HOUSEHOLD ENERGY INFORMATION MANAGEMENT SYSTEM FOR AFRICA : A UGANDAN CASE STUDY

PETER OPIO

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Dedication

To my ever-loving memory of my late Dad who showed me the way to better livelihood through education. Even though you are gone, I will ever be grateful for your effort in educating me.

DECLARATION

I, Peter Opio, submit this dissertation to the University of Cape Town in partial fulfillment of the requirements for the degree of Masters of Applied Science in Energy Studies. I declare that, unless otherwise acknowledged, this to be my original work and that it has not been submitted in this or similar form for a degree at my University.

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Abstract

Limited data on household energy is often a constraint to the formulation of domestic energy policy and planning, hence a comprehensive household energy information or database is often considered as a prerequisite for effective energy policy-making and planning for the improvement of the household energy sector. In Uganda and most African countries, little consistent and reliable household energy information is available on poor household's current energy consumption or demand for the need for improved energy services. As a result, energy policy-makers and planners jointly have access to scanty information. This suggests that policy-makers as well as planners are poorly informed about the access and the energy needs of households and thus risk making policies which are contradictory to their needs and preferences. An information database built through regular planned surveys in a comprehensive manner is the objective of this study. A foundation for periodic up-date of household energy is necessary and requires a proper institutional or structural set up that gives priority to household energy issues. This study explores the fundamental need to shift away from the current ad hoc surveys to a more reliable, systematic, comprehensive and financially effective way of conducting household energy surveys to generate household energy information that is representative of national picture and which supports effective planning and policy-making. Promotion of the importance of the household energy sector in terms of social equity and improved living standards is vital for investors, developers, financiers and policy-makers and planners to improve the sector. Thus the study addresses the appropriate way of obtaining comprehensive household energy information and harmonized data collection methodology through cooperation in information exchange amongst African countries to achieve comparability of data for a common African energy database. The designed system was applied to the Ugandan economy so as to identify prospecting policy implications in implementing this system.

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I must begin by thanking the Almighty God for the wisdom, courage and strengthen that He gave me to go through this study to its completion. It is my prayer and desire that the study gives the policy-makers, planners, investors and financiers' light to improve the lives of especially the poor households.

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Acronyms and Abbreviations

CSO	Central Statistical Office
DANIDA	Danish International Development Agency
ESD	Energy for Sustainable Development
GEF	Global Environment Facility
GoU	Government of Uganda
GTZ	Germany Technical Cooperation
IDA	International Development Agency
JICA	Japanese International Cooperation Agency
MEMD	Ministry of Energy and Mineral Development
MFEP	Ministry of Finance and Economic Planning
MFPED	Ministry of Finance Planning and Economic Development
MPED	Ministry of Planning and Economic Development
MPS	Ministry of Public Service
SDA	Swedish Development Agency
SEUHI	Sustainable Energy Use in Households and Industries
SWOT	Strengths, weakness, opportunities and threats
UBOS	Uganda Bureau of Statistics
UNDP	United Nations Development Programme
UNESCAP	United Nations Economic and Social Commission for Asia and the Pacific
UPPPRE	Uganda Photovoltaic Pilot Project for Renewable Energy
USAID	United States Agency for International Development

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1.

Introduction

1.1 Background

This study investigates the household energy information status and its structure in Uganda in particular, and Africa in general, with a view of suggesting a system. (Pearsall, Ed., 1999) defines a system as *an organized method or scheme* of performing an activity. The system should facilitate collection of comprehensive, reliable, adequate and suitable household energy data for effective policy-making and long-term planning.

Household energy information collection and management should be a well-thought out process that should be used by the concerned energy institutions, government ministries multilateral/bilateral and Non-governmental Organizations (NGOs'). The outputs of such a system should have effect in providing solutions to domestic energy problems on social, economic, technical and environmental issues. Different institutions such as government ministries and NGOs' together. This could be through a network for the effective achievement of consistent and reliable household energy data for policy-making and planning.

In Uganda, government interventions in the field of energy have been largely concerned to date with electricity and petroleum fuels, implying that other energy sub-sectors have received less attention. Comparatively little attention has been paid to the development and economic use of biomass fuels (Coda and Partners, 1990: I) yet it is the main household energy source for the majority of the population. Further, Coda and Partners (1990: 3) reveal that the Ministry of Energy, established in 1986 has so far concentrated on policy and planning for petroleum and electricity. The biomass energy sector on which most households depend on has, until the commissioning of the Household Energy Planning Program (HEPP) study of 1990, received very little attention, moreover energy is critical because of the vital role it plays in economic and social development. Hence, household energy database is necessary in the country for application in the planning and decision-making process. Such a database will assist in satisfying human needs and advance development.

Considering the focus of the 17-year-old Ministry of Energy and Minerals Development (MEMD), information on household energy sector has been directed more towards electricity and kerosene than on biomass, implying limited planning for the biomass energy sector. The inadequacies of such household energy information create problems in planning; for example, the provision of solar home systems for lighting when the most important household energy needs could be cooking.

Thus, it is essential to have comprehensive knowledge on acquisition and usage of energy so as to formulate activities and policies that can improve the living conditions of the households and even protect the environment. According to Leitmann (1988:1), the existence of reliable, disaggregated information on residential consumption and supply is essential to the formulation of sound household energy strategies. Thus, energy institutions and NGOs' responsible for energy data collection and management should consider regular inclusion of detailed energy characteristics in the design of household energy information collection in order to achieve the formulation of sound household energy strategies. However, because this is often not the case, it is essential to cautiously develop and maintain household energy database on demand and supply that can guide planners and policy makers to assess the key socio-economic issues relating to household energy use.

Limited information relating to residential energy consumption in Uganda has been dealt with through country energy balances, national household surveys and micro-studies. All of these have certain advantages, but are out-weighed by their drawbacks. A dedicated nationwide household energy survey can be the most effective means of generating the desired data for planners, policy-makers, investors and evaluators.

The major sources of household energy utilized in Uganda are: fuelwood, charcoal, kerosene, electricity and liquid petroleum gas (LPG) (Coda and Partners-Africa, 1989:5). Besides, crop residues, wood waste and dung are other sources that have no commercial entry points. However, fuelwood and charcoal are primary fuels used widely in the country for cooking, water and space heating, lighting and for some informal activities.

In Uganda, as well as in most African household sectors, it is usually only information on electricity and fossil fuels consumption that can easily be obtained. This is because there are formal established distributions and metering systems to generate it while on the contrary, information on widely used household energy sources such as fuel wood and charcoal is not easily obtainable through regular collection of energy information because of informal distribution channels. However, even for electricity, the information available is largely supply-driven and not that

methods of energy delivery. In the household sector, energy information is usually obtained through ad hoc surveys which cannot be effectively used for planning purposes.

According to Coda and Partners-Africa (1989:5), although information available on supply of commercial fuels such as kerosene, electricity and LPG is reliable, in most cases, statistical information on supply and usage of fuel wood and charcoal in the country is lacking. Further, according to the same authors, the most reliable source of data available on consumption of fuel wood and charcoal are those estimated by World Bank as far back as 1983 and by now that data is obsolete.

At present no systematic, comprehensive and structured system of household energy data collection and dissemination exists in Uganda because of the problems highlighted below.

1.2 Problems Identification

Most African countries experience various forms of deficiencies in their household energy information systems. The critical problems within the household energy sector which Uganda and most African countries experience and are being addressed by the study include:

- **Structure**

  Although limited household energy information exists in most African countries, it is scattered in different reports of various departments. Usually, there is no documented structure for the information system in place and no planned programme or time frame. Responsibilities for household energy information is not coordinated amongst energy related institutions, for example, MEMD, Forestry Department, and the Central Statistical Office (CSO).

- **Surveys**

  The frequency of surveys is irregular and is usually externally driven. Over time, such surveys turn out to be expensive. Because surveys are not comprehensive, they can lead to staff demoralization and labor shifts, and more important, the outputs may not represent the national picture of the economy at a particular point in time. Thus survey results cannot be easily integrated or compared across the country or continent because of different base periods. Though much of this is applicable to Uganda, it also applies to most African countries. There is limited potential for aggregation and projections of survey results over a longer period of time in Uganda and Africa in general.

- **Supply-oriented**

Most of the information available on household energy are supply-oriented. Household electricity consumption data from the electric utility may not represent actual household demand which is essential for future planning. The information is not usually needs-oriented, for it does not say what people's needs are. For example, it usually does not make clear the specific needs for which the electricity has been used to satisfy.

- **Data gaps**

There exist large gaps in the data of energy-related issues. Not all energy sub-sectors are covered, for example, forest stock data for supply of biomass was not covered in the Biomass Study done in 1995 (ESD, 1995). This data is essential since wood fuel stock supply affects people's lives. Biomass sub-sector is not well covered in energy information system. Other socio-economic issues are also not well covered. These include issues such as income levels, access, preferences, and perceptions of households.

- **Development planning**

Effective long-term development planning cannot be done with data obtained from the current structure of household energy information system which is ad hoc, with unreliable data. Thus projections cannot be effectively and precisely made for energy requirements in relation to population growth rates, and technical improvements. Electrification and other energy penetration rates need to be known in order to estimate future energy supply.

Long-term plans are based on issues arising from the need for energy efficiency, improved wood stoves, biomass crops for gasification, capacity building, human resources, and minimized environmental impact. However, these are not covered in existing household energy information system.

- **Funding**

Limited funding is a common problem in the energy sector and in the household energy in particular. Limited budgetary allocation is given to this sector by governments, hence ad hoc surveys are performed, as in the case of Uganda. Donor funds only become available when there is an external need for particular energy information, thus the need to shift from ad hoc energy projects to a more comprehensive programme for establishing a more reliable and consistent information system for Uganda's own use.

projects to a more comprehensive programme for establishing a more reliable and consistent information system for Uganda's own use.

- **Recognition of household energy information**

  Apart from profit motives of private companies, household energy is not of concern to sectors of the economy except government who endeavors to generate such information for planning. Many sectors of the economy see no benefit from such information. For example, household energy information has not usually been packaged to communicate powerful information that would attract the business community for investments.

- **Lack of collaboration**

  The problem of energy information systems is not only limited to Uganda but cuts across most African countries. This limits collaboration amongst African countries in the implementation of energy projects and energy planning in general. For example, an energy efficiency programme like compact fluorescent lamps dissemination would be more attractive to investors if there was reliable information that extend markets across nations.

- **Data specification**

  There is lack of data specification in terms of its collection, organization, analysis and dissemination in Africa. Countries do this according to their own needs and situations and this leads to limitation on the extent of regional co-operation. Since many countries have similar experiences, tools for data collection (like questionnaire designs) could be standardized across countries. Furthermore, countries could collaborate more in terms of compatible databases, data analysis and dissemination models.

In view of the above, the nature of the problems is such that many issues are inter-linked and one affects the other. Because of the interlinkage, related issues are grouped and assessed under the objectives outlined below.

