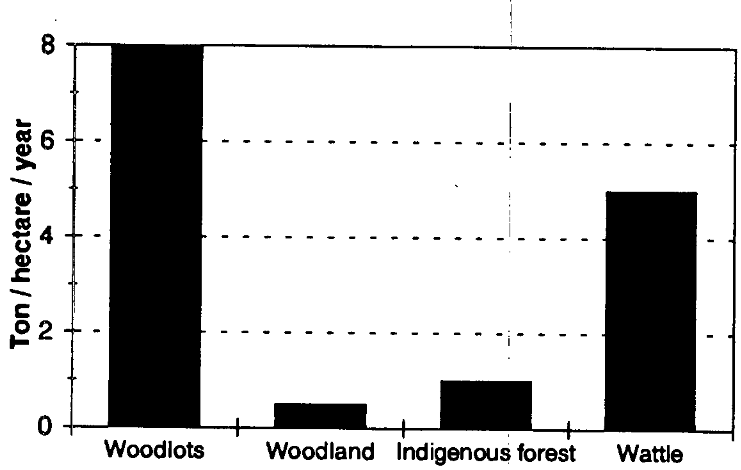



**FIGURE 4.12: Mean yield from on-farm fuelwood sources**
*Source: Gandar (1991:20)*

Gandar (1991:30) estimates that 13% of farms import fuelwood, and 28% export, and that possibly as much as a quarter of the fuelwood used in KwaZulu is from the commercial farming and forestry sectors. Currently the distribution of wood occurs through informal sector merchants, individuals with their own transport, the issue of annual permits to individuals by farmers, the sale of headloads (sometimes paid in labour), or collection by commuting labour.

Similarly to the role of agricultural residues, forestry residues, though limited to regions close to commercial plantations, represent an important firewood resource for farmworker families. In Natal, 12% of farms with fuelwood deficits get fuelwood from nearby commercial timber operations. Access to fuelwood from commercial forestry operations is usually on an informal basis.

### 4.5.2 Fuelwood supply

Despite abundant on-farm resources of fuelwood there are clearly areas where workers experience shortages. These have been revealed through investigating the extent of the fuelwood resource as well as through looking at farmworker households' problems related to fuelwood use.

There are two main supply options to improve farmworker households' access to fuelwood: improve the utilisation of the current resource, and increase the overall size of the resource through planting more trees.

#### 4.5.2.1 On-farm resource management and development

Though the primary motivation is to improve farmworker households' access to fuelwood, the development of on-farm fuelwood resources may be undertaken within a broader context of natural resource management and multipurpose tree growing. Fuelwood may be a by-product of these programmes but the consequence will be an improvement in worker households' access to energy.

Three important strategies are:

- the management of natural woodland;
- harvesting and controlling invasive species, and
- multipurpose tree growing programmes.

***Woodland management and bush encroachment***

On many commercial rangelands, the agropastoral approach to savanna management (that is management of the herbaceous layer), and under utilisation of the woody component, has resulted in severe bush encroachment problems.

There are various factors that favour the increase of the woody component. The use of the land for commercial farming means there are not the natural controls of large herbivores, such as elephant, and in the drier savanna areas the continuous presence of cattle prevents the build up of a herbaceous fuel able to generate a hot enough fire to kill off woody plants. Recent moves towards incorporating browsers, for example goats or kudu, have had limited impact. The wood-use in these areas is mainly for fuelwood (mostly farmworkers and some off-farm export), but the fuelwood resource far exceeds the demand, and fuelwood harvesting has thus far had little impact on the encroachment problem.

Examples of different approaches to wood harvesting are given by Gandar and Grossman (1993:27). In the first approach a clear management strategy is directed to bush thinning. Wood is harvested and stacked in the veld by contractors and subsequently purchase and removed by wood merchants. A second approach is where a wood merchant both cuts and removes the wood - resulting in less control over the remaining woodland structure, and a third approach is where wood gatherers (mainly women) collect dead wood and trim dead branches, which they remove as headloads.

Some farmers have marketed braai-wood, and a well developed firewood trade in the Western Cape (Port Jackson Willow and Rooi-Krans) is coupled with the clearing of private land. For wood harvesting to have an impact on invasive species, and towards fulfilling fuelwood needs, large amounts would have to be harvested and transported.

Woodland growth is a dynamic process. If sustainable wood harvesting were an objective, woodland could be held at the optimal growth density by formulating and applying a suitable burning regime, manipulating livestock, and implementing controlled and selective wood harvesting.

Incorporating the woody component into the overall production potential of the land, could add value to the woody component resource base rather than perceiving it as a threat, and result in an increase in the value of the land.

Farmers currently control their workers' harvesting of natural woodland to the extent where workers may experience fuelwood shortages. There is a need for commercial farmland to be included in a national programme on the management of natural woodland, particularly where there are fuelwood scarcities and encroachment problems. Farmers and workers need to be included in educational drives that teach appropriate bush thinning strategies, ensure the maintenance of appropriate woodland structure, and provide a sustainable supply of fuelwood.

### *Multipurpose tree growing*

Much of South Africa's agricultural land is ideal for multipurpose tree growing, but farmers need to be willing to make land available and offer support.

Trees can be grown for various products other than fuelwood: trees that produce fruit and nuts can supplement the farmworker household's dietary requirements; eucalypt trees can be grown for pulp; wattle can be grown for bark, and both species can be used for charcoal production. Trees can be grown for improving the farm environment: for shade (for people as well as animals); as wind breaks; to reduce soil erosion; and for the nitrogen fixing properties of some tree species.

There are also potential benefits to the farmer. Many farmers use wood for their own space and water heating (a third of W-Tvl farmers sampled by Gandar used simple wood-fired drum boilers for their domestic hot water). Non-energy uses from woodlots include poles, electric fence droppers, tomato stakes, and paddock fences.

Fuelwood would be a by-product, and the cost of growing trees on farms can be lower than in other circumstances because of the use of farm-labour and machinery. By undertaking tree-growing during the farm's slack time, labour and machinery can be used more optimally.

Requirements for establishment of trees are: land; high levels of solar radiation; water; seedlings and labour. No area of the country does not have sufficient solar radiation and there is ample land available on nearly all commercial farms that would be suitable for tree growing. Trees can be grown on very small areas e.g. isolated patches or marginal land unsuitable for crop production, and land on borders of grazing fields where the root systems of trees will not interfere with crop production.

Areas with a rainfall of 500mm per annum and above are favourable for tree growing. In areas with a rainfall below 500mm, mainly the Karoo and parts of the North and North-West Cape, it is possible to establish species that do not require as much water, for example *Prosopis*. Trees will grow more slowly in these areas and the yield will be lower. According to the postal survey, the extent to which farmers offer support and land for establishing woodlots on their farms is not significantly less in these areas, . Only one farmer who supported fuelwood production indicated that water would be a problem.

Considerable human and infrustructural resources are needed for tree growing. Farmworkers have some agricultural training and familiarity with the use of machinery. On commercial farms there is also access to machinery, a source of fertilisers, in many cases water and some form of transport. The potential for growing trees will depend on available land, the farm's water resource, the attitude of the farmer and the worker community's willingness to get involved.

The support of farmers for establishing woodlots for the express purpose of fuelwood for farmworker households, and the percentage farmers offering land and money, are presented in Figure 4.13. Details of the amount of land and money offered are presented in Tables 53 and 54, Appendix 4).

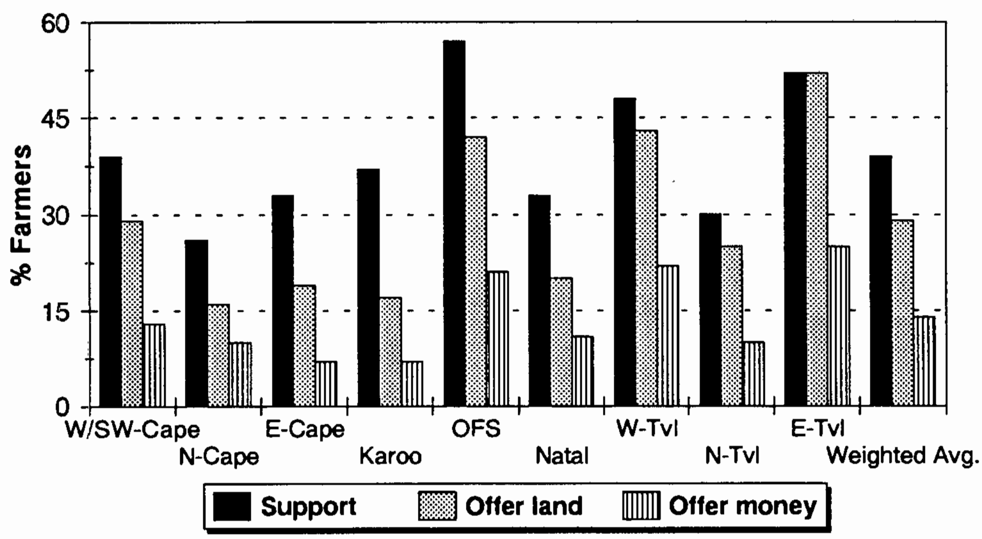



**FIGURE 4.13: Percentage farmer support for fuelwood production**
*Source: Author (1993)*

There is quite a large regional variation in the extent of support and amount of land and money offered by farmers. The number of hectares farmers offered are in many cases more than the on-farm work force would need.

In total the 4% of farmers sampled offered 2857 hectares. Extrapolation of this data means that nationally a total of 57000 hectares could be made available for on-farm woodlots.

At a consumption level of 4 tons per farmworker household per year, and an average yield of 8 tons per hectare, 57000 hectares could produce enough fuelwood to sustain about 114 000 farmworker households, nearly three-quarter million people.

### *Cost of producing fuelwood from woodlots*

The costs of producing gum and wattle woodlots, incorporating the cost of establishment, tending, harvesting, and preparing wood for use, are shown in Table 4.6 (Rusk et al 1991).

Establishment costs include machinery and labour costs for land preparation, planting, and fertilising, and the cost of plants. Tending includes labour for weed control. Harvesting includes labour and machinery costs for chain-saw felling, debranching and cross cutting, stacking, and extraction to the road-side.

**TABLE 4.6: Cost of producing fuelwood from woodlots**

| Activity | Gum | | | Wattle | | |
|---|---|---|---|---|---|---|
| | Cost R / ton | Labour R / ton | Person-days / ton | Cost R / ton | Labour R / ton | Person-days / ton |
| **Establishment** | 68 | 54 | 4 | 60 | 60 | 4 |
| **Tending** | - | 10 | 1 | - | 14 | 2 |
| **Harvesting** | 5 | 6 | 7 | 3 | 4 | 7 |
| **Total** | 73 | 67 | 12 | 63 | 78 | 13 |

These costs are probably higher than would be experienced in practice for the primary task of the farm machinery and labour, is not for woodlot development or fuelwood harvesting. In such instances the major cost would be the opportunity cost of land and the cost of plants. Where marginal land or patches of land unsuitable for crop production are used, the cost of producing fuelwood on commercial farms consist of to the cost of plants, which make up 33% of the total cost. There is no cost involved in maintaining a woodlot for fuelwood, other than labour, and the cost for harvesting is minimal. Most labour time is spent on harvesting.