1.3 Study Objectives

The study argues for an effective, reliable, systematic and comprehensive household energy information system and suggests how it might be done for Uganda in particular, and for Africa in general, as an on-going system that retains staff. Thus, the specific objectives of the study, based on the problems analyzed above, are:

- To determine the existing status of household energy information in Uganda.
- To identify the contribution of funded energy projects to household energy information
- To develop a household energy information *system* that reflects:
    - ✓ Household energy needs
    - ✓ National energy economy
    - ✓ Adequate coverage of household energy information
    - ✓ Long-term planning objectives in the country
- To apply the designed system to Uganda

1.4 Methodology

A literature review of information on household energy was undertaken to investigate and critically analyze household energy information collection and dissemination, the existing structure of energy institutions, the funding mechanisms and content of household energy surveys, and the integration and co-operation amongst energy institutions.

The study uses open-ended questions to interview energy stakeholders in Uganda so that they can express their views on having a household energy information system. The study analyses the information obtained with a view to identifying trends and gaps in household energy information and possible similarities with other countries in order to suggest an appropriate model for household energy information collection. Both qualitative and quantitative methods are applied. Graphical representations are used to create value for household energy information among various stakeholders in addition to the government role in the energy sector. The study structure is outlined below.

1.5 Structure of the Study

The structure of the study is organized into seven chapters. Chapter 1 gives an introduction to the background of the work, the research problems and the objectives, and the methodology.

Following the introductory chapter, Chapter 2 presents the importance of household energy information in an economy.

Chapter 3 presents the fieldwork report. Its structure involves analysis of the status of existing household energy information available in Uganda, followed by analysis of funding of energy projects/surveys as well as an analysis of the content of those projects/surveys in relation to

economic projects or surveys done. This chapter discusses the location of household energy information in the energy department and energy divisions or sections in other relevant institutions.

Chapter 4 deals with the development of a system for household energy information system. In this chapter, a household energy information questionnaire is proposed.

Chapter 5 explores the application of the system designed to Uganda based on the various information collected on the country.

Chapter 6 discusses the policy implications of the system applied in Uganda and such actions will be needed for the successful application of the system.

The conclusions and recommendations for the study are presented in Chapter 7

2.

Importance of Household Energy Information

2.1 Introduction

The household is the socio-economic unit in a household energy survey that is often analyzed. Thus, the household's definition is vital in guiding proper collection of data on household size and energy consumption. This is to avoid tendencies of double counting of individuals who may live in more than one place.

In an African setting, the household needs to be clearly defined as household sizes vary from time to time and can affect the results of surveys. Pearsall (Ed) (1999) defines "household" as a house and its occupants which together is regarded as a unit. On the other hand, a household is often described as those who live under the same roof, and cook and eat food together.

Both descriptions of a household have loopholes. This is because African situation is complex and promotes eating together even if they are not under the same roof. Thus, if any of those definitions is applied in a survey, fieldwork out-put may give an incorrect picture of household energy consumption. For the purpose of this study, the definition by Afrane-Okese (1998) is adapted which states

> "*Household is defined as a socio-economic unit of a person or persons who eat(s) from the same pot or who contribute to a common budget and is housed by a dwelling or group of dwellings*".

African homesteads usually have a dwelling or a group of dwellings in the rural areas while in urban areas, it is often one dwelling that houses all the family members. The definition by Afrane-Okese is applicable in the study as it takes care of the African urban and rural settings. Besides, it is possible that the persons in the group can pool their incomes together and have a common budget. The extent of this arrangement may vary among households and the persons involved may or may not be related.

United Nations Economic and Social Commission for Asia and the Pacific, UNESCAP (www.UNESCAP.org/enrd/energy/psec/) defines household energy consumption as the energy consumed in homes to meet the needs of the households themselves. Cooking food, for example, at home for the household is included, while cooking food for sale is not. Thus, final energy

consumption of households is often called residential energy consumption and it covers the energy consumed in household dwellings.

Although the definition of household energy excludes income-generating activities, this study argues for the inclusion of home-based income generating activities such as baking pancakes, cooking food at home for sale or the use of lighting for home-based businesses that is excluded in the UNESCAP definition. The share of home-based income-generating businesses in the household energy consumption is important to be analyzed because of the significant number of small-scale micro-enterprises in an African economy.

Energy provision is linked with many informal commercial activities in the household e.g., sewing, welding, beer brewing and computer-based jobs like typing (Afrane-Okese, 1998:16). Thus, the objective for including informal commercial activities is to facilitate assessment by policy-makers and planners, for example, if electricity, for lighting could be a driving force behind the establishment of a business. Thus, the home-based income-generating activities is an area that should be planned for and data collected on energy use on associated informal commercial activities as they may contribute a significant proportion of final national energy consumption. Hence, it is necessary to include in the household energy data collection and planning.

Household energy needs require to be fulfilled for the livelihood of households. These needs include cooking, lighting, space heating, hot water, refrigeration and space cooling, household appliances, communications and entertainment. They are met through the multiple uses of the different energy sources available to the households such as wood, charcoal, electricity, LPG, kerosene (paraffin), candles, and batteries with the use of different devices such as electric cookers, bulbs, hurricane lamps, sufurias, solar lanterns, radios, telephones and televisions (TVs). Household energy data on all the above items when analyzed and processed constitute household energy information that is essential for planning purposes.

2.2 Need for Assembling Household Energy Information

Energy institutions or CSO responsible for collecting energy data should have a clear rationale for carrying out such an exercise. Some of the rationale could be to:

- Provide simple information on household energy sector being investigated;
- Describe household energy use and consumption patterns;

- Make inferences about household energy;
- Measure the performance of household energy sector, or
- Satisfy curiosity of an energy researcher, for example, on efficiency of household energy use.

The purpose of household energy data collection must be meaningful, focused, useful and accurate and should be used to benefit an objective or several objectives.

There is need for capacity for the household needs, a stable government and sufficient resources to fulfill people's needs, as household energy is a critical aspect of human survival. As part of a bigger energy issue, household energy demand affects peak demand, for example, of electricity generation. Hence, it is important to know how the (household) as a unit is growing and how much energy is required for future investments.

The need for assembling data can be attributed to the following reasons:

- **Analysis of trends in energy consumption, production and availability**

Adequate data is essential in analyzing trends of energy use and supply for the households so as to enable future planning for the households. The analysis of trends in consumption, production and availability becomes difficult if adequate data is not available. Future estimates in consumption often become difficult to predict if they are not based on past and current data.

- **Policy-making and planning**

Energy data is required to enable energy policy-makers formulate energy policies for improvement of the household sector based adequate information. Visagie (2002:7) quotes Huggett and Blomkamp to the effect that "energy statistics can be used to analyze energy policy alternatives, particularly when viewed in conjunction with other statistics such as Gross domestic Product (GDP), population and sectoral economic growth.

- **Identification of needy households**

The data is essential for identifying households as well as areas or regions that are in dire need of energy services. Thus, through planning, better use or allocation of scarce resources can be achieved for improving the livelihood of the households.

- **Access to information**

  Where public awareness is regularly done, the data is necessary for communities and local government leaders, especially in rural areas where non-commercial energy sources are abundant, to access household energy information so as to solve energy related issues in society. Further, the availability of the household energy data can facilitate in assisting households or consumers in general, to make informed decisions regarding, for example, the safe, healthy and environmental use of various energy sources. However, this is possible where consumers are educated and are aware of the likely dangers of the use of the different energy sources.

- **Investment consideration**

  Available transparent and reliable household energy information is essentially important for investors and NGOs' considering an investment programme for a country. Essentially good and reliable information in a country can attract investors, as they will have confidence in the statistics and information. For example, programmes on energy efficiency measures such as Compact Fluorescent Lamps (CFL) Programme can be attractive to investors if information on preferences and willingness to purchase the CFL is available.

Household energy information therefore represents information on residential (household) energy demand and use that helps to define household energy issues and assist in formulating appropriate energy strategies. Thus, it is necessary to assemble data on household energy usage in order to provide information on trends of household energy consumption which constitutes different proportions in different countries.

Household energy use constitutes the largest proportion of most country's energy consumption in African countries due to their relatively low industrial activity. As the energy balance data of Uganda shows (see Appendix 1), residential/commercial sectors-energy consumption in Uganda constitutes approximately 88% of the national energy consumption (MEMD, 2001). The household (residential) consumption in Zimbabwe constitutes 47% of national final energy consumption by sector as shown in Appendix 2 (Ministry of Mines and Energy Zimbabwe, 2002) while in Kenya, rural and urban households constitute approximately 57% and 16%, respectively for the year 2000, of total energy shares for all sectors such as cottages, agriculture, transportation, and commerce and industry (Kamfor Company limited, 2002) (see Appendix 3). Thus, data for the three countries shows that comparatively residential energy consumption is higher than energy consumption in

other sectors implying that household energy consumption universally forms a higher proportion of total final energy consumption in most countries.

The difference in the magnitude of the proportion of residential energy consumption in Uganda and Zimbabwe arises from the number and composition (and also disintegration) of energy consuming sectors taken into consideration. In Uganda, four sectors were analyzed. These include residential/commercial (that is the two sectors are integrated), industry, transport and agriculture. In Zimbabwe case, residential and commercial sectors are disintegrated and analyzed independently hence lowering the proportion of residential energy consumption in the final energy consumption share in Zimbabwe. Mining sector is included separately in the energy consumption in Zimbabwe which is a more detailed and better method of analysis energy consumption by sector for planning purposes than for the Uganda grouping method.

Considering the number and intensity of energy consumption of the two categories, that is, residential and commercial, residential sector often forms a higher percentage than the commercial sector in terms of energy usage as demonstrated in the Zimbabwe energy consumption by sectors for the year 1999 as most African countries have rural based populations.

Due to the high proportion of household energy consumption, household energy affects most people yet it is least catered for thus implying that energy is not likely considered a priority in the list of end uses. It is probably that most users of household energy are especially women who are affected and have no energy forum to voice their concern in energy planning. Even though it is true that most women are affected, addressing the household energy needs is essential for the country's prosperity.

Various objectives have been advanced for the collection of information on household energy consumption. Leitmann (1988:6) argues that the objectives of household energy survey include:

- Painting a comprehensive picture of residential energy consumption;
- Assessing the relations between fuel use and household socio-economic characteristics;
- Identifying existing and potential problems or limitations in the use of specific fuels; and
- Analyzing the impact of implemented or contemplated efforts to influence consumption in the sub-sector.

On the other hand, UN (1991:3) states that the primary objectives of the household energy survey should be to provide estimates of household energy consumption by:

- Urban and rural areas,
- Type of fuel,
- Nature of end-uses, such as cooking, lighting, space heating and water heating,
- Household income and other socio-economic variables, and
- Estimates of fuels collected, and information of source of collection and who collects them should also be available from the survey.

Thus, the primary objective of household energy information is to provide a database for energy use. This objective is good but it suggests looking at the supply side especially the infrastructure that facilitates the supply of fuels such as distribution channels of commercial fuels, and distances to the nearest supply point for energy sources as the infrastructure has effect on energy use. In both objectives, it is important that the definition of "urban and rural" should follow the definitions used in Population and Housing Census of the respective countries, as applied in the case of Vietnam Household Energy Use Survey (Taun and Lefevre, 1996).

Thus, assembled household energy data can provide information that can be used to understand the energy problems in the household sector better. The household energy data can highlight useful information on:

Domestic energy use: Information on this aspect will show the consumption patterns of the different energy types by households encountered in the data collection. These include, for example, firewood, charcoal, LPG, kerosene/paraffin, grid electricity, batteries, candles, agricultural residue and animal dung.

Access to energy: Energy interacts with people's lives in many ways, from basic needs to income generation activities. Household energy information will highlight access to various forms of energy and end-uses by the households which can assist policy-makers in prescribing appropriate policy measures for the sector improvement to modern energy access, being one of the Millennium Development Goals (MDG). The lack of access to energy including electricity has profound consequences especially in relation to poverty and the quality of life of the people.

Cross-boundary planning: Domestic energy production and use in many ways disturbs the ecological equilibrium of the planet. Fuel combustion represents the most significant sources of greenhouse gas emissions, resulting in climate change. There is scarcity of traditional energy sources, namely wood fuel and biomass that affects ecosystem. Assembled data is therefore

required for cross-border national planning in the face of global warming, deforestation and crop loss.

Measuring energy for poverty alleviation: Domestic energy use information helps in measuring the extent of poverty to energy through information on access to energy, both traditional and commercial types. Further more, there is a link between energy and basic needs such as lighting and cooking. Therefore measuring energy use through household energy data collection assists in measuring the extent to which these needs are fulfilled. The wide range of energy services which are made possible by different fuel types and devices can have a major impact in facilitating sustainable livelihoods, improving health and education and significantly reducing poverty. Measuring energy to assess access is vital given the importance of energy in facilitating poverty eradication (DFID: http://enpov.aeat.com/ENPOV/).

2.3 General Importance

Household energy information is important for forecasting energy demand, both short- and medium-term. Generally, data on household energy consumption patterns classified by income and other socio-economic variables such as occupation and household size are useful for energy planning in Uganda and other countries in the world. For example, in the context of developing alternative energy sources, biogas has been generally receiving increasing attention (UN, 1991:3). Because of absence of comprehensive household energy information in Uganda, energy planning cannot be effectively undertaken. Data by income groups is also important for estimating income elasticities for different fuels which are used for projecting the demand for, and the pattern of fuel consumption.

Household energy information is useful in projecting the pattern of fuel consumption which can be planned in order to cope with population growth. Uganda's population has been growing at an average annual rate of 3.4% between 1991 and 2002 (UBOS, 2002a:5). Based on this trend, the study shows that energy consumption is likely to increase in Uganda because of population growth and demographic changes such as the changes in age groups and household size. The population within the age-bracket of say 0-3 years, for example, require more attention in terms of health-care and, in most cases require a lot of water-boiling, regular washing, and heating of food become necessary. Thus using more energy for the age group. On the other hand, the age-group of say 15-20 comprises the secondary school going age. This age-group implies that less energy would be utilized by such families for whom some of the family members attend boarding schools away from home for the most part of the year. Besides, the larger the family size, the more likely the amount of

energy source(s) needed to satisfy the household energy requirements. In addition, the increase in economic activity and development is a contributory factor to energy consumption pattern. These factors lead to substantial expansion in total energy consumption, including household consumption which must be planned for. It is important to analyze household energy consumption patterns because such estimates are vital in formulating energy policies for:

- Promotion of sustainable energy consumption
- Meeting the needs of people
- Further updating energy consumption in households, and
- Developing policies to alleviate poverty.

Naturally and as concluded by Leitmann (1988:2), representative information on household energy plays a vital role for institutions which seek to:

- Identify problems and trends;
- Prepare supply and demand projections;
- Engage in energy sector planning;
- Conduct market research;
- Develop effective policies and programs; and
- Evaluate ongoing and completed projects.

2.4 Energy Planning

With one comprehensive framework of needs-oriented household energy information, energy planning is likely to be easier and effective in combination with other factors such as population growth. Energy planning, based on existing reliable data and information, consists of estimating future energy requirements and identifying the appropriate supply technologies to satisfy these requirements. Thus, when household energy databases including the needs-oriented information, for example the need for grid electricity for cooking rather than solar home systems, are available, they greatly improve the process of decision-making and long-term planning. Overtime, when the existing data and information are regularly updated, a representative, reliable and comprehensive situation, both past and present, can be visualized clearly. As a result, the updating process can progressively provide a better basis for planners to allocate resources effectively in order to achieve their desired goals.

Equally important in the planning process is energy end-use analysis which requires household energy information. Energy end-use analysis involves an examination of what households are using

and why they are using them, as well as an analysis of their needs. For this reason, energy end-use analysis can lead to a consideration for issues such as energy intensity, conservation and efficiency, technical innovation and diffusion, and to fuel-switching and improved accessibility by households to energy and accessories.

Household energy needs can only be established through detailed household energy surveys upon which household energy projects can be formulated. For example, cooking is women's most important energy need in terms of time and effort. In addition, cooking takes a very large portion of household energy consumption. Cooking is the largest single rural energy use in poor households. This implies that unless cooking needs are addressed, through household energy projects formulated with the application of household energy information, positive impacts on women's health and time will be fairly marginalized. Household energy information, and in particular information on household energy needs can assist in effective planning for women's most important energy needs.

Through disaggregated end-use analysis, the household sector is usually broken down into sub-sectors such as rural and urban households. The rural and urban households, in turn, are divided into end-uses, such as the basic needs - cooking or lighting - and end-user sections disaggregated by fuel type, energy technology used, level of energy intensity and social class of users. In the process, each energy use is formulated from this level of disaggregation which permits a clear analysis of policy options from fuel switching through technology transfer and energy efficiency, to government strategies for different users.

Information on household energy use assists in energy planning. Energy planning done through the end-use approach as explained above, is important for contributing to sustainable development. This is particularly so if the actual uses for which energy is required is applied in energy planning. Furthermore, sustainability is based on the ways that the needs are most efficiently met. Through this approach, avenues for energy-savings can be identified which can help in formulating technological and policy alternatives for achieving higher efficiency.
In conclusion, household energy information is necessary for understanding the energy use pattern of households and end-uses that satisfy the human energy needs.

3.

Fieldwork and Critical Analysis of Existing Household Energy Information System

3.1 Introduction

Chapter 2 has highlighted the importance of household energy information and its usefulness in energy planning for the household sector. With this background, this chapter critically examines the existing structure of the energy institutions and the status of household energy information with the objective to explore three key areas: the structure, funding of energy projects and the data gaps. The chapter analyzes the contribution of the funded energy projects and socio-economic surveys to household energy information. The data gaps are presented at the end of the chapter in a summary of the weaknesses and threats of energy institutions.

Past and current energy information are needed to address the prevailing issues in the household energy information management system. Past household energy information is necessary to compare with the present in order to model a more systematic future household energy information system. This is the basis of this chapter.

3.2 Fieldwork and critical analysis

In the fieldwork, information were collected through a combination of both interviews and literature reviews and these activities took a period of approximately 2 months from March and April 2003. The following institutions were visited and are categorized into the main institutions and other institutions visited.

The main institutions are:

- MEMD formed the core of the visits, as it is the ministry responsible for energy issues.
- Uganda Bureau of statistics (UBOS) being the principal data collecting and disseminating agency and is responsible for coordinating, monitoring and supervising national statistical system in the country.

Other institutions visited include:

- Forestry Department and Forest Sector Co-ordination Secretariat which is responsible for forest sector and related policies, and in particular biomass energy supply.

- A list of the other institutions interviewed is shown in Appendix 4.

A literature review of all information on household energy publications was undertaken to investigate the existing structure of energy institutions, household energy information collection system, the funding mechanisms and content of the surveys. The integration and co-operation amongst energy institutions was assessed. The study used open-ended questions to interview the energy stakeholders in Uganda so that they could express their views on the household energy information system being analyzed.

3.2.1 Overview of data production in Uganda

In the 1970s and 1980s, there was a general decline in the statistical production in Uganda and Africa in general (www.singstat.gov.sg/conferences/). This resulted from poor economic performance and political instability with governments that had low priority for statistical information for socio-economic planning. These factors affected the production of useful statistics in the country.

According to a paper on "Capacity Building Challenges for Uganda" presented by Dr. Polycarp Musinguzi, Economic Advisor to the Governor of Bank of Uganda in November 2002, it was indicated that the lack of timely, comprehensive and accurate data on the real economy in Uganda remains a major constraint to any timely assessment of the current state of the economy. The household energy sector is no exception. This is due to its low priority and limited funding.

Coda and Partners-Africa (1989:5) state that although information available on supply of energy sources such as kerosene, electricity and LPG is available, in most cases, statistical information on supply and usage of fuel wood and charcoal in the country is lacking. Furthermore, the authors believe that the most reliable source of data available on the consumption of fuel wood and charcoal, before the HEPP project in 1990 is the World Bank estimate in 1983. This information is approximately two decades old, outdated and cannot be used for planning purposes because of demographic and other changes. It would appear that household energy is not a planning priority in the country and this is why the data is probably not updated.

In Uganda, the household energy surveys so far undertaken constitute a small component of larger surveys usually aimed at establishing several parameters. The most important larger surveys of this nature include: the National Population and Housing Census, the National Household Budget

Surveys, and Socio-economic Surveys. However, in such surveys, parameters such as household energy, its source and use assume secondary importance yet it is the area that affects households. Thus, such surveys do not give a detailed account of household energy issues in the country.

Even though, the statistical system is being restored, there is still a need to strengthen the restoration of the system especially the coordination and collaboration of all relevant energy organizations in the country.

3.2.2 Structure of Energy Institutions

This section discusses the structure of MEMD and UBOS as the two main institutions responsible for household energy information collection.

MEMD

In general, the availability of household energy information is dependent on the structure and the inter-relationship amongst energy institutions. In the past, the structure of the energy sector in Uganda was a problem for energy planners, decision-makers and implementers. Ministry of Planning and Economic Development, MPED, (1991:99) and Ministry of Finance and Economic Planning, MFEP, (1993:9) explain that the energy sector was divided into four sub-sectors, namely electricity, wood, petroleum, and new and renewable sources of energy. This division gave a narrow scope on household energy issues because household energy issues never featured clearly in any of these units. Further, wood fuel and charcoal which are the principle sources of households' energy for the vast majority of Ugandans were not included especially for the rural population that mostly uses wood fuel. Therefore, there was no provision made for these fuels or planned for in the national budget, hence no accurate and reliable data on wood fuel use.

Currently, the Energy Resources Department is sub-divided into four divisions namely Electric Power, New and Renewable Sources, Petroleum Supplies and Energy Efficiency Divisions (MPS, 2000:32). In the structure, household energy issues feature both in the Energy Efficiency Division and New and Renewable Sources of Energy. For example, the "Sustainable Energy Use in Household and Industry (SEUHI)" project that started in 1998 and was completed in 2001 (MFPED, 2000:270) falls in the division of energy efficiency yet this is a biomass related energy issue that should be in New and Renewable Energy Division. SEUHI's objective to increase efficiency in biomass energy production and utilization for maximum contribution to rapid

economic development and minimize negative impacts on the environment also suggests biomass to be in New and Renewable Energy Division.