How soon fuelwood can be harvested, and the actual yield from a hectare, is dependent on rainfall, soil depth and other site characteristics, as well as woodlot management. On an average harvest of 8 tons per hectare, three and a half years after planting, a woodlot life-time of twenty years and a household need of 4 tons per year, the cost of producing fuelwood from woodlots ranges between R19 to R68 per household per year without labour, and the number of person-days to establish, maintain and harvest enough fuelwood for a household, calculated over a woodlot life-time of twenty years, is in the region of 12 a year.

The costs in Table 4.6 are applicable to fuelwood production, but are also applicable for the establishment and tending of wattle for bark production or eucalypt for pulp or charcoal, and for other on-farm needs such as poles and droppers. The cost of establishing trees to harvest fruit or nuts would be more because of the initial cost of plants. The cost of the fuelwood by-product from any of the above activities is minimal and would relate to the harvesting costs in Table 4.6.

Few farmers were willing to meet the full cost of establishing woodlots. Using the establishment and tending costs (without labour) of Table 4.6, nationally in the region of 28 000 hectares could be established through farmers' support, on average about 12 hectares per farm.

The survey results, however, give no indication of the extent to which farmer support would improve worker households' access to fuelwood, that is whether farms where land is offered are in areas where fuelwood shortages are currently experienced.

#### 4.5.2.2 Fuelwood distribution

The most convenient source of fuelwood for worker households is the farm, and planting trees to increase the fuelwood supply in areas of scarcity is important. There are however, considerable lead times between the establishment of woodlots on farms and fuelwood harvesting, and there are farms where land is not suitable or available for woodlot development.

In the short-term, the improved distribution of fuelwood could play an important role in alleviating fuelwood shortages, both for farmworkers and other rural communities.

The cost of preparing and distributing fuelwood is presented in Table 4.7 (Rusk et al 1993). All figures include labour costs. Preparation costs include chain-saw felling, de-branching and cross cutting, stacking, and extraction to the road-side. The transport costs assume the use of a 7 ton truck.

The fuelwood preparation and transport costs are similar for all fuelwood sources. The viability of distributing depends on the distance wood has to travel.

**TABLE 4.7: Cost of fuelwood preparation and distribution**

| Source | Preparation | Transport | |
|---|---|---|---|
| | R / ton | Capital R / ton | Running R / km |
| Forestry field residues | 7 | 10 | 0.61 |
| Farm woodlots | 10 | 10 | 0.61 |
| Farm woodland/forest | 10 | 10 | 0.61 |

Transnet's published price for the transport of raw timber is in the region of R32 / ton for 250 km, with a minimum load of 18 tons. Contract prices, which are negotiated by timber companies for timber transport, are confidential, but are probably considerably lower.

The informal sector transports large amounts of wood. Organised harvesting and transport of bush encroachment wood or surpluses from on-farm woodlots could benefit communities close to areas of clearance or production. And railage of large quantities of forestry wastes could benefit rural communities at a considerable distance from the source.

Fuelwood shortages may occur because an area is unsuitable for producing trees on any scale. These regions are also likely to be a fair distance from forestry residue sources or from farms which have extensive natural woodland. There is a need to investigate and disseminate appropriate species for these areas.

### 4.5.3 Cost and benefit

The cost of producing and distributing fuelwood for use by rural households must be weighed against potential benefits. For example the environmental benefit of using a renewable resource for power intensive energy functions like cooking and heating, and of fuelwood harvesting in clearing or controlling bush encroachment and in better utilisation of forestry residues.

The incorporation of commercial farms and farmworkers in a national social forestry initiative could result in other less direct benefits for farmworkers such as community development and empowerment through helping themselves, improving their environment, training opportunities, and being involved in an initiative that goes beyond their own backyard. There may also be the potential for farmworkers to be involved in producing or harvesting more fuelwood than their own needs and marketing the surpluses.

Problems relating to the development of woodlots on farms are the possibility of plantations creating frost pockets by preventing the drainage of cold air, the soil drying effect of trees and possible fire hazards (Gandar 1991:27). A national programme could make advice available to farmers that could ensure appropriate tree growing strategies are used.

One potential serious problem for farmworker households using fuelwood is the health risk associated with wood smoke. Any fuelwood programme should be accompanied by incentives that make the use of wood-stoves more widespread.

## 4.6 The supply of other fuels used by farmworker households

Farmworker households also need improved access to paraffin, candles, LPG, batteries, and battery charging facilities. Paraffin and LPG are important cooking and heating fuels and might in certain cases be more cost effective than electricity. There will always be farmworker households without access to electricity, or even fuelwood for cooking and heating, and it is also appropriate that households have an alternative to fuelwood. Factors that affect demand for these energy carriers include:

- the extent of electrification of farmworker houses, level of supply and affordability of appliance;

- the lead time before electricity will reach many households;
- access constraints - mainly poverty and lack of mobility.

### 4.6.1 Supply options for paraffin, LPG, and candles

There is not much the worker household can do to improve their access to paraffin, LPG and candles. Current constraints on access to paraffin, LPG and candles include the reported high cost of these fuels from local shops, problems with lack of transport to reach supply stores, the fact that fewer farmers 'provide' these fuels compared to, for instance, fuelwood, and in the case of paraffin and particularly LPG, the cost of appliances.

Retail price controls could make paraffin and LPG more affordable to those who live in remote areas, but controls at small rural outlets would be difficult, if not impossible to enforce. In towns, retail price controls could be enforced and competition between large suppliers encouraged, but few workers have a regular means of reaching such a supply.

To improve the affordability of these fuels, worker households need to gain access to a large supplier or the fuels have to be delivered to workers by such a supplier. Farmers currently obtain many products from agricultural co-ops that purchase paraffin, LPG and candles. Bulk suppliers' could be encouraged to support worker households' needs through the farmer by offering incentives to encourage farmers to supply workers with these fuels.

This should need little effort on the farmer's behalf, particularly if the fuel is suitably packed for typical household needs; for example, small quantities in safety bottles, in crates. These would be easy for the farmer to transport, would not require dispensing, and would ensure the fuel enters the worker household in a safe container.

The benefits to the bulk supplier of commercial hydrocarbon fuels is the widening of their customer base, and being sure their new customers would be reached via the farmer who is already a customer. However, relying on the farmer to include workers in an initiative to improve their access to energy carriers will always exclude those workers whose employer is not concerned about or aware of their energy needs and it is also not conducive to the objective that worker households develop more independence from farm owners.

An alternative to the farmer's assistance is for the bulk suppliers of these fuels to extend their delivery system in rural areas. Diesel is currently delivered by bulk carriers to farms; these deliveries could in future include paraffin and LPG.

### 4.6.2 Supply options for coal users

Coal is little used by farmworker households, and its use appears to be concentrated around areas of coal mining. It is probably not feasible to investigate improving farmworker households access to coal on a national basis. A more appropriate intervention is possibly to replace conventional coal that is used by households with a low smoke variety.

The advantages of low-smoke coals to farmworker households are primarily the reduction of harmful emissions within the dwelling. There is probably not the general environmental need to reduce levels of emissions experienced within dense settlement coal users. There are currently three low-smoke coal varieties being developed (Van Horen 1994a):

Enertek reconstituted coal briquettes are produced from discard coal and cement. The cement acts as a binding agent and has the effect of reducing the particle emissions from combustion. Enertek briquettes may be more expensive than conventional coal, which will reduce their potential for replacing conventional coal considerably.

Wits/UCP coal is produced from waste coal and waste heat. Exposing discard coal to temperatures of 500° C to 600° C drives off the harmful volatile compounds that are normally released during combustion. UCP coal could be produced at a competitive price on condition that both coal and heat are waste products.

Wundafuel is made by Ecofuel, a private company based in Lesotho. The fuel is made from discard coal which is bound into briquettes. This fuel retails at a price higher than conventional coal and is therefore probably not a viable alternative without state subsidies.

## 4.7. Energy demand side management

### 4.7.1 Electricity demand side management

Currently Eskom has the surplus generating capacity to cope with new electricity connections. Sooner or later, in order to cope with the peaky nature of domestic consumption, new generation capacity would need to be built, the cost of which would have to be incorporated in the electricity tariff.

An important aspect of demand-side management for domestic users is to reduce peak period demand. In the short term it is unlikely that farmworker households are going to make a significant contribution to the consumption peaks that are currently causing concern. However in the longer term, as the number of connections increases, and farmworker households consume more electricity, they will become a factor and managing their demand may be necessary.

Time-of-use tariffs that are higher during peak periods would encourage the use of electricity during off-peak periods and cooking with other fuels (such as fuelwood and LPG) would diminish peak loads. Other strategies to reduce peak loads would be for electric geysers, or an electricity back-up to a solar water heater, not to operate at peak times (this should not reduce the worker households' benefit from the service), and house insulation to reduce space heating requirements.

Aside from reducing peak loads, the efficient use of electricity services (incorporating the use of efficient appliances) is also important, but these appliances would need to be affordable.

DSM programmes typically need 5 to 10 years to become effective (Ligoff 1992:1). To have maximum impact DSM strategies need to be developed and tested now, during this phase of expanding the domestic electricity customer base. Initiating a DSM programme with new customers would encourage appropriate usage behaviour from the start, and the use of metering technology which has the option of a time-of use tariff would avoid the costly process of retrofitting meters. Benefits to the household would include making optimal use of their electricity supply, and possible savings on the cost of electricity.

### 4.7.2 Fuelwood demand side management

Though there are not major fuelwood problems on most commercial farms, shortages do occur and there is room for DSM strategies. Fuelwood efficient stoves have been developed, both with appropriate fittings to maximise the value of the fuel (such as water heating extras) as well as to reduce the amount of wood needed to deliver a specified amount of heat. In the past, fuelwood users have not always responded well to woodstove programmes. It is clear that for DSM strategies to be effective there needs to be communication with communities to ensure measures developed are suitable.

### 4.7.3 Paraffin and LPG demand-side management

It is difficult to make a case for petroleum companies to introduce demand-side management programmes as they aim to maximise sales, but there is room for suppliers to improve the user friendliness of these fuels.