The MEMD was silent about household energy information issues. Existing household energy information is categorized in different ways. Biomass issues are categorized under New and Renewable Energy Sources Division of the Department of Energy while energy efficiency issues are categorized mainly under Electric Power Division.

Although there is no clear demarcation, household energy information cuts across the Divisions of New and Renewable Sources of Energy, and of Energy Efficiency. However, household energy information appears to fall more in the Energy Efficiency Division than in New and Renewable Sources Division as energy efficiency ensures efficient utilization of energy in all sectors of the economy. The promotion of the use of improved cookstoves by MEMD through SEUHI project supports this argument in which the project cuts across the two divisions.

Thus, existing household energy information is scattered in the divisions within the MEMD implying that there is no definite location for it as there is no clear category of household energy especially in the two divisions, hence difficult to locate it. Due to the cross-cutting nature in the ministry, policy implementers might often find difficulty in locating the right division to direct policies in MEMD for implementation.

UBOS

UBOS was established in 1998 by Act of Parliament (UBOS, 2002:5 & www.singstat.gov.sg/conferences/) and became operational a year later. It is a semi-autonomous organization established to re-organize the national statistical system that had declined since the 70s.

The institution acts as the principal data collector and dissemination agency that meets the increasing need for national statistics on the social, economic and political developments in the country. As a fully-fledged data-collecting agency, it is relatively young with new sections still building on existing data. In the institution, a section exists for handling energy statistics. The section is located in the Directorate of "Business, Industry, Agriculture and Energy Statistics" which has core functions that include production of Index of Industrial Production (monthly and quarterly), and National Business Register. The core activities form the main activities of the

Directorate which are inherited from the former Statistics Department of the Ministry of Finance Planning and Economic Development (MFPED) and thus less attention paid to energy statistics. This could be attributed to the young semi-autonomous organization and the limited understanding for the importance and role of energy data.

Currently, the section covers officially available statistics on only conventional sources of energy such as on petroleum products and electricity. This is because the section is still relatively underdeveloped and thus building the existing information. There is a plan to develop energy statistics as shown in the "Consolidated Five Year Plan" (UBOS, 2002:16) implying appreciation of the role and importance of energy statistical data and information for socio-economic planning. However, there is limited information generated regularly on household energy by the Bureau. Information appears in reports and publications of other Directorates within the Bureau such as the Directorates of District statistics, Population and Social Statistics, and Macro-Economic Statistics and not in the directorate that energy section belongs to. Hence, existing household energy information is scattered in UBOS thus creating problem for searching for the data. A planned development of energy statistics will integrate the information on household energy in the Bureau and make it more useful for application to policy-making and planning.

The probable explanation for the scattered reports in MEMD and UBOS is the lack of planning and collaboration amongst these energy institutions as the institutions collect household energy data independently. Analyzing the structures of energy institutions can assist in assessing the independency of the structures and thus suggest on how to integrate their activities.

3.2.3 Status of Existing Household Energy Information and Gaps

Section 3.2.1 shows that there is lack of integration and coordination of activities in the energy divisions of MEMD and in UBOS and thus can have a negative impact on household energy data. This section analyses the existing household energy information by examining related energy projects and identifying possible data gaps. The analysis is grouped according to surveys done by MEMD and UBOS. The critical issues dealt with are status of household energy information, data gaps and funding and are analyzed concurrently.

Uganda dependence on external sources to finance energy development and surveys as it happens in most African countries. This is due to the weak economies in Africa. Consequently, the investing donors and multilateral institutions have greatly influenced activities in the sector including the

household sector. Financing from local sources has been limited (as shown in Table 3.9) and hence has had minimal influence in directing the development of the sector because of inadequate domestic savings. Thus, the economies have to rely on external sources of financing to bridge financing gaps.

There are some household energy surveys conducted and funded by different organizations in the country. Some are surveys that include household energy information gathering as a primary objective while others as a secondary objective. The following include two categories of household energy surveys in Uganda.

Direct household energy surveys: These are energy surveys which generate mainly quantitative data on household energy. One example in Uganda is the Household Energy Planning Program (HEPP) which according to Sebbit et al (2001:237) was the first national domestic energy survey carried out in 1990, implying the beginning of collecting household energy information for energy planning.

According to Sebbit et al (2001), a second survey titled "National Domestic Energy Survey for Uganda" was conducted. However, the year of this survey was not mentioned nor the details of the survey were included. The survey was conducted in sixteen districts out of the 45 districts in Uganda which were selected from four geographical regions of central, eastern, northern and western (Sebbit et al, 2001), representing a coverage of approximately 35% of the total districts in the country. The sample selected is based on availability of wood fuel and population distribution implying that other sources of energy such as electricity and kerosene could have had a limited coverage. Sebbit et al (2001) states that the data collected includes biomass, electricity (which is not specified whether both grid and off-grid or not) and kerosene consumption, and the types of devices used in the households.

Indirect household energy surveys: These are surveys whose objectives are different from household energy data collection but include some quantitative information collection. In some cases, they provide qualitative information on household energy. This category includes:

- SEUHI Project;
- Uganda Photovoltaic Pilot Project for Rural Electrification (UPPPRE)
- Construction of Demonstration Biogas Digesters
- Household Budget Surveys
- Socio-economic Surveys

- National Household Survey

3.2.3.1 Energy Programmes under MEMD

Five energy projects are discussed below and these include HEPP, SEUHI, UPPPRE, Rural Electrification Project and Construction of Demonstration Biogas Digesters. A discussion of their funding and contribution to household energy information is presented. A component on national budget share to energy sector is analyzed that shows the importance given to energy sector.

HEPP Program

Sebbit et al (2001) concludes that HEPP is the only known significant household energy study done in Uganda in 1990 in MEMD. The HEPP program was carried out before the formulation of UBOS and the re-organization of the national statistical system in Uganda. The HEPP began in 1988 when the statistical system as well as the performance of the economy had declined. Thus the program could have been implemented to address the need for data for the planning of the household sector which could have declined due to poor economic performance.

The results of the HEPP study were meant for policy actions by government to ensure improved forestry management in order to increase renewable stocks of wood fuel, to limit environmental degradation, and to promote energy conservation (such as energy-efficient charcoal cooking stoves). Thus information on energy use patterns by households is necessary for monitoring these concerns and household energy use data should be comprehensively collected.

The HEPP, initiated by the Government of Uganda through International Development Agency (IDA) credit facility, had its goals and objectives (Coda and Partners, 1990:7) and these are:

- The establishment of a sound data base and the analysis of supply and consumption patterns of household energy, through the development of an ongoing of system of data collection, processing and analysis that provided the then Ministry of Energy with a clear picture at any point in time as to the true energy situation as it affects the household sector;
- The testing and development of energy efficient and socially acceptable cook stoves (charcoal and firewood), followed by the initiation of a dissemination program of the selected stoves;

- Improvement of the capabilities of the Ministry of Energy to develop sound household energy policies and plans and related strategies for their implementation, including a least cost investment program;
- Provision of the training, skills and tools by which the Government can formulate and implement sound management interventions in the household energy sector;
- The identification of viable project interventions, particularly on the wood fuel utilization side.

Since about 90% of household fuels in Uganda are derived from biomass (Coda and Partners-Africa, 1989), the rational management of biomass resources to ensure a sustainable supply of wood fuel was an important component of the HEPP study and for the household sector thus having the potential to generate household energy information. The collection of information on biomass energy would form a sound database for energy use and supply patterns for the development of appropriate policies and plans for the household sector as required in the objectives of the HEPP project.

Household Planning is a national priority and as such HEPP is an important program to examine as it provides a better insight into the further requirements for the planning process and a basis to develop an on-going system of data collection, processing and analysis. It also enables the study to carry out an objective analysis of the effectiveness of the program in relation to the value of the household energy information collected for planning, and the effectiveness of funds that were used in the program.

The International Development Agency (IDA) funded the project (MPED, 1991b: 103) and the program costs are summarized in Table 3.1 below. Total costs, including allowance for cost escalation, were assessed at US$7.320 million, comprising US$6.128 million in the public sector and US$1.192 million in the private sector (Coda and Partners, 1990:x). The funds were to facilitate addressing the goals of HEPP.

Table 3.1: Summary of Program Costs (US$)

Source: Adapted from Coda and Partners (1990:x)

	(US$'000)	(UShs Million)
Public Sector		
Institutional Development	4,195	1.846
Improved Cook stoves	1,446	0.636
Charcoal Production	487	0.214
Sub-Total	**6,128**	**2.696**
Private Sector		
Charcoal Production:		
Non-woody biomass (briquette)	1,159	0.510
Sawmill Waste, Kiln	33	0.015
Sub-Total	**1,192**	**0.525**
TOTAL	**7,320**	**3.221**

The results of the HEPP program show that although a database was established on the supply and consumption patterns of household energy under the funding scheme, an ongoing system of data collection, processing and analysis which would provide the Ministry of Energy with a clear picture, was not achieved. This is due to lack of continuity and thus, still needs to be done.

Thus, considering the weakness in HEPP, at any point in time the true energy situation as it affects the household sector cannot be reliably established hence the need to develop an on-going system. Further, the survey related to three urban areas of the central region of the country (that is, Kampala, Entebbe and Jinja as the project areas) implying limited national coverage. The household energy surveys covered 638 urban and rural households comprising 480 urban households and 158 rural households distributed over nine districts (Coda and Partners, 1990). Statistically, there are shortcomings of such selection that are discussed below.

Table 3.2 below provides information from the HEPP project and shows the percentage of households that utilize various energy sources for defined end-uses in the districts where the project was conducted. In the project, the scenario that was used in the household energy surveys was to take the Municipal Council areas of Kampala, Entebbe and Jinja as the urban and peri-urban areas representing the major urban areas in the country where wood fuel demand and supply issues are largely on commercial basis, and select other districts in the country for the rural sample. With selected rural areas being similarly studied in the project, besides the "sample", a representative picture of the dynamics involved in the national household energy sector would not be achieved.

This is due to the limited coverage which was restricted mainly to urban areas that cannot allow for appropriate strategies and programmes to be developed in the country.

Table 3.2: Household Energy Consumption
Source: Coda Surveys, 1989 (as adapted by Coda Surveys, 1990).

A. End-Use Pattern (% of total households covered)

Fuel	Cooking					Ironing		Lighting	
Type/Area	Firewood	Charcoal	Kerosene	Electricity	LPG	Charcoal	Electricity	Kerosene	Electricity
Kampala	11.3	63.3	6.8	16.6	0.8	58.5	33.2	45.5	51.3
Jinja	12.0	70.0	2.0	14.0	0.0	66.0	16.7	36.0	64.0
Entebbe	46.0	33.0	3.3	16.7	2.0	80.0	26.0	70.0	30.0
Total Urban	13.6	62.3	6.1	16.3	0.8	60.7	31.4	46.0	51.3
Total Rural	69.5	2.6	1.3	0.6	0.0	82.8	2.6	67.5	5.7

B. Stated Fuel Preference (% of total households)

Fuel	Cooking					Ironing		Lighting	
Type/Area	Firewood	Charcoal	Kerosene	Electricity	LPG	Charcoal	Electricity	Kerosene	Electricity
Kampala	1.0	15.6	3.8	77.6	2.0	-	-	7.5	91.7
Jinja	0.0	18.0	2.0	80.0	0.7	-	-	0.0	100.0
Entebbe	6.7	20.0	3.4	63.3	6.7	-	-	3.3	96.7
Total Urban	1.3	16.1	3.6	77.0	2.1	-	-	6.5	92.0
Total Rural	25.5	14.6	3.8	55.4	0.0	-	-	29.9	70.0

While firewood, charcoal, kerosene, electricity and LPG form the energy sources for cooking as shown in Table 3.2 above, there are other sources of energy in the rural areas for cooking. These include crop residues and animal dung. The use of these additional sources of energy is not reflected in Table 3.2 above. These are likely to constitute the balance in energy for cooking which are essentially important in the rural areas and should also be monitored.