Problems with paraffin include the fumes released on combustion as well as the packaging. There are apparently additives available to reduce the fumes released and alter the accompanying smell, and introducing safe packaging of paraffin will reduce the dangers of ingestion by small children. Though there are always safety problem with using a fuel such as LPG, it is apparent that the fear of explosion is in excess of the actual danger to users and those familiar with using LPG are not overly concerned. Perhaps it would be appropriate for suppliers to improve the image of LPG through advertising and safety awareness campaigns.

## 4.8 Appliances

The poverty of farmworker households and relative expense of appliances result in numerous problems. Substituting for fuelwood and candles is impossible and households are prevented from using more convenient or preferred fuels.

The inability to purchase particular appliances can also lead to the inefficient use of energy, for example the use of an electric stove to heat an iron or boil water. The use of fuelwood without a stove is both inefficient as well as exposing users to high levels of pollutants and consequent health risks.

Though some farmers are known to support farmworkers in their purchase of appliances, because of the resultant indebtedness of worker households and the possible effect this assistance has on their cash wages, the value of this support is questionable. Workers could probably benefit considerably from access to a source of low cost finance to enable them to purchase appliances and make optimal use of energy services.

For households that will receive a limited electricity supply there is the need to develop and market appropriate low power appliances that will allow for the optimal use of the supply. For example a 5 Amp supply could be supported by a single plate stove, a kettle, an oven/slow cooker, and a water heater (that for example offers an off-peak electrical back-up to a solar water heating system), with a maximum power consumption of about 750 Watts.

## 4.9 Comparative energy costs

There is not enough data to develop detailed comparative energy costs of various fuels for different end-uses. The total cost of energy for farmworker households is on average low because the most expensive power-intensive end-uses, those of cooking and heating, are to a large extent covered by a free source of energy - fuelwood. For other end-uses there is little doubt that the costs of fuels used by farmworkers, who do not have access to electricity, are more expensive, particularly because in many cases transport costs to obtain these fuels would need to be added to their purchase price. It is likely that for end-uses other than cooking and heating electricity will be cheaper, even if a cost recovery tariff such as the Eskom S1 tariff is paid, but for cooking and heating purposes fuelwood should be cheaper even if the true cost of producing and preparing fuelwood was counted. For example candles used by worker households for lighting are estimated to cost about R10 to R12 per household per month (without considering transport costs or the fact that some of these households are also using paraffin for lighting), compared to about R8 per month for electrical lighting. The average cost of using fuelwood for cooking is between R2 to R6 per month per household compared to in the region of R16 per month for electricity - assuming 8 kWh / day at 20 c / kWh

## 4.10 Conclusion

The conclusion has been kept to a short generalised summary of the main points. Much of the discussion on energy supply options will take place in Chapter Five.

It appears that no single energy carrier could satisfy all farmworker households' energy needs, either in the short or longer term.

Supplying worker households with grid electricity that will allow access for all domestic energy uses is the most comprehensive supply option. However it will take some time for electricity to reach worker houses and in certain cases, because of the remoteness of dwellings and by implication expected connection costs, it is likely that an electricity supply will be a remote area power supply such as PV or a limited grid supply. Workers will therefore continue to use other energy sources for more power intensive applications. It is also likely that for both 'tradition' as well as reasons of affordability, worker households will continue to use fuelwood for some time to come.

In developing supply strategies it is therefore essential to consider the worker households potential access to all energy carriers currently used. Where there are fuelwood scarcities efforts must be made to improve access and reduce the burden of fuelwood collection, and where electricity for cooking or heating is not an option it is essential that worker households have access to an energy source other than fuelwood for these functions.

There is the need for supply strategies to consider the socio-economic and physical aspects of energy use by worker households, to offer households some choice and to relieve the dependence of households on farmers. Though there is a considerable amount of support for providing worker households with fuels from farmers, this support is unlikely not to involve some cost to workers both through the dependence factor as well as the possible effect this support has on their cash wages.

Farmworker households need access to cheaper, more convenient and safer fuels as well as assistance that encourages the efficient and safe use of fuels.

# Chapter Five
# CONCLUDING DISCUSSION

## 5.1 Introduction

Farmworkers and their families - some 25% to 30% of the rural population - are amongst the poorest people in South Africa. Poverty is experienced in several dimensions, including low cash income, poor access to services, isolation, intermittent and insecure employment, dependence on employers, and limited social, economic and political power to improve their conditions.

Chapter Three investigated the farmworker households' patterns of energy use and it became apparent that these are dictated by their access to energy services: which are for the most part inadequate. Relatively few households have electricity, there are numerous constraints on acquiring commercial fuels and most households are reliant on fuelwood. There is clearly a need for farmworker households to have improved access to cheaper, more convenient and safer fuels.

In Chapter Four energy supply was investigated and, for electricity and fuelwood, supply costs were estimated. It appears that there are grid possibilities for improving the worker households' access to energy services. To do this comprehensively, however, would require substantial organisational and financial support.

### 5.1.1 Current process of energy provision - limitations

Service provision for farmworker households is at present in the hands of farmers. There are no guidelines or minimum standards and the level of provision varies considerably depending on the attitude of the farmer towards his workers, and the viability of the agricultural activity.

There are farmers who plant trees or manage woodland to improve fuelwood availability. Others have arranged for electricity to be supplied to worker households. Such initiatives are however not coordinated or systematic. For example, an extensive programme by the Eskom West Cape Distributor to electrify farmworker houses in the West Cape coastal regions has resulted in over 1000 farmworker dwellings being electrified during 1993 and plans for a further 2000 are underway. The success of the programme has been attributed to the tight operational structure (each partner in the process has clearly defined roles), the financial backing from the West Cape Regional Services Council, and the fact that the work is being carried out with community participation and includes meetings with both farmers and farmworker families (pers. com., D. du Toit, Eskom, W-Cape Distributor 1993).

These initiatives are likely to continue and worker families in particular areas will benefit. But there are severe limitations in an uncoordinated approach which is not backed up by more general policies and planning. The arbitrariness of an electrification process (where access is dependent on a particular electrification manager and the extent of local subsidisation), and the universal dependence on the farmers' support, means that the energy needs of the majority of farmworker families are unlikely to be adequately met. Further, the families who benefit are likely to be already amongst the better-off whilst the needs of the most vulnerable and marginalised may be neglected.

### 5.1.2 Challenges to the status-quo

Besides any specific energy interventions, however, there are changes underway which may impact on the supply of energy services to farmworker families.

In recent times the higher profile of workers has resulted in their inclusion in labour legislation, the development of an ANC policy document on farmworkers (ANC 1993), and their inclusion in land reform options.

Future housing policy has particular significance for the provision of services to farmworker families. Possible changes in the ownership of houses or tenancy arrangements on the farm, or independent housing off the farm, are currently under investigation, for example: the establishment of farm villages - both on and off the farm, the use of semi-abandoned rural towns, and housing in local towns within commuting distance.

In May 1993 farmworkers were included in the Basic Conditions of Employment Act, which regulates amongst other conditions their working hours, leave allowance, and entitlement to overtime pay, and in January 1994 the Labour Relations Acts was extended to cover workers in the Agricultural sector. This will allow for example, workers to go to arbitration or challenge farmers in the labour court.

Farmworker families are likely to fulfil many of the criteria that would allow access to land under a land reform programme. There are certain to be legitimate land claims on historical grounds for some worker communities, or they might obtain access to land through circumstances where there are absentee landlords, in regions of marginal farming or under-utilised land, or through changes in labour practices that include a form of labour tenancy and share cropping. Joint ventures and joint enterprises between present farmers and workers are also currently being examined. In a World Bank report on land reform in South Africa (World Bank 1993) farmworkers are recognised as one of the categories of potential beneficiaries. Four models for inclusion are put forward: an improved conventional employment model, a common property model, a productive cooperative model, and an equity sharing model. The models result in a range of possible situations for farmworkers, including joint ownership of the land, profit sharing with respect to land and / or farming operation or simply the securing of rights to residence and arable plots.

There are other changes in the agricultural and political sectors that may have an impact on the farmworker community. Representatives of farmers and political parties are investigating the current system of monopoly marketing boards and farming practices. One of the aims is to reduce the gap between the large scale commercial and small scale semi-subsistence farming sectors.

## 5.2 Proposed guidelines for intervention

The process of identifying farmworker households' energy needs and suggesting improved energy supply options which will address these needs, has been undertaken in response to the current limitations in service provision and the opportunities presented opened up by political transition in South Africa, .

In order to address the energy needs of the greater farmworker community - including the most isolated and disadvantaged - considerable changes in practice and policy will be required. Important goals are:

- to improve the households' access to all fuels currently used;
- to address the energy needs of domestic and productive activities as well as those of community facilities such as schools or clinics;
- to locate interventions within a larger energy planning initiative

aimed at improving the access to energy services of all disadvantaged communities in South Africa.

There is requirement for substantial financial and organisational support, and for co-operation between numerous implicated parties including farmworker families, farmers, national and local government, non-government organisations, and the energy supply institutions.

There is the need for integrated energy planning. Based on the analysis of farmworker household energy use patterns and the influence of socio-economic factors (Chapter Three), and the assessment of energy resources and supply options (Chapter Four), the following guidelines for intervention are proposed.

### 5.2.1 Electrification

Currently about 22% of farmworker houses are electrified, but fewer than 10% have the use of electricity for services other than lights and media. Where worker households do have access, electricity is in most cases the preferred energy carrier, for convenience, versatility and an improved environment.

Based on the authors survey data, and Eskom costing methods it has been estimated that at least 88% of farmworker houses on farms with grid electricity could be electrified for under R5000 with an average connection cost per household of about R2300 (excluding transport, and assuming on-farm labour). At least 85% could receive a 20 Amp supply and the remaining 2% to 3% a 5 Amp supply.) Considering Eskom' current electrification drive and investment in urban electrification programmes the target of supplying these houses with electricity is not unrealistic.

#### *Level of supply*

The level of supply offered to worker households would depend on the potential demand and the initial cost of the supply.

A 20 Amp supply is likely to satisfy domestic needs and to be in the long run affordable for the majority of households. A 5 Amp grid supply or PV supply should be made available for those houses where a 20 Amp connection would exceed the national cost-of-connection parameter. Though the level of supply of a small PV system is considerably lower (e.g. 100 to 200 Wh / day, DC) this should be considered for farmworker houses which are too far from existing supply points to permit grid connection, and on non-electrified farms. It is possible to provide solar photovoltaic systems to power lights and media appliances for a capital cost of about R1500 to R2500 (excluding installation). In the event of a national rural electrification programme which includes a level of capital subsidy, this should be made available for both grid and PV electricity options.

Higher levels of supply (e.g. 30 Amp or 60 Amp) could be made available within a set limit, or if demand matched the capital cost recovery requirement. These supply levels could have particular application if the electricity were to be used for small-scale production with income generating potential, or for community facilities which service a number of households.

There are several factors that need to be considered in selecting appropriate supply levels, including projected consumption and the associated potential for cost recovery. It would perhaps be more cost effective to invest in support to assist farmworker households to make optimum use of a limited supply, rather than subsidise higher capital costs for higher levels of supply. This could be less of a drain on financial resources and would achieve the efficient use of an electricity supply.

### *Level of service*

A national set of cost of service parameters is likely to be developed with a ceiling established for rural and farm dwellers. In situations where costs are likely to exceed this parameter, communities could negotiate with the utility for lower levels of service or community contributions. The development of programmes that would enable workers to contribute towards system maintenance as well as educate consumers to facilitate the safe and efficient use of electricity could in the long run benefit consumers as well as suppliers.

### *Technology and costs*

There are various technology and implementation costs and procedures that impact on the overall cost of electrification. Using appropriate low cost technology, while maintaining standards of safety and adequate power supply, will be requirements for the extensive electrification of farmworker houses.

### *Payment system*

Paying of energy bills on a regular basis is often difficult because of the low cash incomes of worker households. Workers may receive their cash wages daily, weekly, monthly or at longer periods, depending on whether they are regular, seasonal, or domestic workers. Some receive a substantial portion of their salary as a harvest bonus; some households earn as little as R60 / month.

It is likely that the most suitable payment system for worker households with access to grid electricity is a pre-payment meter. This system places electricity consumption more within the control of the user, allowing households to purchase electricity in discrete quantities according to need and affordability, and avoids the danger of control by the farmer. However, workers would need to be able to purchase pre-payment meter cards in a convenient way, without restriction, and in small amounts (e.g. R2 to R10). A considerable amount of research and planning still needs to be undertaken to ensure that this is possible.

### *Tariff*

Any tariff that includes a fixed basic charge is unlikely to be suitable for farmworker households. It is proposed, on equity grounds, that a national single flat rate tariff for all domestic consumers, whether they be urban, rural or farm dwellers, should be developed. Such a tariff implies a degree of cross-subsidisation from larger domestic electricity consumers to lower-consumption customers, and the level at which it is set will have vital implications for the overall viability of the electricity supply industry. At the same time, to avoid the low-use trap, the tariff must be set at a level which provides affordable electricity for new consumers.

Some farmers are currently contributing to the capital cost of bringing medium voltage rural grid extension to their farming areas, through payment of a monthly grid extension charge. In the broader context of financing future extensions of the rural network, this needs to be re-examined. It would be anomalous for some farmers to continue to pay large amounts towards capital cost of infrastructural development while farmworkers' access to electricity is significantly cross-subsidised.

*Process*

Programmes for improving access to electricity need to be undertaken on a broad basis within the context of a national accelerated electrification programme, and should include both grid and off-grid supply options.

For equity considerations as well as to avoid problems which result from access on an individual household basis, electrification planning would need to be undertaken for all houses on a farm, and preferably all farms in a district. Future grid extension potential to farms currently without electricity needs to be investigated, with the inclusion of worker households as potential customers.

### 5.2.2 Fuelwood

Fuelwood is very widely used on farms: it may be the fuel of choice in certain situations, is used for functions other than cooking, and is generally free. Access to fuelwood on farms appears generally more favourable than in many other rural areas, but there are localities where fuelwood shortages occur and reliance on fuelwood can be a burden to farmworker households.

Fuelwood is widely used by other rural and peri-urban communities where shortages are more widespread and damage from biomass degradation more acute. There is therefore the need for national planning for fuelwood provision. An assessment of fuelwood supply and demand needs to be undertaken in areas where fuelwood is widely used, where shortages or surpluses exist, where electricity is unlikely to be provided and where access to commercial fuels constrained. Fuelwood shortages on farms should be addressed within the context of a national fuelwood and social forestry programme that includes strategies such as the management of natural woodland, harvesting and controlling invasive species, and multipurpose tree growing.

Because of the extent of fuelwood resource on farms and the farmers' support for fuelwood production, commercial farms have an important role and farmers and farmworkers need to be incorporated as partners in any national fuelwood strategies.

### 5.2.3 Paraffin and LPG

Commercial hydrocarbon fuels are used and needed by many farmworker households. There are currently various constraints on access to these fuels. An important aspect of improving worker households' access to energy services is improved access to paraffin and LPG. Where electricity is not available, worker households need to have access to a more convenient source of energy than fuelwood, farmwaste or coal for cooking and heating purposes.

The time and energy required to use fuelwood, farmwaste and to a certain extent coal, can be a burden and paraffin and LPG are more convenient and immediate fuels. Paraffin and LPG can also offer a better quality of light than candles. Ultimately it would benefit all households to have electricity at least for lights and small appliances. However until such time as they do, improved access to paraffin and LPG for lighting should be promoted.

Bulk suppliers (agricultural co-ops and/or oil company routers) could be encouraged to support worker households' needs through farmers, by offering the farmer incentives in exchange for supplying worker households with paraffin or LPG. Alternatively, suppliers should investigate the potential of a mobile delivery system for rural areas, for example by including paraffin and LPG for farmworkers while running bulk diesel delivery to farms.

## 5.3 The potential for change in energy planning

There are supply opportunities, but there are numerous barriers to improving farmworker households' access to energy services, even more so if the approach is to be demand-driven and integrated. The barriers are broad and widespread, including factors particular to the circumstances of farmworkers, such as their poverty and dependence, as well as macro factors such as the lack of rural development policy and representative local government.

### *Macro-factors*

At a national level, rural policy making and implementation have taken place in an ad-hoc and low-priority fashion. The current system of state rural administration is generally not geared for rural development or to service the needs of rural communities. Existing authorities are in many cases considered low in legitimacy and credibility.

An integrated energy planning initiative would need strong central policy development. The setting of minimum standards and the allocation of responsibility for implementation and maintenance would have to be undertaken, and mechanisms for administering funds for service provision would need to be in place. On the other hand, regional district and local-level organisation is requires for implementation. Farmworker communities need to be represented at both national and local levels, by both labour and civic organisations. The role of the state, the utility, and NGOs with regard to service provision would need to be clearly defined, within a framework which supports economic sustainability to fulfil these needs.

In the past, rural electrification in South Africa has largely supplied farm homesteads and production activities. Attempts to reach farmworkers or rural villages have been less systematic. The realities of rural electrification are, in a number of important ways, in conflict with the primary concern of electricity supply utilities: economic and engineering logic dictate that rural electrification has a lower priority - after urban and industrial needs have been satisfied. However, the costs of connection for large numbers of farmworker houses on farms which are already electrified are in the same range as new urban domestic connections. There needs to be a rural electrification task force, to tackle this potential, assured of an allocation of funds and support for appropriate technology development.

Fuelwood is relied on by many rural communities both on and off commercial farms, yet the trade, transport, and production of fuelwood generally take place on an ad-hoc basis. The various structured projects that have been undertaken are isolated, under-funded, and have had limited success. Support for improved access to fuelwood particularly involves a number of sectors.

In April 1992 the National Energy Council (NEC) established a Biomass Initiative. The broad goal of the initiative was stated as 'the amelioration of the fuelwood problem in the rural areas of the SATBVC countries and the deforestation of these areas' (Viljoen, 1992:21). At the end of the planning phase a workshop was held where one of the objectives was to develop a set of guidelines for the formation of an institutional framework for a national social forestry programme. It was recognised that this would necessitate many inter-departmental linkages, spanning water, forestry, finance, energy and agriculture. Social forestry can play an important development role, and is potentially a catalyst for convergence in agriculture and rural development (Gandar, 1993:7).

Electrification, fuelwood provision, as well as the transport of commercial fuels are all required to fulfil the farmworker households' energy needs. There is a need for the institutionalisation of functions and structures for implementation and management, and the formation of well defined linkages between sectors, organisations and role players.

### *Micro-factors*

Some of the factors particular to farmworker households which need consideration and attention are:

- the poverty of farmworker households and their dependence on employers;
- current legislation that tends to support farmers' control and dominance over employees and their families;
- the ownership of state subsidies aimed at improving the conditions of farmworker households;
- the lack of farmworker representation within socio-economic and political arenas.

For sound integrated energy planning it is vital that farmworker families are viewed by national policy makers as rural residents in their own right, and that their current status of dependency on farm-owners is addressed. To recognise farmworker households as separate domestic consumers would be an important part of an electrification programme. Electrification opportunities could be seriously impeded if totally reliant on farmers' good will.

Current legislation that limits the worker households' right to freedom of association, such as the trespass laws, could similarly have a detrimental effect on the efficacy of efforts to improve their access to energy services - for example, by not allowing access to energy-related extension services and support agencies.

The implementation of national policy aimed at improved provision of rural services would require a degree of subsidisation and extension support. Farmworkers have been recognised as intended beneficiaries of financial allocations (directed for example towards education, health and energy provision) in an ANC working document (ANC, 1993), and the present government does offer subsidy support (for example for the electrification of worker houses). However all subsidies, intended to improve the conditions of farmworkers, are at present under the farmers' control and because of the workers' lack of tenancy security, ultimately benefit the land owners. The ownership of such support needs to be examined.

Farmworkers currently have few support institutions. They have secondary access to agricultural institutions and infrastructure via the farmer, but are not the direct responsibility of any level of government or service agencies. About seven unions do represent some workers on commercial farmland, and there are various NGOs working with farmworkers and farmworker family members. In total probably not more than 1% of farmworkers are members of a union and probably not many more have contact with NGOs (pers. com., Wildschut, Centre for Rural Legal Studies, 1993). About 300 000 farmworkers and family members reside on farms which are members of the Rural Foundation, an organisation which is funded by the state, donors (South African private sector and overseas grants) and by member farms. However the route to services offered, is still the farmer.

## 5.4 Conclusion

The problems of service provision to farmworker families relate to their remoteness, lack of transport (both public and private) and dependence on the support of farm-owners. Any successful programme to reach workers depends on an integrated approach that will offer equitable opportunities for all disadvantaged communities, the establishment of democratic and efficient local governance, and partnerships between farmers, local government, NGOs, unions and supply agencies. It will also require substantial improvements to the economic and political status of the farmworker community.

The objective of equity in basic needs fulfilment is perhaps attainable. It is unlikely, however, the levels of service provision enjoyed by the rich minority will be affordable to all, or to the country as a whole, in the foreseeable future. Macro-economic constraints will limit the extent of financial support available for intervention and improvement.

Even to achieve the goal of adequate energy provision to meet basic needs, it is clear that substantial changes from the status-quo is required.

South Africa is undergoing fundamental political and institutional changes, old paradigms are being challenged. There is perhaps a window of opportunity, but there are many uncertainties and unknowns. It is uncertain to what extent farmworker families may benefit from a land reform programme and changes relating to housing and tenure. There is uncertainty about the face of future rural development, energy and agricultural sector policies, and the potential for the extreme poverty of farmworker families to be alleviated, and for their political status to improve. The existing relations of power, class and ownership in the commercial farming sector will not change overnight.