Table 3.2 above shows that wood fuel is the major household energy in the country. The data shows that there is a clear distinction between urban and rural wood fuel demands. In the urban areas of the HEPP project (Kampala, Entebbe and Jinja), most of the domestic wood fuel demand is met by charcoal, while the demand in the rural areas is met by fuel wood (Coda and Partners, 1990:12). However, energy solutions cannot be channeled properly due to the larger generalized grouping of households. The database should disaggregate consumers into smaller groups with likely energy use pattern in order to understand better the fuel use pattern so that energy supply solutions can be properly channeled.

In the selection process, the study observes that the nature of selection of the sample in HEPP project covered a geographical area of nine districts which are key market areas for biomass fuels. This implies that there is a likely high tendency of generating results that are not necessarily representative of the whole country. The household energy surveys covered 480 urban households and 158 rural households distributed over nine districts (Coda and Partners, 1990), thus indicating an urban biased study of mainly commercial fuels and results that probably do not necessarily achieve the objectives of the study.

There are a number of reasons observed for the limited coverage of household energy survey. Three reasons observed are; the limited funding by both government and donors, the low priority given to household energy sector and last but not least the limited time given for the survey, for example, for HEPP project (Coda and Partners-Africa, 1989:1). These reasons contributed to the limited geographic coverage, hence the size of population involved in the survey. The system to be developed has to take precautions of these barriers.

For energy planning, information on biomass energy use generated from HEPP project is about 12 years old and outdated and this still needs to be updated. There are also inconsistencies in the statistical information that supported the project which could be updated with the present comprehensive population and housing census data conducted in 2002 (UBOS, 2002).

The fieldwork shows that the population data and estimates used in the HEPP program differed widely depending on the source of information thus presenting problems of reliability of estimates. The wide variations in population data were due to the loss of population and census data for 1980 (Coda and Partners-Africa (1989:5) during the period of political and social upheaval and instability before it was analyzed. The available information was only on population by sex and administrative areas that could be extracted. Thus the existing population data in Uganda at the HEPP time might have been unreliable and had to be used with caution. This implies that geographic coverage could have been based on availability of data on population leading to the selection of biased samples that could result in biased results. For the system designed (see Chapter 4), the problem of estimates and unreliable population data can be solved by use of the current population and housing data collected in 2002 (UBOS, 2002).

The study observes that the present procedures of survey practices have concentrated on improved cook stoves, kilns and afforestation which do not target particularly household energy information gathering hence increasing the already large data gaps.

The most important household characteristic which influences energy consumption is the household size and income. However, the household size in terms of age structure has several implications on household energy supply and consumption. The limited demographic data available in Uganda did not permit the HEPP project to include detailed information such as the household size implying that data had to be extrapolated for the survey (Coda and Partners-Africa, 1989:6). However, reliance on un-representative statistics and theoretical extrapolations such as in the HEPP can generate biased results and hence inappropriate policies and plans for the household sector.

Furthermore, household energy consumption is strongly related to population and its structure; hence analysis of energy consumption requires basic demographic data which the recent population and housing census in Uganda could provide the needed data. In the HEPP project (1990), several important demographic aspects such as income, educational levels, and occupation were not analyzed properly because of deficiencies in the population data, thus this still needs to be done.

Reliability of the above data is important especially in providing reliable forecasts for energy demand and use. To verify reliability, comparison with other sources of data is useful. In the literature review, it was difficult to find similar data from other sources for comparison and it was not possible therefore to establish the reliability of the data set. Similarly, the change in trend of energy use could not be established due to the inadequacy of the data. This calls for regular planned surveys to facilitate verification of reliability of data even in non-energy sectors.

Qualitative data on the testing and development of energy efficient and socially acceptable cook stoves (charcoal and firewood) was achieved which can be used by policy-makers to promote dissemination of the improved stoves. A dissemination program of the selected stoves was also conducted in order to manage and improve wood fuel supplies in Uganda. A creation of public awareness enhanced the dissemination process.

Improved capabilities of the Ministry of Energy through training and workshops was achieved for the development of sound household energy policies and plans and related strategies for their implementation, including a least cost investment program. Provision of the training, skills and tools by which the Government can formulate and implement sound management interventions in

the household energy sector were made thus improving the capacity of MEMD for policy-making and planning.

The update of the household energy information of the HEPP programme can provide a better analysis of policy alternatives for households, particular when considered in combination with GDP, population, and sectoral economic growth. Statistics in this form of aggregation are of interest to national policy makers for sound management energy strategies in the economy.

SEUHI Project

The SEUHI project was established and funded from 1998 to 2001 (MFPED, 2002: 290) to improve household charcoal stoves efficiency and popularize the usage of these stoves in the selected districts in Uganda. This is because biomass energy use practices are extremely inefficient which can lead to biomass resource depletion, environmental degradation and human health hazards among users.

For the household sector, the major problem addressed was the poor conversion efficiency of wood fuel-using technologies including household stoves, whereas on the industrial sector, the project addressed the low rates of improved business energy technology adoption. Particular outputs tackled improvements in stove and kiln design, construction and materials selection, and their operation and maintenance for possible maximum fuel efficiency. Under the Dutch funding, SEUHI carried out training of trainers' programmes in the design and construction of improved efficient mud stoves thus building capacity in the sub-sector.

The SEUHI project is an important one to examine as:

- the major interventions focused on demand-side management where households are involved, involving the dissemination of improved efficiency stoves both for charcoal and wood in fuel wood deficient districts, and
- one of the few recent energy projects conducted in the country that can be used for advocating policies for energy conservation measures and planning.

Financial support was received from the Royal Netherlands Government to carry out the two-year project (1998-2001) in the energy sector (MEMD, 2002). The total planned expenditure was US$0.39 million (equivalent to Ushs635m) of which US$298,488 (equivalent to Ushs486m) was from the Dutch Government (MFPED, 2000:270, MFPED, 2002:390) and the gap was to be met by

the Uganda Government. This means continued reliance and influence by donors on projects due to the limited domestic savings potentials that cannot support indigenous projects. The project was designed and implemented in four of the worst hit fuel wood scarce districts in Uganda (MEMD, 2002:2). It is observed that the project deals with the demand side issues excluding the supply side issues such as reforestation of fuel wood scarce districts which is also an important intervention to solve fuel wood scarcity.

The effective use of the funds was demonstrated by the achievement of the goals and establishment of qualitative and quantitative data.

Qualitative data include:

- Acceptability of improved stoves
- Improved cook stoves establishment and dissemination
- Charcoal production efficiency improvement and marketing
- Awareness campaign on energy conservation in households
- Multiplier effect in those who acquire the skills to the pass them onto others

Quantitative data include:

- Number of households installed with improved stoves, and
- Number of trained charcoalers and artisans.

Both qualitative and quantitative data can be used in different ways. Energy policy-makers can use qualitative data to advocate for more efficiency programmes in households since the project was a pilot. Energy planners can use the data to project future cook stove dissemination based on the data, and acceptability and preference criteria as well. Energy database requires substantial data from different fields of household energy for compilation and integration with other energy databases. SEUHI data can be a useful addition to Biomass use technologies and energy conservation measures in households.

In the project, no income level and preferences were taken into account in the distribution of the desired improved charcoal stove models, as they were demonstration models for dissemination. The choice was based on existing technologies and availability of materials to make the stoves in consideration that biomass is a "free" source where expenditure on energy, price and consumption levels are not the determining factors. Through a technology and impact assessment, it was established that most households in Kampala (Central Region) use and could afford metal stoves,

while the majority of communities in Kabale (Western Region) use cheaper ceramic stoves (MEMD, 2002:60) and could also afford the ceramic stoves.

In view of the SEUHI project, energy-related issues such as income and educational levels and fuel use are not essential. However, where energy related issues become important to be considered as in the case of commercial fuels, it is essential to consider energy-related issues in a survey as data gaps that often occur originate from the lack of their extensive inclusion. The auxiliaries have a bearing on energy consumption. Levels of energy consumption vary from household to household due to these characteristics, hence influencing the pattern of energy consumption, thus should be incorporated in detail in any household energy study.

Besides, the auxiliary characteristics facilitate stratification of households and the selection of the sample in such a way as to control variability between households. Households can be classified into broad income groups which stratification would be effective from the point of view of precision, as the higher income households exhibit a large variation in the level as well as pattern of energy consumption. With the inclusion of energy related issues, reliability and effectiveness of policy-making and planning can be achieved.

UPPPRE Project

The UPPPRE was an experimental project of rural electrification in Uganda. The project targeted individuals, communities and government services that had the ability and willingness to pay the real market cost of PV-based services. The targeted beneficiaries of the project were located in Mbale (Eastern Region), Mbarara (Western Region), Luwero (Central Region), and Lira (Northern Region) districts.

According to the socio-economic status of the targeted areas, the project was to establish the foundation for sustainable use of Photovoltaic (PV) technology for rural electrification in the areas considered not accessible to the natural electric grid in the foreseeable future. The main objective of the project was to overcome the existing financial, social, and institutional barriers to the widespread dissemination of the technology within Uganda.

The United Nations Development Programme (UNDP) document (1997) states that the broad objectives of the project was meant to overcome constraints to market development including:

- The initial cost and lack of term financing.
- Lack of information at the household and community levels, as well as among decision-makers and government ministries.
- Un-developed private sector-based supply service networks, and
- A policy environment which is not conducive to PV market development.

Thus, the UPPPRE project is of great value to examine because its database is a valuable addition to the entire database of household energy information. As information on provision of lighting by solar PV was excluded in the HEPP Program, the thesis advocates for the promotion of recognition of this sector in terms of social equity and improved living conditions. Data on solar lighting is important to be included in the household energy information for assessing the contribution of solar home systems to the improvement of living standards.

UNDP/Global Environment Facility (GEF) funded the pilot project at US$2,956,000 of which US$200,000 was Government of Uganda contribution (UNDP Project Document reports of 1997).

In the above objectives, there was a focus on addressing lack of information at the household and community levels, as well as among decision-makers and government ministries. This is of interest to this work. Household information at the two levels was addressed through an awareness campaign to promote the dissemination of the PV systems.

Planners and policy-makers can use the lessons learnt from the pilot project to build upon it and implement similar programs countrywide. The lessons learnt include:

- There is acceptance for the solar PV technology
- A potential demand for solar PV systems exists
- There is potential for income generation from the use of PV systems, and
- Various income groups of households can afford suitable sizes of PV systems according to their ability to pay.

Rural Electrification Project in Uganda

The Rural Electrification project is an important project to examine as it provides information on electricity services to the households in the rural areas. In regard to households, rural electrification is often justified on the basis that it will improve health care and education standards in rural communities. Thus, the rural electrification project in Uganda provides additional data to existing

household energy data for planning and policy-making for households. The objective of the project is to electrify rural agricultural villages and to enhance the stability of power supply in the rural areas.

Japanese International Cooperation Agency, JICA, was the financier of the project. Records by JICA (www.jica.go.jp/) show that the project funding is 1.144 million yen. JICA (www.jica.go.jp/) states that in Uganda, the national government focuses its efforts on building infrastructure in rural agricultural villages to narrow the gaps in living standards between urban and rural areas. Globally, current development trends have focused on poverty eradication measures in which projects should be poverty-oriented (see Section 3.2.1). However, JICA reports that due to the low profitability, rural electrification project was slow and by 1998, it had only achieved 5% average electrification rate in the country. Therefore, considering the current population of Uganda of 24.7 million (UBOS, 2002a: 3), a 5% electrification rate of households implies a large number of households without grid electricity and thus a higher percentage using other fuels such as biomass.

The lesson learnt from this project is that even if rural areas benefit from electrification, the number of households electrified does not significantly alter the overall electrification rate. This is because the potential use of electricity in rural areas is low or unaffordable.

Both quantitative and qualitative data are generated from this project. The quantitative data, that is, the electrification rate enables policy-makers to study why electrification rate is low and thus how to improve it. This enables the policy makers to prescribe appropriate policies to improve the situation. Energy planners can base the future electrification plan on the current electrification rate and population growth. Qualitative information such as the living standards of rural areas helps in designing appropriate socio-economic policies suitable for the rural areas to improve their livelihoods.

Construction of Demonstration Biogas Digesters

Though biogas could be a household fuel, it has limited coverage in the country. The "Construction of Demonstration Biogas Digesters" project is a technical project that is suitable for demonstration and dissemination to other suitable areas.

The Construction of Demonstration Biogas Digesters projects looked at the provision of alternative fuel for households for lighting, cooking and provision of hygienic methods of waste disposal. The

project's principal objective was to increase energy production and sustainable use and minimize negative impacts on the environment that are caused by energy exploitation. The project was located in the central region of the country that is more urbanized and uses mainly modern and commercial fuels than other regions in the country.

The project is of importance to this work as it provides additional household energy services, hence information, to the household energy database of household energy sources.

The project was funded partly from a loan stipulated in the agreement on economic and technical cooperation signed between the Government of People's Republic of China and the Republic of Uganda in 1989 (MFPED, 2000:272). China side provided RMB1,450,000 (one million and four hundred fifty thousand RENMINBI YUAN ONLY) equivalent of US$168,675. Government of Uganda provided Ushs34,000,000 (thirty four million Uganda shillings) equivalent of US$23,109. Substantial amount of donor funding in comparison to local contribution shows that domestic savings are low to independently finance energy project.

The study could not assess the outcome of the project, as reports of the project could not be accessed. The re-structuring of the Government ministries in the 90s affected greatly record keeping in MEMD. However, the expected performance indicators of the project included (MFPED, 2000:272):

- Improved performance of digesters
- Increase in number of people made aware of the technology within the pilot area
- Increase in number of people willing to adopt technology within the pilot area, and
- Increase in level of adoption of skills by the trainees.

The indicators show that both qualitative and quantitative information could be generated which could be suitable for planning for households who have the potential for biogas digesters projects.

3.2.3.2 Household Surveys by UBOS

UBOS is responsible for the national statistical system in the country and hence a review of past survey questionnaire samples and results of surveys is useful to understand how household energy information has been dealt with in the organization. The objective is to critically examine the areas

of data gaps in the surveys reviewed in order to suggest a system for collecting and analyzing household energy information.

The 2000 Socio-economic Survey Questionnaires

Table 3.3 below presents an example of the questionnaire designed by UBOS (2000) in a Socio-economic Survey. The "2000 Socio-economic Survey Questionnaire" by UBOS and the District Local Government covered limited questions on energy issues on general household welfare, as shown below.

Table 3.3: General Household Welfare

Source: UBOS and District Local Government (2000:7)

A) Does the household have electricity?

Answer	Code
Yes	1
No	2

B) What is the main fuel used for cooking?

Type	Code
Firewood	1
Charcoal	2
Kerosene	3
Gas	4
Electricity	5
Others (specify)	6

C) What is the main source of lighting?

Type	Code
Kerosene/Hurricane Lamp	1
Gas	2
Electricity	3
Tadooba	4
Other (Specify)	5

The questions covered included access to electricity, and main sources of energy for cooking and lighting for the households which excluded other energy end use pattern such as refrigeration,

ironing, water heating and space cooling. This limited coverage on energy in the socio-economic survey questionnaire does not provide an opportunity for comprehensive information on household energy. In order to understand better how access to electricity affects fuel use patterns, it is necessary to examine in more detail different end-uses of energy and energy use patterns.

The limited coverage of energy issues was a result of the objectives of the survey which probably had priority to other socio-economic issues. According to UBOS (2001:2), the objectives of the socio-economic survey questionnaires were:

- Building capacity in District Planning Units in the area of data collection, processing, analysis and report writing;
- Avail districts with reliable data for planning purposes;
- Monitor poverty trends in the districts; and
- Test the collection of data using local personnel on a sustainable basis and make recommendations for the future.

The objectives indicate that a number of socio-economic variables including household energy are to be covered but not in great detail. The questionnaire in Table 3.3 shows the need for re-designing so as to gather adequate data and to cover substantial issues in the household energy. The aim would be to fulfill the objective of comprehensiveness of data collection for long-term planning. Among the socio-economic issues (such as characteristics of household members, education, health, housing, general household welfare and community welfare), the areas of household energy covered (under the heading "General Household Welfare) in the questionnaire and the report are access to electricity and main sources of energy for lighting and cooking (see Table 3.3). Though the purpose of the overall survey is not to assess the energy, it should, however, receive more in-depth coverage than what is stated in the questionnaire at present because of the socio-economic impact that energy has on society in relation to poverty in general.

Similar questions in Table 3.3 are also reflected in the survey conducted in the rural areas by UBOS in 2001 and the results of the survey are shown in Table 3.4 below. The survey focused on the "Socio-economic conditions in five Selected Districts" (UBOS, 2001). The five districts represent approximately 9% of the total districts in Uganda which is relatively a small coverage that does not represent the entire picture of the country. In this survey, the investigation on energy issues is grouped under "General Household Welfare" (UBOS, 2001:47) implying continued low significance attached to energy issues or it could be that Uganda applies a unique integrated approach to energy surveys in the country.

Table 3.4: Percentage Distribution of Households by Source of fuel for lighting and Cooking, Rural-Urban Residence and District, 2001.

Source: UBOS (2001:55)

A) Source of fuel Lighting

Source	District									
	Rural					Urban				
	Arua	Kalangala	Luwero	Ntungamo	Tororo	Arua	Kalangala	Luwero	Ntungamo	Tororo
Kerosene Lamp	14	32	16	22	15	34	61	29	29	43
Gas	-	-	-	-	(0.4)	2	-	2	-	-
Electricity	(0.1)	(0.4)	4	1	2	12	-	19	18	26
Tadooba	86	66	79	77	82	52	37	51	52	31
Others	(0.3)	1	1	(0.3)	1	-	2	-	-	-
TOTAL	100	100	100	100	100	100	100	100	100	100

B) Source of fuel for Cooking

Source	District									
	Rural					Urban				
	Arua	Kalangala	Luwero	Ntungamo	Tororo	Arua	Kalangala	Luwero	Ntungamo	Tororo
Firewood	97	77	91	99	97	16	70	36	70	36
Charcoal	3	20	8	1	3	82	25	57	25	58
Kerosene	-	1	1	(0.1)	(0.4)	1	5	4	2	2
Gas	(0.1)	(0.3)	(0.1)	0	0	2	0	-	0	0
Electricity	0	0	(0.1)	0	0	0	0	1	3	3
Others	(0.1)	2	1	(0.2)	(0.1)	0	0	2	0	1
TOTAL	100	100	100	100	100	100	100	100	100	100

The questionnaires administered in the above surveys do not cater for information on types of devices used for lighting and cooking for the different types of fuels, proportion of the different income groups using the different fuels, and the household appliances used. As noted, details pertaining to household energy were not of primary interest. It is observed that yearly, the same questions in Table 3.3 on access to electricity and main sources of fuels for cooking are administered in collecting information on socio-economic conditions of households implying that there will be a continued low coverage of household energy issues thus requiring broadening the questionnaires.

The socio-economic survey project is funded by Danish International Development Agency, DANIDA (UBOS, 2001:2). The survey focuses on the improvement of social statistics including poverty monitoring. On the basis of monitoring poverty, the study points out that energy and poverty are interlinked and detailed information on household energy use and appliances is necessary for monitoring the socio-economic conditions of households. Cecelski (2000:5) notes that little or no mention is made of (rural) energy poverty in current thinking on poverty – with the

exception of occasional references to strengthening of infrastructure and public services to the poor. Furthermore, energy is perhaps not yet fully recognized as a basic need nor as an "aspect of poverty" whose policies are relevant to fighting poverty. Cecelski's arguments provide useful explanations for the shallow coverage of the energy issues in the questionnaires on socio-economic conditions of households by UBOS.

In view of the above, for substantial data collection on household energy, the perceptions on energy and poverty should be broadened. Cecelski (2000:14) states, " poverty means, among other things, limited access to energy sources. Poverty influences and determines energy choices of households", hence should be taken into consideration when designing and implementing household energy surveys.

The 2002/2003 Uganda National Household Survey (UNHS)

The UNHS is another survey that is regularly carried out by UBOS. An analysis of the "2002/2003 UNHS" shows the exclusion of an energy component in the survey, yet the main objective of the survey was to collect high quality and timely data on demographic, social and economic characteristics of the household population for monitoring development trends of the country (UBOS, 2003:1). The survey excluded household energy data collection, as the survey had specific aims which were mainly economic rather than social as highlighted (UBOS, 2003:1) below:

- To provide information on the economic characteristics of the population including their economic activity status, employment, unemployment and underemployment situation.
- To generate data for calculating gross output, value added, and other economic indicators required for National Accounts.
- To integrate household socio-economic and community level surveys in the total survey programme so as to provide an integrated data set. The purpose of this objective was to provide an understanding of the mechanism and effects of various government programmes and policy measures on a comparative basis over time.
- To generate and build social and economic indicators and to monitor the progress made towards social and economic development goals of the country.

In the above objectives, there is no provision for household energy data collection. Historically, limited attention has been paid to household energy issues. According to Ministry of Planning and Economic Development, MPED, (1984:34), the 1984 records show that priority in the energy sector

was given to the optimum utilization of Uganda's hydroelectricity potential and energy conservation by government rather than household energy demand, thus the lack of adequate and systematic household energy information which needs to be collected.