Nevertheless farmworker families are a recognised group of people whose needs will be on future development agendas including those addressing access to energy services. They are a significant proportion of the rural population and as such represent a political opportunity for making visible and rapid gains in social welfare. Although considerable investment and support is required, the cost of improved service provision to farmworker households could be lower than in other rural areas, and electricity in particular could be extended to the majority of this community.

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# Appendix 1

# POSTAL QUESTIONNAIRE

QUESTIONNAIRE FOR A SURVEY OF FARMS AND FARMWORKER HOUSEHOLD ENERGY SUPPLY ON ELECTRIFIED FARMS IN SOUTH AFRICA

Instructions: 1) Please enter answers in the space provided. 2) For * questions, mark the appropriate box/boxes with an X.

**The FARM and ELECTRICITY**

What is the name and district of your farm ? ____________________

How large is your farm in hectares ? __________

What farming activity is the main contributor to the farm's income ? __________

What do you pay for a unit of electricity ? (c/kWh) __________

What is the farm's average electricity bill per month ? R __________

**FARMWORKER HOUSES and HOUSEHOLDS**

How many farmworker dwellings are there on your farm ?

| Total | With Electricity | With Piped Water | Both |
|---|---|---|---|
| | | | |

How many people in total (adults and children) live in farmworker dwellings ? __________

What is the average monthly income of a farmworker household ? R __________

**WORKER HOUSEHOLD ELECTRICITY PROVISION**

Are any workers' houses electrified ? If all, answer questions A; if none, questions B; if some, both A and B.

A.1 What was your total initial cost of providing workers with electricity ? R __________

A.2 What is the average monthly cost of worker electricity per household ? Cost To You: R __________ To Workers: R __________

A.3 How many of the electrified dwellings use each of the itemised appliances ?

| Lights | Stove | Kettle | Fridge | Geyser | Heater | Radio | TV |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

A.4 Did you subsidise the purchase of appliances ? If yes, how much per household ? R __________

A.5 What is the most significant impact of worker dwelling electrification Please comment over the page.

B.1 What is the spatial layout of non-electrified worker dwellings ?
If clustered fill in Frame I; if spread-out Frame II; if both Frame I and II.

**FRAME I: Clustered**

| | |
|---|---|
| Number of clusters on your farm | |
| Average number of dwellings in each cluster | |
| Average distance between dwellings in a cluster in metres | |
| Average distance between clusters in metres | |
| Shortest distance to an electricity supply point in metres | |

**FRAME II: Spread-out**

| | |
|---|---|
| Number of spread-out dwellings | |
| Shortest distance between two dwellings in metres | |
| Longest distance between two dwellings in metres | |
| Shortest distance to an electricity supply point in metres | |

B.2 Would you support a programme to electrify workers' dwellings ? __________

B.3 * How much would you contribute to the initial cost of electrification per house ?

| Nothing | R100 | R250 | R500 | R750 | R1000 | R1200 | R1500 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

B.4 How much would you contribute towards the purchase of appliances / household ? R __________

B.5 How much would you give towards the monthly cost of electricity use / household ? R __________

B.6 Are you aware of tax benefits and financial assistance available for electrification ? __________

PLEASE CONTINUE OVER THE PAGE

/ORKER HOUSEHOLDS and OTHER ENERGY PROVISION

| | Fuelwood | Paraffin | Gas | Candles | Batteries | Battery charging | Coal |
|---|---|---|---|---|---|---|---|
| * What other fuels do you provide your workers ? | | | | | | | |
| /hat is the monthly cost of each fuel you rovide ? R | | | | | | | |

o any of your worker dwellings have solar water heaters. If yes, how many ? ________

/hat was the initial cost of providing solar water heaters / household ? R ________

| | None | Quarter | Half | Three-quarters | All |
|---|---|---|---|---|---|
| If you provide your workers with fuelwood, how much comes from the farm ? | | | | | |

f the wood that comes from the farm how much is natural woodland ? ______ Cultivated ? ________

ould you suppport a tree growing programme for fuelwood on your or other land ? ________

ow much would you donate towards establishing such a programme ? R ________

ow much land could be made available on your farm for tree growing in hectares ? ________

COMMENT

Please return to: Ilne Hofmeyr. EDRC, University of Cape Town, Private Bag, RONDEBOSCH 7700.

## VRAELYS VIR 'N OPNAME VAN PLASE EN PLAASWERKERS SE HUISHOUDELIKE ENERGIE VOORSIENING OP GEËLECTRIFISERDE PLASE IN SUID - AFRICA

Opdrag: 1) Skryf antwoorde in beskikbare ruimte. 2) By * vrae, dui toepaslike blok/blokke met 'n X aan.

**Die PLAAS en ELEKTRISITEIT**

Wat is die naam van u plaas en distrik? ______________________

Hoe groot is die plaas in hektaar? ______________

Watter boerderybedryf dra die grootste by tot u plaas se inkomste? ______________

Wat betaal u per elektrisiteitseenheid? (kWh) ______________

Wat is die plaas se gemiddelde maandelikse elektrisiteitsrekening? R __________

**PLAASWERKERS se HUIS en HUISHOUDINGS**

Hoeveel werkershuise is daar op u plaas?

| Total | Met elektrisiteit | Met Lopende Water | Albei |
|---|---|---|---|
| | | | |

Wat is die somtotaal van mense (volwassenes en kinders) wat in die huise woon? __________

Wat is die gemiddelde maandelikse inkomste per werkershuishouding? R __________

**ELEKTRISITEITSVOORSIENNING vir WERKERSHUISE**

Is u werkershuise geëlektrifiseer? Indien almal, antwoord A; indien geen, afdeling B; indien sommige, beide A en B.

**A.1** Wat was die totale aanvanklike koste van diè elektrifisering? R __________

**A.2** Wat is die gemiddelde maandelikse koste van elektrisiteit per werkershuis? Koste aan U: R __________ Aan Werkers: R __________

**A.3** Hoeveel geëlektrifiseerde werkerswonings gebruik die volgende toestelle?

| Ligte | Stoof | Ketel | Yskas | W/W Tenk | Verwarmer | Radio | TV |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**A.4** Het u bygedra tot die aankoop van toestelle? Indien ja, hoeveel per huishouding? R __________

**A.5** Wat is die hoofresultaat van werkershuis elektrifisering? Lewer kommentaar agterop asseblief.

**B.1** Hoe is nie-geëlektrifiseerde werkershuise uitgelê?
Indien in groepe gebruik Raam I; indien versprei, Raam II; indien albei, Raam I en II.

**RAAM I: Groepe**

| | |
|---|---|
| Aantal groepe huise op u plaas | |
| Gemiddelde aantal huise in elke groep | |
| Gemiddelde afstand tussen huise in elke groep in meter | |
| Gemiddelde afstand tussen groepe huise in meter | |
| Afstand na die naaste elektrisiteitsvoorsieningspunt in meter | |

**RAAM II: Versprei**

| | |
|---|---|
| Aantal verspreide huise | |
| Korste afstand tussen twee huise in meter | |
| Verste afstand tussen twee huise in meter | |
| Afstand na die naaste elektrisiteitsvoorsieningspunt in meter | |

**B.2** Sou u 'n program om werkershuise te elektrifiseer ondersteun? __________

**B.3** Hoeveel sou u bydra tot die aanvanklike elektrifiseringskoste per huis?

| Niks | R100 | R250 | R500 | R750 | R1000 | R1200 | R1500 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

**B.4** Hoeveel sou u bydra tot die aankoop van toestelle per huishouding? R __________

**B.5** Hoeveel sou u bydra tot die maandelikse koste van elektrisiteit per huishouding? R __________

**B.6** Is u bewus van belastingvoordele en finansiële bystand vir elektrifisering? __________

VERVOLG AGTEROP

PLAASWERKERS en ANDER ENERGIE VOORSIENING

* Watter ander brandstof verskaf u aan werkers ?
* Wat kos diè brandstowwe maandeliks ? R

| Brandhout | Paraffien | Gas | Kerse | S-kool | Batterye | Laai Batterye |
|---|---|---|---|---|---|---|
| | | | | | | |

Gebruik enige van die werkershuise sonwaterverwarmers ? Indien ja, hoeveel ? ________

Wat was die aanvanklike koste van diè waterverwarmers per huishouding ? ________

* Indien u hout verskaf, hoeveel kom van die plaas af ?

| Niks | Kwart | Derde | Helfte | Driekwart | Alles |
|---|---|---|---|---|---|

Hoeveel hout wat van u plaas verskaf is, is van inheemse bos ? ________ Aangeplant ? ________

Sou u 'n boomplant program vir brandhoud op u of ander grond ondersteun ? ________

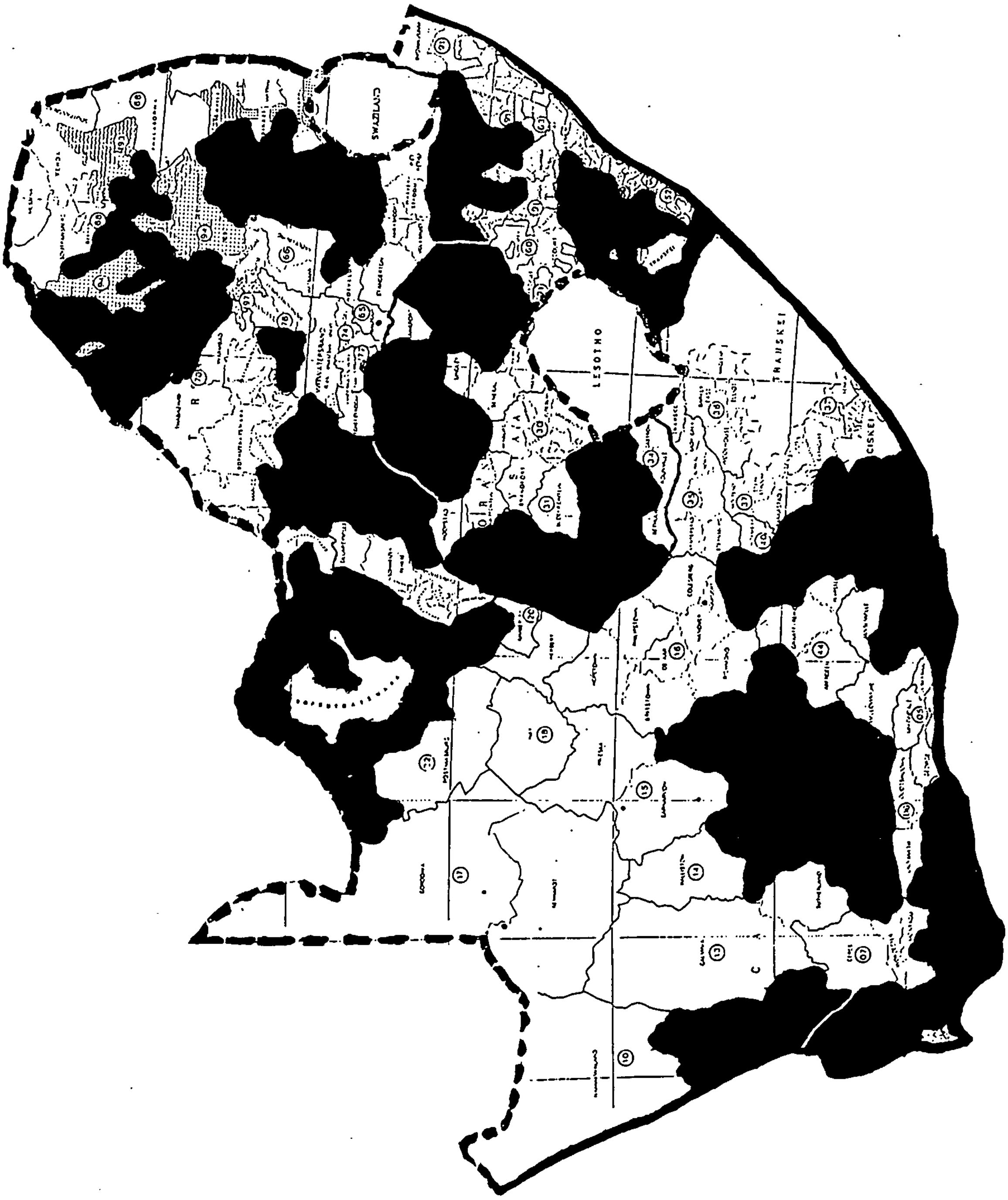
Hoeveel sou u bydra tot die vestigting van so 'n program ? R ________