Uganda National Integrated Household Survey (IHS)

Similarly, the IHS conducted from March 1992 to March 1993 by the Social Dimensions of Adjustment (SDA) Project of the Statistics Department of the Ministry of Finance and Economic Planning (MFEP) sector of the Government of Uganda (GoU) had some information on household energy as it was an integrated household survey. The objectives of the IHS was to fill-in gaps in socio-economic data and build time-series data relating to key economic indicators needed in formulating, implementing, monitoring and evaluating plans for social and economic development of the country. Although the survey virtually covered all the districts of Uganda (MFEP, 1993), it had limited information on energy issues. According to the results, the survey looked at the household energy use in terms of lighting in both urban and rural areas of the country and expressed the results in percentages of households using lighting. The results, as shown in Table 3.5 below, were matched with the source of water supply to the households.

Table 3.5: Percentage Distribution of households By Source of Lighting and Drinking Water (Minimum basic needs)

Source: MFEP, 1996

Source of Water	Source of Lighting			TOTAL
	Electricity	Kerosene	Others	
Indoor Tap	0.8	0.1	0.1	1.0
Sharing tap	2.9	2.3	0.3	5.5
Well/bore-hole	3.0	51.7	3.9	58.6
River/lake/spring	0.4	25.7	5.9	31.4
Rain water	0.0	0.3	0.1	0.4
Others	0.9	2.3	0.0	3.2
TOTAL	8.0	81.8	10.3	100.1

In the IHS, similar tables to the socio-economic survey were generated for source of lighting for each region/district. The totals for the country have been selected to indicate the general focus of the survey on energy. The results in Table 3.5 show that the source of lighting is linked to source of water. Household energy is linked with the provision of other basic services and products like water and food. However, to generate useful information for effective planning, the source of lighting should have been introduced with energy-related issues such as income levels of households. This

would be a more related issue than the water source as these energy sources dealt with are modern and commercial types.

The implication of the results of the socio-economic questionnaire is that the questionnaire was designed with low priority on energy information gathering and thus missed the key energy issues such as the household energy needs and uses as explained in Section 2.1. Due to this, low priority and little understanding of energy is likely among energy policy-makers and planners.

3.2.4 Household Energy Projects in Kenya: A comparative Overview

Even though the Uganda situation is evaluated, it is worth analyzing the data collection systems and funding mechanisms of other countries. There are two reasons for this. First, lessons can be learnt from what other countries are doing and spending on data collection and can apply the best system in other countries in Africa that might be planning to conduct household energy surveys. The second is to investigate effective use of the funds in terms of data generated and it's usefulness for effective planning.

In Kenya, energy sources are broadly classified into two categories (Kamfor Company Ltd, 2002: xi): traditional that include wood, charcoal and other biomass, and conventional such as kerosene, LPG, electricity, wind and solar. This classification is similar to the classification in Uganda implying that energy situations are likely to be similar due to the existence of similar climatic and economic conditions in the two countries. Hence, household energy information collection and analysis could be modeled under similar household energy information system for the two countries.

Traditional energy types are used in traditional ways, i.e. in 3-stone stoves and open fireplaces as done in Uganda and Tanzania. Often, in both countries, these energy forms do not enter the formal market but nevertheless are critical and most appropriate for particularly the low-income families. Concern with suitable use of both forms of energy to stimulate economic growth and development leads to the desire for periodic analysis of the energy sector to facilitate strategic planning for appropriate applications.

The study on Kenya's Energy Demand, Supply and Policy Strategy for Households, Small Scale Industries and Service Establishment that was carried out in 2002, examines the major energy resources used by the households and small-scale industries and services establishment in the

country. The objective of the study is to develop a policy strategy for providing Kenyan households (and Cottage Industries) with their respective energy needs in a cost effective manner and with minimum negative environmental effects. The HEPP program in Uganda covered only households and did not include small-scale industries and services establishment in the country thus the program was not as comprehensive as the Kenya case. Uganda could apply the methodology used in Kenya in order to collect comprehensive data.

The scope of the Kenya study included undertaking two studies – one on Energy Demand, and the other on Energy Supply of both urban and rural households (and the Cottage Industry Sector) (Kamfor Company Ltd, 2002: 3). Information on supply side is important for assessing the adequacy of the energy resources to satisfy the demand for energy services. It is necessary for formulation of appropriate policies in regard to environmental degradation arising from biomass inefficient use.

The study also identifies alternative energy sources such as solar, wind, geothermal, biogas and nuclear, to distinguish them from "traditional" (wood, plant materials) used with low conversion technology. This is important for a country to have information on its energy resources so as to plan within the available sources, as imported energy is a drain to the economy that affects the balance of payment situation.

The "Study on Kenya's Energy Demand, Supply and Policy Strategy for Households, Small Scale Industries and Service Establishments" was conducted from February 2001 to September 2002 (Kamfor Company Ltd, 2002), approximately 12 years after the HEPP study. The results of the Kenya study are recent and are applicable for planning and policy-making than the HEPP results. Since Uganda has similar conditions with Kenya, the lessons from the Kenya energy study could be applied to Uganda.

Both countries use questionnaires for data collection. However, the design of the questionnaires differed. For Uganda, the consultants designed questionnaires independently for the household energy survey without consultation of the Central Statistical Office (CSO) that has experience and skills in survey techniques. This implies a lack of an input of scientific techniques of survey methods from CSO that could have affected the quality of the survey designs and outputs.

In the Kenya energy study, two sets of structured questionnaires, one for households, and the other for small-scale industries and service establishments – Cottage Industries were designed to capture

quantitative and qualitative information. All energy sources at the household level from firewood to candles were documented hence comprehensively covering most of the energy sources. Both the Ministry of Energy and the Central Bureau of Statistics were involved in the design of the household questionnaires hence making the survey reliable and comprehensive in energy issues covered. The study shows that the following parameters were covered in the Energy Consumption Pattern Survey (Kamfor Company Ltd, 2002); firewood, charcoal, farm residues, wood waste, kerosene, LPG, electricity, solar, biogas, and other energy sources such as dry cell batteries, 12V vehicle batteries, candles, windmill and mini-hydro units. On the Energy Supply side, the following sources were analyzed in the study: biomass energy, petroleum products (kerosene and LPG) and solar energy (PV cells). The comprehensive coverage of the energy consumption and supply issues are lessons useful for Uganda to improve on the household energy information system.

The Kenya's Energy Study is financed principally by the World Bank (e-mail communication from Kamfor Company Ltd (kanfor@nbnet) on 27th August 2003) which is also involved in financing energy projects in Uganda. This shows that World Bank is a multinational organization for funding projects including household energy.

Kamfor Company Limited could not provide information on the amount used in the study on the basis that the funding was on competitive bidding, hence confidential and thus effective comparison cannot be done with the funding of energy projects in Uganda. This is an indicator of the lack of transparencies in funds spent on energy projects on which, if available, future planning could be based on for the possible use of the limited domestic savings. Further, researchers cannot analyze the effectiveness of the use of the funds in energy projects in the absence of information on funding. Implementers of energy projects are argued to be transparent and share information on energy with analysts for the betterment of the economy and in particular, the household sector.

3.3 Analysis of funding of Energy Projects in Uganda

Analyzing government support to energy sector is necessary to assess the additional government funding and support to the sector. The discussion below focuses mainly on the government budget support to the sector and the likely projects with household energy information collection.

Government of Uganda Budget Share to Energy Sector

The magnitude of the National Budget allocated to energy sector development is often low and this affects the planning and implementation of activities in the sector, hence household energy information collection and analysis. The allocation given to the sector in the budget and where household energy information could be derived from is discussed below.

The 2000/2001 Development Budget Performance is examined to assess the inclusion of household energy information gathering. Table 3.6 below shows the extent of budget allocated to energy department, in terms of government's contribution, in relation to the Ministry's Development Budget. Table 3.6 shows expenditures that were expected to be financed locally, usually by Uganda Government sources including non-profit assistance such as from United Nations Agency for International Development (USAID) but also including funds generated directly by the project implementing agencies (termed "Self-Funding" or "Appropriation-in-Aid"). The study uses the information in Table 3.6 below, as this was the only available information that could be accessed.

Table 3.6: Development Budget Performance 2000/2001

Source: Annual reports (MEMD, 2001:59)

Project Name	2000/2001		% Released		Comments for Household Energy Data collection
	MEMD Funds, (UShs '000)	Released, (Ushs'000)	Outturn	% Total Release	
Power III	25,000	17,500	70	5.2	No data
Support to Petroleum Exploration	239,602	220,616	92	65.0	No data
Power Sector Regulatory Framework	30,600	21,420	70	6.3	No data
National Seismological Network	44,400	31,206	70	9.2	No data
Uganda Photovoltaic Pilot Project	12,100	8,553	71	2.5	Yes, data
Jinja Storage Tanks	3,223,377	-	0	0	No data
Evaluation of Small Hydro Power Sites	28,800	20,160	70	5.9	No data
Sust. Energy Use in Household and Ind.	28,800	20,160	70	5.9	Yes data
Constr. Of Demo. Biogas Digesters	13,700	-	-	-	Yes, data
Rural Electrification	15,800,000	-	-	-	Yes, data
TOTAL	**19,446,380**	**339,615**	**2**		

Note: In Table 3.6 above,

- **No data:** implies no data collected on household energy, and
- **Yes, data:** implies some data (quantitative and qualitative) collected on household energy.

Table 3.6 presents the different energy projects in the stated period and outlines the funds allocated to and released for the projects. The last column is added to show where potential household energy data – qualitative and quantitative – could be generated. It is observed that out of the 10 projects, only four are identified to have potential for household energy information generation.

Table 3.6 above shows that in terms of total government releases, related issues to household energy are given low priority in the 2000/2001 Budget and this seems to be the same pattern for all other previous budgets, as shown in Table 3.7 below. The analysis of Table 3.6 focuses on UPPPRE and SEUHI as potential projects where data on household energy can be obtained. UPPPRE and SEUHI got budget releases of 2.5% and 5.9% respectively of the total budget release as shown in Table 3.6 above. When combined, it had approximately 8.5% of the total release. Although there was limited quantitative information on household energy, the implication is that even within energy issues, priorities are accorded different importance. Overall, there was approximately 2% government release (see Table 3.6 and column for Outturn) from the total expected release, implying limited funds to energy sector.

Table 3.6 shows that project performance is based on the extent of the budget released. However, this work considers that project performance assessment should be based on the actual amounts of funds spent and the effectiveness of each project in relation to household energy data generation in this case. The effectiveness of each project could not analyzed due to the difficulty to access data on actual expenditure and more important, the breakdown for household energy sector. This calls for a detailed transparent budget not only for energy sector but also for other economic sectors for better resources allocation and consistency in budgeting. It is good practice that the MFPED publicizes the Government Ministries' activities to enhance the transparency of budget execution. This started with the publication of the annual Budget Performance Report for Financial Year (FY) 1999/2000 (MFPED, 2002:6) which is recent and the practice should continue in order to obtain public view on budget allocation. Even though resources mobilization and sectoral issues are taken into consideration, detailed expenditures for every project are required to be greatly strengthened to show actual expenditures for every project within sectors for analysis of effective use of the funds spent.