Hoeveel hektaar grond kan u beskikbaar stel vir boomplanting ? ________

KOMMENTAAR

Steur asseblief terug aan: Ilne-Mari Hofmeyr, EDRC, University of Cape town, Private Bag, RONDEBOSCH 7700

# Appendix 2
# REGIONS SAMPLED



# Appendix 3
# INCOME LEVELS of FARMWORKERS

## 1. Introduction

Farmworkers are paid for their labour in both cash wages and payments in kind.

There is a large variation in the monthly cash incomes of worker households, depending on for example, the extent of the worker's skill, the value of payments in kind, and the type of ownership and profitability of the farm. In general better wages are found amongst workers on crop rather than livestock farms and it is also apparent that 'coloured' workers are on the whole better paid than 'black' workers.

Payments in kind include a value placed on accommodation and land use and rations - such as food and clothing and often the subsidisation energy carriers used by worker households.

Information has been obtained from the Rural Foundation, the Central Statistical Service, the Farmworkers Resource and Research Project and research reports by Moller, Lieberman, Gandar, Jooste and Norje, and the Centre for Rural Legal Studies.

## 2 Tables

Table 1 gives the Central Statistical Services average total monthly remuneration of regular farmworkers, including cash wages and the value of payments in kind.

**TABLE 1: Total monthly remuneration received by farmworkers**

| Region | Average remuneration / worker / month | | |
|---|---|---|---|
| | Cash | Other | Total |
| West Cape | R 142 | R 35 | R 177 |
| North Cape | R 64 | R 33 | R 97 |
| East Cape | R 68 | R 37 | R 105 |
| Orange Free State | R 80 | R 43 | R 123 |
| Natal | R 113 | R 38 | R 151 |
| East Transvaal | R 100 | R 33 | R 133 |
| North Transvaal | R 79 | R 27 | R 106 |
| S&C Transvaal | R 99 | R 35 | R 134 |
| West Transvaal | R 64 | R 30 | R 94 |

*Source: Central Statistical Services (1988)*

The value of payment in kind is similar for all regions - between R27 and R43. Generally, in regions where workers receive a lower cash wage (between R64 to R80), the value of payments in kind are about 50% of the cash wage. In regions where cash wages are higher (R99 to R142) the value of payments in kind is about 30% of the cash wage.

Moller (1986) reported that the median per capita income of farmworkers is substantially lower than that of other groups, Table 2.

**TABLE 2: Estimated median per capita income per month in rands**

| Rural | White Farm | Townships | Shacks |
|---|---|---|---|
| R 25 | R 12 | R 52 | R45 |

*Source: Moller (1985:25)*

These figures are substantially lower than those provided by the Rural Foundation, Table 3.

**TABLE 3: Estimated median per capita income**
per month in rands

| Region | Income R / month |
|---|---|
| West Cape | R 130.97 |
| North Cape | R 45.96 |
| East Cape | R 45.11 |
| Orange Free State | R 26.90 |
| Natal | R 84.55 |
| East Transvaal | R 61.01 |
| North Transvaal | R 61.40 |
| S&C Transvaal | R 46.46 |
| West Transvaal | R 28.66 |

*Source: Rural Foundation (1990)*

The difference in the remuneration paid to coloured and black workers given by Lieberman (1987:22) is shown in Table 4, and the difference in cash wages paid to coloured and black farmworkers according to region in Table 5 (Lieberman, 1987:21).

The value of rations is the same for both groups, but 'coloureds' receive a cash wage that is about 30% higher. From Table 5 it can be seen that this difference is reflected in all four provinces.

**TABLE 4: Remuneration received by coloured and black farmworkers**

| Remuneration | Coloured Employee | Black employee |
|---|---|---|
| Cash Salary | R 70 | R 44 |
| Ration Value | R 19 | R 19 |
| Total | R 89 | R 63 |

*Source: Lieberman (1987)*

**TABLE 5: Regional variations in cash wages received by coloured and black farmworkers**

| Region | Rands / month | |
|---|---|---|
| | Coloured Workers | Black Workers |
| Cape | 90 | 70 |
| OFS | 70 | 60 |
| Tvl | 95 | 70 |
| Natal | 210 | 70 |

*Source: Lieberman (1987)*

Table 6 (Lieberman, 1987:21) shows the changes in farmworkers' remuneration from 1980 to 1985

**TABLE 6: Cash wages and rations all employees from 1980 to 1985**

| Year | Rands / month | | |
|---|---|---|---|
| | Cash | Rations | Total |
| 1980 | 36 | 10 | 46 |
| 1981 | 44 | 14 | 48 |
| 1982 | no data | - | - |
| 1983 | 60 | 16 | 76 |
| 1984 | no data | - | - |
| 1985 | 66 | 24 | 86 |

*Source: Lieberman (1987:21)*

The increase in both the cash wage and the value of rations over the five year period is in the region of 50%.

The remuneration received by farmworkers and families according to the Gandar study is given in Table 7.

**TABLE 7: Earnings of farmworkers and farmworker households**

| Earnings | Natal | Transvaal |
|---|---|---|
| Mean wage / month | R 204 | R 213 |
| Mean earnings: casual workers / family / month | R 2.93 | R 5.90 |
| Cash income / family / month | R 343 | R 314 |
| Non-farm cash income / family / month | R 65 | no data |
| Total cash income / family / month | R 407 | no data |
| Rations R equivalent / family / month | R 53 | R 108 |

*Source: Gandar (1991:7)*

Household incomes given in the Jooste report are shown in Table 8.

**TABLE 8: Household monthly incomes**

| Income Rands | Percentage households |
|---|---|
| Less than R200 | 10 |
| 200 to 399 | 23 |
| 400 to 599 | 27 |
| 600 to 799 | 20 |
| 800 to 999 | 13 |
| 1000 and more | 6 |

*Source: Jooste and Nortje (1887:5)*

Gandar's (1991) study indicates that the farmworker household income is in the region of R350 and the Jooste (1987) study shows that the income of most farmworker households is between R200 and R800.

The minimum and maximum wage paid to workers (Gandar, 1991:7), minimum and maximum farmworker household income (Authors survey), and the minimum and maximum wages according to region and sector (FFRP), are presented in Table 9.

**TABLE 9: Minimum and maximum cash wages in rands**

| Sector | Region | Minimum Wage R | Maximum Wage R |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Black Workers | Natal / W&E.Tvl | 70 | 700 |
| Households | All regions | 60 | 2000 |
| Maize | Tvl / OFS | 100 | 150 |
| Livestock | All regions | 30 | 100 |
| Fruit | E.Tvl / E.Cape | 150 | 220 |
| Vegetables | E.Tvl / W.Tvl | 120 | 150 |
| Cotton | N.Cape / OFS | 120 | 180 |

The distinction between casual and permanent workers is not always clear cut. Some casual workers work full-time although they are paid on a very low daily rate such as R1.50 to R10.00, but usually in the region of R3 to R4 (Gandar 1991:8).

Gandar found that the payment of unskilled labour was in the range of R100 to R200 per month.

There are inconsistent reports about whether the wages of farmworkers are increasing or decreasing. Marcus (1989:183) states that the wages of unskilled labourers have declined both in absolute terms and relatively to other sectors since 1960. Since the mid-eighties farm wages increased by about 2% per year in absolute terms (Robertson, 1988:79).

The two findings indicate that there is a widening gap between low paid unskilled labour, and better paid skilled and semi-skilled farmworkers.

# Appendix 4

# TABLES

The original tables from which figure were produced are presented below. Tables are numbered in sequence, the figure that each table relates to is shown in italics.

**TABLE 1 (*FIGURE 2.1*): Indicators of well-being**

| Indicators | Percentage dissatisfied | |
|---|---|---|
| | Rural | White farm |
| General life satisfaction | 53 | 61 |
| Personal happiness | 43 | 47 |
| Life for blacks in South Africa | 48 | 56 |

*Source: Moller (1985:14)*

**TABLE 2 (*FIGURE 1.2*): Percentage of farmworker houses with piped water**

| Region | Houses with piped water / % |
|---|---|
| Cape | 55 |
| Natal | 22 |
| OFS | 43 |
| Transvaal | 48 |

*Source: Author (1993)*

**TABLE 3 (*FIGURE 2.3*): Percentage of households using different types of toilets**

| Sector | Flush inside | Flush outside | Pit/bucket | Bush/veld |
|---|---|---|---|---|
| Rural | 3 | 3 | 79 | 15 |
| White farm | 1 | 15 | 35 | 49 |

*Source: Moller (1985:23)*

**TABLE 4 (*FIGURE 2.4*): Estimated median per capita income per month**

| Rural | White Farm | Townships | Shacks |
|---|---|---|---|
| R 25 | R 12 | R 52 | R45 |

*Source: Moller (1985:25)*

**TABLE 5 (*Figure 2.5*): Cash income of farmworker households**

| Household income | Rand / hh / month |
|---|---|
| Minimum | 60 |
| Maximum | 2000 |
| Mean | 378 |
| Median | 300 |

*Source: Author (1993)*

**TABLE 6 (FIGURE 2.6 and 2.87): Regional variations in workers' circumstances**

| Region | Average income | | % Houses | | % Support for electrification |
|---|---|---|---|---|---|
| | Household | / cap | Elect | Water | |
| SW-Cape | 544 | 126 | 71 | 80 | 92 |
| N-Cape | 326 | 55 | 11 | 22 | 71 |

*Source: Author (1993)*

**TABLE 7 (*Figure 3.1*): Comparative fuel use in electrified and non-electrified dwellings**

| Energy Carrier | Non-Electrified | Electrified |
|---|---|---|
| Fuelwood | 91 | 85 |
| Paraffin | 62 | 25 |
| Coal | 7 | 8 |
| Farmwaste | 25 | 10 |
| Candles | 63 | 29 |
| Batteries/all | 15 | 13 |

*Source: Lieberman (1987:28)*

**TABLE 8 (*Figure 3.2*): Electrification of farmworker houses according to region**

| Region | % Elect |
|---|---|
| Weighted avg. | 32 |
| SW-Cape | 71 |
| W-Cape | 32 |
| N-Cape | 11 |
| E-Cape | 26 |
| OFS | 26 |
| Natal | 15 |
| E-Tvl | 22 |
| N-Tvl | 27 |
| W-Tvl | 26 |

*Source: Author (1993)*

**TABLE 9 (*Figure 3.3*): Electrification of farmworker houses according to farming activity**

| Farming Activity | %Elect |
|---|---|
| Vines / wine / grapes | 65 |
| Fruit | 50 |
| Vegetables | 60 |
| Wheat | 28 |
| Maize | 39 |
| Mixed crops / other vegetation | 37 |
| Mixed - animal and vegetable | 16 |
| Dairy cattle | 21 |
| Beef/cattle | 18 |
| Sheep/goats | 32 |
| Other animal | 33 |

*Source: Author (1993)*

**TABLE 10 (*Figure 3.4*): Farms where all, some, or no worker houses**

**are electrified**

| Electrification status | % Farms |
|---|---|
| No houses | 64 |
| Some houses | 16 |
| All houses | 20 |

*Source: Author (1993)*

**TABLE 11 (*Figure 3.5*): Electrification of farmworker houses according to farmworker household income**

| Household Income | %Elect |
|---|---|
| R60 to R150 | 10 |
| R160 to R200 | 20 |
| R210 to R300 | 25 |
| R320 to R400 | 26 |
| R420 to R500 | 48 |
| R520 to R650 | 54 |
| R700 to R980 | 66 |
| R1000 to R2000 | 87 |

*Source: Author (1993)*

**TABLE 12 (*Figure 3.6*): Electrification of worker houses according to type of housing material**

| Material | % Houses without electricity | % Houses with electricity |
|---|---|---|
| Cement | 11 | 9 |
| Mud | 13 | 10 |
| Thatch | 4 | 4 |
| Stone | 10 | – |
| iron | 57 | 11 |
| brick | 5 | 66 |

*Source: Lieberman (1987:27)*

**TABLE 13 (*Figure 3.7*): Electricity consumption levels of farmworker households**

| Region | Consumption kWh / month |
|---|---|
| Weighted Average | 203 |
| SW-Cape | 310 |
| W - Cape | 260 |
| N - Cape | 110 |
| E - Cape | 189 |
| OFS | 226 |
| Natal | 140 |
| E - Tvl | 204 |
| N - Tvl | 189 |
| W - Tvl | 153 |

*Source: Author (1993)*

**TABLE 14** ***(Figure 3.8)*****: Average monthly household income and electricity consumption**

| Mean household income R/month | Consumption catergory kWh/month |
|---|---|
| 404 | Less than 80 |
| 385 | 80 - 150 |
| 486 | 150 - 250 |
| 775 | more than 250 |

*Source: Author (1993)*

**TABLE 15** ***(Figure 3.9)*****: Farmer and worker contributions to the households' electricity costs**

| Region | Cost R/month | Cost R/month | | % Cost paid by | |
|---|---|---|---|---|---|
| | Total / hsh | Farmer | Worker | Farmer | Worker |
| Weighted Avg | 28 | 22 | 6 | 81 | 19 |
| W - Cape | 42 | 26 | 18 | 62 | 48 |
| N - Cape | 16 | 17 | 0 | 100 | 0 |
| E - Cape | 29 | 24 | 5 | 83 | 17 |
| OFS | 33 | 27 | 5 | 84 | 16 |
| Natal | 21 | 19 | 2 | 90 | 10 |
| E - Tvl | 28 | 25 | 7 | 78 | 22 |
| N - Tvl | 25 | 28 | 0 | 97 | 3 |
| W - Tvl | 20 | 14 | 4 | 78 | 22 |

*Source: Author (1993)*

**TABLE 16 (*Figure 3.10*): Farmworkers' attitude to electricity**

| Attitude | Percent |
|---|---|
| important | 41 |
| only a bit | 24 |
| not at all | 35 |

*Source: Gandar (1991:34)*

**TABLE 17 (*Figure 3.11*): Interviewees expressing appliances/fittings preference**

| Appliance | Percentage households expressing choice | | |
|---|---|---|---|
| | 1st Choice / % | 2nd Choice / % | 3rd Choice / % |
| Lights | 56 | 44 | - |
| Stove | 44 | 45 | 9 |
| TV | - | 7 | 52 |
| Fridge | - | 2 | 39 |

*Source: Author (1993)*

**TABLE 18 (*Figure 3.12*): Hhouseholds that would like to buy (have the use of) particular electrical appliances**

| Appliance | Workers % |
|---|---|
| Stove | 36 |
| Fridge | 53 |
| Heater | 36 |
| Kettle | 93 |
| Iron | 82 |
| Geyser | 11 |
| Hi-Fi | 29 |
| TV | 64 |

*Source: Kotze and Wolhuter (1992)*

**TABLE 19** ***(Figure 3.13)*****: How much workers are willing to pay for house wiring**

| Amount willing to pay | Workers % |
|---|---|
| Nothing | 50 |
| R50 - R500 | 46 |
| Dont know | 4 |

*Source: Kotze and Wolhuter (1992)*

**TABLE 20** ***(Figure 3.14)*****: Workers willing to use a redi board**

| Response | % Workers |
|---|---|
| Yes, definitely | 96 |
| Maybe | 0 |
| Dont know | 4 |

*Source: Kotze and Wolhuter (1992)*

**TABLE 21** ***(Figure 3.15)*****: Availability of fuelwood to farmworkers compared to other rural dwellers**

| Fuelwood | Rural / % | 'White'Farm/% |
|---|---|---|
| Collected nearby | 45 | 90 |
| Collected 30min away | 10 | 1 |
| Bought | 45 | 9 |

*Source: Moller (1986)*

**TABLE 22 (Figure 3.16): Percentage of farmers who provide farmworkers with fuelwood**

| Region | Percent of Farmers |
|---|---|
| National Average | 90 |
| E-Cape | 90 |
| Karoo | 98 |
| N-Cape | 100 |
| SW-Cape | 86 |
| W-Cape | 95 |
| N-Natal | 81 |
| S&C-Natal | 90 |
| E-OFS | 100 |
| N-OFS | 86 |
| W&S-OFS | 95 |
| W-Tvl | 91 |
| N-Tvl | 100 |
| E-Tvl | 74 |

*Source: Author (1993)*

**TABLE 23 *(Figure 3.17)*: Farmer perceptions of fuelwood availability**

| Availability | % Farmers |
|---|---|
| Will not be a problem for the foreseeable future | 79 |
| Will soon be a problem | 12 |
| Is already a problem | 9 |

*Source: Gandar (1991:24)*

**TABLE 24 *(Figure 3.18)*: Farmworker perceptions of fuelwood availability**

| Availability | % Farmworkers | | | |
|---|---|---|---|---|
| | Ntl Midland | Ntl Coast | E-Tvl | W-Tvl |
| no shortage | 65 | 55 | 50 | 100 |
| slight shortages | 11 | 27 | 42 | 0 |
| serious shortages | 24 | 18 | 8 | 0 |

*Source: Gandar (1991:24)*

**TABLE 25 *(Figure 3.19)*: Stoves used for wood burning**

| Stove | Percent use |
|---|---|
| Open fire | 63 |
| Brazier fire | 18 |
| Mud/Metal | 38 |

*Source: Lieberman (1987:34)*

**TABLE 26 *(Figure 3.20)*: Per capita consumption of fuelwood by farmworker households**

| Region | Source | Kg/cap/year |
|---|---|---|
| National | Eberhard (1986:105) | 800 |
| E-Tvl | Gandar (1991:14) | 792 |
| W-Tvl | | 818 |
| Natal | | 934 |

**TABLE 27 *(Figure 3.21)*: Percentage farmers who attached a cost to providing fuelwood and the amount spent**

| Region | % Farmers | Amount spent / farmer / household / month R |
|---|---|---|
| W-Cape | 23 | 10 |
| N-Cape | 28 | 7 |
| E-Cape | 31 | 17 |
| OFS | 25 | 15 |
| Natal | 38 | 8 |
| Transvaal | 19 | 30 |
| Weighted Average | 27 | 15 |

*Source: Author (1993)*

**TABLE 28 *(Figure 3.22)*: Time spent collecting Wood.**

| Hours / week | % Farmworkers |
|---|---|
| none | 37 |
| 1-2 | 13 |
| 3-4 | 14 |
| 5-6 | 10 |
| 7-8 | 20 |
| more than 8 | 6 |

*Source: Jooste (1987)*

**TABLE 29 *(Figure 3.23)*: Households buying fuels from various sources**

| Source | Candles | Paraffin |
|---|---|---|
| Farmer | 25 | 13 |
| Local / Farm shop | 25 | 32 |
| Mobile shop | 3 | - |
| Town | 57 | 32 |

*Source: Gandar (1991:42)*

**TABLE 30 *(Figure 3.24)*: Number of farmers who provide fuels used**

| Region | Sample size | Number of farmers who provide fuels used | | | |
|---|---|---|---|---|---|
| | | Paraffin | Gas | Candles | Coal |
| W-Cape | 37 | 2 | 9 | 6 | 2 |
| N-Cape | 16 | 6 | 1 | 4 | 0 |
| Karoo | 17 | 5 | 1 | 9 | 0 |
| E-Cape | 23 | 8 | 1 | 9 | 0 |
| Natal | 22 | 7 | 0 | 7 | 2 |
| OFS | 33 | 2 | 1 | 6 | 1 |
| Tvl | 22 | 3 | 0 | 3 | 2 |

*Source: Author (1993)*

**TABLE 31 *(Figure 3.25)*: Farmworker household expenditure on paraffin and candles**

| Energy Carrier | Expenditure/hsh R/year | |
|---|---|---|
| | Kotze (N-Cape) | Gandar (Natal/Tvl) |
| **Paraffin** | 93 | 90 |
| **Candles** | 141 | 75 |

**TABLE 32 *(Figure 3.26)*: Expenditure by worker households on fuels - other than electricity and batteries**

| Amount spent/month | Percent of workers |
|---|---|
| Less than R 5 | 38.4 |
| R 5 - R 9 | 43.4 |
| R 10 - R 19 | 14.3 |
| R 20 - R 29 | 2.6 |
| R 30 or more | 1.3 |

*Source: Jooste (1987)*

**TABLE 33 (Figure 3.27): Amounts spent by farmers on paraffin, candles, LPG and coal per worker household per year**

| Region | R / year / household | | | | |
|---|---|---|---|---|---|
| | Paraffin | Gas | Candles | Coal | Total |
| Weighted avg | 56 | 30 | 47 | 27 | 142 |
| W-Cape | 30 | 100 | 68 | 0 | 204 |
| N-Cape | 48 | 12 | 36 | 0 | 84 |
| E-Cape | 34 | 24 | 59 | 0 | 108 |
| Natal | 107 | 0 | 36 | | 132 |
| OFS | 66 | 0 | 48 | 0 | 162 |
| Tvl | 72 | 0 | 28 | 50 | 150 |

*Source: Author (1993)*

**TABLE 34 *(Figure 3.28)*: Paraffin Consumption**

| Region | Paraffin consumption Litres / hh / year |
|---|---|
| E-Tvl | 119 |
| W-Tvl | 35 |
| Natal | 74 |

*Source: Gandar (1991)*

**TABLE 35 (Figure 3.29): Source of batteries**

| Source of batteries | Percentage workers |
|---|---|
| Farmer | 23 |
| Local / Farm shop | 14 |
| Mobile shop | 4 |
| Town | 55 |

*Source: Gandar (1991:42)*

**TABLE 36 (*Figure 3.30*): Farmers who subsidise the use of batteries**

| Region | Sample size | Number of farmers | |
|---|---|---|---|
| | | Batteries | Battery charging |
| W-Cape | 37 | 0 | 2 |
| N-Cape | 16 | 2 | 3 |
| Karoo | 17 | 1 | 3 |
| E-Cape | 23 | 1 | 4 |
| Natal | 22 | 2 | 1 |
| OFS | 33 | 3 | 4 |
| Tvl | 22 | 6 | 2 |

*Source: Author (1993)*

**TABLE 37 (*Figure 3.31*): Average household expenditure on batteries**

| Energy Carrier | Expenditure/hsh R/year | |
|---|---|---|
| | Kotze (N-Cape) | Gandar (Natal/Tvl) |
| Batteries/all | 168 | 102 |

**TABLE 38** ***(Figure 3.32)*: Amounts spent by farmers on batteries per worker household per year**

| Region | Sample size | R / year / household | |
|---|---|---|---|
| | | Batteries | Battery charging |
| W-Cape | 37 | 0 | 30 |
| N-Cape | 16 | 63 | 32 |
| Karoo | 17 | 30 | 36 |
| E-Cape | 23 | 25 | 40 |
| Natal | 22 | 20 | 54 |
| OFS | 33 | 48 | - |
| Tvl | 22 | 46 | 60 |

*Source: Author (1993)*

**TABLE 39** ***(Figure 3.33)*: Time spent by workers collecting farmwaste.**

| Dung | | Cobs | |
|---|---|---|---|
| Hours/week | % Workers | Hours/week | % Workers |
| none | 59 | none | 49 |
| 1 - 2 | 14 | 1 - 2 | 19 |
| 3 - 4 | 10 | 3 - 4 | 7 |
| 5 - 6 | 9 | 5 - 6 | 5 |
| 7 - 8 | 3 | 7 - 8 | 18 |
| more than 8 | 4 | more than 8 | 2 |
| Average | 1.6 | Average | 2.3 |

*Source: Jooste (1987:55)*

**TABLE 40 *(Figure 3.34)*: Use of solar water heaters by worker households**

| Region | Number |
|---|---|
| SW-Cape | 52 |
| W-Cape | 1 |
| N-OFS | 1 |

*Source: Author (1993)*

**TABLE 41 (*Figure 3.34*): Electrification status of houses where solar water heater are used**

| Electrification status | Number |
|---|---|
| All electrified | 23 |
| Some electrified | 32 |
| None electrrified | 3 |

**TABLE 42 *(Figure 4.1)*: Farmer support for electrification of worker houses**

| Region | Percent support |
|---|---|
| SW-Cape | 92 |
| W-Cape | 82 |
| N-Cape | 71 |
| E-Cape | 83 |
| OFS | 83 |
| Natal | 75 |
| E-Tvl | 68 |
| N-Tvl | 79 |
| W-Tvl | 89 |

*Source: Author (1993)*

**TABLE 43 *(Figure 4.2)*: Summary of worker household access to electricity - on farms with a grid supply**

| End-Use | % Households |
|---|---|
| Light | 33 |
| Cook / TV | 10 |
| Full Range | 1 |

*Source: Author 1993*

**TABLE 44 *(Figure 4.4)*: Cost of supply worker dwellings with electricity**

| 1993 Rands | % Dwellings | | |
|---|---|---|---|
| | 5 Amps | 20 Amp | 60 Amp |
| < 1000 | 19 | 10 | 4 |
| 1000 to 1500 | 35 | 22 | 5 |
| 1500 to 2000 | 10 | 14 | 13 |
| 2000 to 2500 | 10 | 12 | 8 |
| 2500 to 3000 | 6 | 9 | 8 |
| 3000 to 3500 | 3 | 6 | 11 |
| 3500 to 4000 | 3 | 6 | 9 |
| 4000 to 5000 | 2 | 7 | 17 |
| Total | 88 | 86 | 75 |

**TABLE 45 *(Figure 4.5)*: Average cost per dwelling**

| Average cost / dwelling R | | |
|---|---|---|
| 5 Amp | 20 Amp | 60 Amp |
| 2008 | 2297 | 2455 |

**TABLE 46 *(Figure 4.6)*: Farmers offering financial assistence for connection, appliance and consumption costs**

| Region | % Farmers offering support | | |
|---|---|---|---|
| | Connection | Appliances | Consumption |
| Cape | 70 | 55 | 45 |
| OFS | 62 | 42 | 42 |
| Natal | 63 | 33 | 35 |
| Transvaal | 72 | 40 | 43 |

*Source: Author (1993)*

**TABLE 47 *(Figure 4.7)*: Farmers offering financial assistence for connection, appliance and consumption costs**

| Region | Rand / household | | |
|---|---|---|---|
| | Connection | Appliances | Consumption |
| Cape | 380 | 261 | 42 |
| OFS | 361 | 203 | 28 |
| Natal | 356 | 300 | 32 |
| Transvaal | 378 | 304 | 35 |

*Source: Author (1993)*

**TABLE 48 (Figure 4.8): Percentage of fuelwood from the farm and source**

| Region | From the farm/% | Natural/% | Cultivated/% |
|---|---|---|---|
| National average | 95 | 71 | 19 |
| E-Cape | 93 | 85 | 15 |
| N-Cape | 97 | 85 | 11 |
| SW/W-Cape | 95 | 58 | 33 |
| Natal | 96 | 62 | 13 |
| OFS | 95 | 60 | 20 |
| W-Tvl | 90 | 78 | 20 |
| N-Tvl | 100 | 78 | 11 |
| E-Tvl | 95 | 70 | 23 |

*Source: Author (1993)*

**TABLE 49** ***(Figure 4.9)*****: Sources of fuelwood on farms**

| Source | Percent |
|---|---|
| Indigenous vegetation | 31 |
| Woodlots | 21 |
| Waste / residues of commercial plantations | 13 |
| Wattle / other exotic invasions | 30 |
| Other | 5 |

*Source: Gandar (1991:19)*

**TABLE 50** ***(Figure 4.10)*****: Availability of fuelwood on commercial farms**

| Class | % Farms | |
|---|---|---|
| | Natal | Tvl |
| 1 Abundant | 31 | 44 |
| 2 Secure/sustainable | 11 | 17 |
| 3 Marginal | 14 | 13 |
| 4 Inadequate | 10 | 11 |
| 5 Very deficient | 35 | 15 |

*Source: Gandar (1991:21)*

**TABLE 51 (*****Figure 4.11*****): Percentage of farms with a potential fuelwood deficit or surplus**

| Region | % Farms | |
|---|---|---|
| | Surplus | Deficit |
| Natal Midland | 53 | 47 |
| Northern Natal | 74 | 26 |
| Southern Natal | 58 | 42 |
| East Griqualand | 58 | 42 |
| Zululand | 27 | 73 |
| Transvaal | 75 | 25 |

*Source: Gandar (1991:21)*

**TABLE 52 (Figure 4.12): Mean yield from on-farm fuelwood sources**

| Source | Yield ton/ha/year |
|---|---|
| Woodlots | 8 |
| Woodland | 0.5 |
| Indigenous thicket/forest | 1 |
| Wattle jungle | 5 |

*Source: Gandar (1991:20)*

**TABLE 53 (Figure 4.13): Amount of land offered by farmers for fuelwood**

**production**

| Region | Hectares | | | |
|---|---|---|---|---|
| | < 3 | 3-10 | 15-40 | 50-100 |
| W-Cape | 43 | 39 | 9 | 9 |
| N-Cape | 0 | 100 | 0 | 0 |
| E-Cape | 33 | 22 | 45 | 0 |
| Karoo | 29 | 29 | 42 | 0 |
| OFS | 17 | 57 | 7 | 19 |
| Natal | 45 | 27 | 18 | 10 |
| W-Tvl | 20 | 50 | 20 | 10 |
| N-Tvl | 0 | 57 | 29 | 14 |
| E-Tvl | 8 | 50 | 34 | 8 |

*Source: Author (1993)*

**TABLE 54 (Figure 4.13): Amount of money offered by farmers for fuelwood production**

| Region | Rands | | | | |
|---|---|---|---|---|---|
| | 20-100 | 200-300 | 400-500 | 800-2000 | 2500-5000 |
| W-Cape | 17 | 34 | 34 | 8 | 17 |
| N-Cape | 67 | 0 | 0 | 3 | 0 |
| E-Cape | 33 | 0 | 33 | 3 | 0 |
| Karoo | 33 | 0 | 67 | 0 | 0 |
| OFS | 9 | 23 | 27 | 36 | 5 |
| Natal | 17 | 0 | 50 | 17 | 17 |
| W-Tvl | 0 | 0 | 0 | 60 | 13 |
| N-Tvl | 0 | 0 | 0 | 67 | 33 |
| E-Tvl | 20 | 20 | 25 | 62 | 0 |

*Source: Author (1993)*