In budgeting for the sectors in the economy, Table 3.7 below presents an overview of how budget allocation has been in the past. The table shows the Rehabilitation and Development Plan, 1987/88-1990/91 when the National Resistance Movement Regime had assumed powers in January 1986

(MPED, 1987) and when economic performance and statistical system in the economy had collapsed.

Table 3.7: Rehabilitation and Development Plan 1987/88-1990/91, Sectoral Distribution of Planned Expenditure (US$ Million)

Source: MPED (1987)

Sector	Total Expenditure	Funded	Unfunded	% of Total Planned Expenditure
Agriculture	314.52	186.78	127.74	24.4
Industry and Tourism	271.89	93.65	178.24	21.1
Mining and Energy	89.24	53.44	35.80	6.9
Transport and Comm.	378.72	171.02	207.70	29.4
Social Infrastructure	221.02	90.81	130.21	17.2
Public Administration	13.15	1.23	11.92	1.0
TOTAL	1288.54	596.93	691.61	100

Table 3.7 above describes the total planned expenditure allocated to the six sectors in the economy. The unfunded component is the funding gap for the budgeted expenditure. Table 3.7 shows the sectoral distribution of planned expenditures, and funded and unfunded portions of the Rehabilitation and Development Plan. Of interest to this work is that Mining and Energy sectors combined constitute a very small proportion of the planned expenditure of the Rehabilitation and Development Plan as shown in the last column.

It is important to disintegrate the data so as to find out the proportion of the planned expenditure for each sub-sector of mining and energy for the period. Assuming that the proportion of the summary of planned expenditure in the Rehabilitation and Development Plan of 1990/91-1993/94 is computed from the Mining and Energy sector totals (MPED, 1991a:v), Mining and Energy take computed proportions of 9% and 91% respectively. Applying these percentages to the mining and energy sector in Table 3.7, the disaggregated sectoral distribution of Planned Expenditure for mining and energy would be as shown in Table 3.8 below.

Table 3.8: Disaggregated Sectoral Distribution of Planned Expenditure for Mining and Energy at 9% and 91% respectively based on Table 3.7. *Source: Table 3.7*

Sector	Total	Funded	Unfunded	% of Total Planned Expenditure
Mining and Energy	89.24	53.44	35.80	6.9
Mining	8.03	4.81	3.22	0.6
Energy	81.21	48.63	32.58	6.3

Comparing the information in Table 3.8 with the overall total expenditure in Table 3.7, the Planned Expenditure for Energy in the reference period is estimated at 6.3% of the total planned expenditure, indicating that energy was among the least sectors in the priority planned expenditure. This reflects the relatively low significance given to the sector in the total planned expenditure yet energy is a key element in economic development. In addition to the household sector, energy is needed by most economic sectors, for instance commerce and industry for growth in the economy. It is pervasive and cuts across almost the entire economy. However, it is difficult to assess how much is allocated to energy for commerce and industry, as the allocation is not usually indicated.

In the projects shown in Table 3.6, elements of household energy data collection – qualitative and quantitative – do exists in HEPP, UPPPRE, SEUHI, Construction of Demonstration Biogas Digesters, and Rural Electrification Projects in various ways as discussed.

In general, reports from MEMD show that there are diverse sources of funding. These include:

- The Royal Netherlands Government which is responsible for SEUHI project.
- The World Bank which undertook Power IV project at Owen Falls Dam.
- African Development Bank (ADB) responsible for Alternative Energy Resources.
- The Chinese Government – for the Biogas as indicated in Table 3.8, and Training on Mini and micro-hydropower projects.
- German Government through the German Technical Cooperation (GTZ) for Energy Advisory Project, that is, energy policy development and implementation.
- Swedish Government through Swedish International Development Agency (Sida), and
- JICA, that is, Japanese International Cooperation Agency for Rural Electrification.

The financiers of energy projects shown in Table 3.9 indicate that IDA/World Bank is the major financier which is likely to continue as a major stakeholder in the financing of energy projects, as

the organization has significantly undertaken the financing of energy projects in many developing countries.

Table 3.9 below summarizes the funding of projects that are discussed in Section 3.2.3.1. The aim is to assess the overall amount of funding for the energy projects discussed.

Table 3.9: Summary of Funded Projects
Source: Compilation from various documents Reviewed

Program Name	Brief Description	Financiers	Total Funded Amount US$ (Million)		Period	Comments
			Donor	Government of Uganda		
HEPP	Biomass study, database for supply and consumption patterns	IDA, World Bank	7.32	Nil	2 years (1988-1990)	Household energy information available
UPPPRE	Pilot project to establish foundation for sustainable use of PV technology for rural areas	UNDP/GEF	2.756	0.2	3 years (1997-2000)	Expanded provision of sustainable commercially based PV rural electrification services by private sector.
SEUHI	Addressed poor conversion of wood fuel using technologies. Addressed increasing efficiency in energy production and utilization.	Royal Netherlands Government	0.298	0.001512	2 years (1998-2001)	Production and dissemination of improved cook stoves, including capacity building
Construction of Demo. Biogas Digesters	Provision of alternative fuel for household for lighting and cooking	Republic of China	0.169	0.023	1 year (2000-2001).	Increased awareness of the technology.
TOTAL			**10.523**	**0.224512**		

3.3.1 Funding periods and timing of Funding

Table 3.9 and Section 3.2.3.1 show that the energy projects were implemented from 1988 to 2001 that began with the implementation of the HEPP project. These projects came into being two years later after the new government, the "National Resistance Movement, NRM" took over power in 1986 (MPED, 1987). Therefore, the projects can be related to the aftermath of the power take over by the new government that addressed itself to the problems of rehabilitation of the entire economy of Uganda and laid a foundation for future development. The rehabilitation and development plan dealt with the rehabilitation of the economic and social infrastructure which was in a poor state as a result of neglect by past regimes.

Another explanation to support the period of the energy projects is the Public Investment Plan (PIP) (by the Government of Uganda) which came into being from 1996. According to MFPED (2000), the PIP document focuses mainly on on-going poverty oriented projects and new initiatives that need to be put in place in order to tackle the problem of poverty. The document serves as a guide to ministries when preparing their investment plans. Hence, the energy projects/programmes in Table 3.9 including Rural Electrification (see Section 3.2.3.1) that began after 1996 are new projects which were instituted with a poverty focus in mind. The aim was to prioritize resources to ensure that they are poverty focused in order to spend effectively the resources available for the reduction of poverty and the well being of the population.

It can be generalized that energy projects occurred at the time when rehabilitation of the economy was embarked on and in addition, poverty eradication strategies were being implemented.

Table 3.9 shows that in the period between 1988 and 2001, donor funding amounted to US$10.523million while government contribution resulted in US$0.22million. In a period of about over a decade, the total funding amounted to approximately US$10.75million (which excludes the Rural Electrification funding discussed in Section 3.2.3.1). This is spread overtime in an ad hoc manner in projects that have periods of implementations overlapping.

If the country could conduct a general household energy information gathering with the same total funding, once in every 3, 5, or 7 years, probably a much more comprehensive picture on household energy would be achieved. This can only to be attained if planning is put into practice. It is possible that with proper planning, government would add a relatively small amount of funding to the limited funds to conduct energy information gathering.

The three-year energy census or plan of the Republic of Korea (UN, 1991) if applied in Uganda would probably provide end-use energy statistics by sources and comparative analysis of several demand sectors and their characteristics which would serve as basic data for national energy planning and policy making. African countries should therefore put planning a priority as well as a practice in order to achieve significant results with limited funding.

3.4 Structural gaps

In view of the discussions in this chapter, below is a summary of the structural gaps and the status of the existing household energy information. The gaps are expressed in the form of the weaknesses and threats that exist in energy institutions, hence the need for the development of a system for household energy information. Generally, the strengths, weaknesses, opportunities and threats (SWOT) analysis is presented in Table 3.11 below.

Table 3.10: Summary of the Existing household energy information in Uganda

Item	Comments
Unorganized Institutional structure	MEMD, UBOS and Forestry collect household energy information independently. Household energy information cuts across energy divisions in MEMD. Reports on household energy information are scattered in Energy institutions. Further, they cannot be integrated for effective energy planning
Lack of collaboration and coordinating framework amongst energy institutions	MEMD and UBOS carry out surveys independently with independently designed questionnaires
Lack of planning for surveys	Ad hoc surveys regularly done that have limited application to policy-making and planning as the surveys are not usually comprehensive
Inadequate coverage of household energy information variables thus inadequate data for effective planning	UBOS deals mainly with access to electricity and main sources of energy for lighting and cooking. Excluded are other energy use patterns. Not useful for long-term planning which requires adequate and reliable data from regularly planned comprehensive surveys
Low priority for household energy issues thus not adequately planned for in the national budget	Limited understanding for the relationship between energy and poverty
Lack of household energy information related policies	Inadequate information and the poor institutional structure or set up makes it difficult to locate where policies should be directed to due to no clear location of household energy information
Unfocussed objectives on household energy information	Evidenced by surveys conducted, for example, by UBOS which have data gaps, for example, in types of devices used for lighting and cooking
Lack of on-going system of household energy data collection, processing and analysis.	HEPP did not institute an on-going system hence no system in place for regularly updating household energy information

Thus Table 3.11 below presents a summary of the strengths, weaknesses, opportunities and threats to energy institutions.

Table 3.11: SWOT Analysis of Energy Institutions

a) Strengths and Weaknesses

Strengths	Weaknesses
1. Build on existing information 2. Trained personnel 3. Some institutional framework	1. Lack of organized and coordinated energy institutions 2. Lack of planning and unfocussed objectives for household energy (sector) information 3. Lack of policies for household energy information system 4. Lack of on-going system for household energy information

b) Opportunities and Threats

Opportunities	Threats
1. Collaboration between MEMD and UBOS in the creation, management and updating of database on household energy 2. Available indigenous technical skills of UBOS to conduct comprehensive household energy use and consumption survey on behalf of MEMD 3. MEMD to feed UBOS with its data needs and budget to do the survey 4. MEMD to incorporate data collection into policy role 5. Population and Housing Census data 6. National Integrated household data 7. Schools available to conduct surveys 8. Universities and research institutions related household data 9. ESMAP Research (World Bank) data 10. NGOs' with a wealth of information	1. Low priority for household energy sector by government 2. Limited domestic funding for household energy survey 3. Influence by donor agencies on energy projects 4. Untargeted energy surveys for the household sector due to external influence 5. Political considerations

Strategies to correct the weaknesses for household energy information need to be cautiously designed as suggested in the following chapter. The suggestions are focused towards solving the structural weaknesses and gaps in the current household energy information system.

4.
Household Energy information System Development

4.1 Introduction

This chapter reports the development of a household energy information system that will attempt to address the inadequacies of the Ugandan system. The system will involve collaboration and cooperation among energy institutions and be comprehensive, reliable and sustainable. As defined by Pearsall, ed., (1999), a "system" to be developed will be *an organized scheme or method* of collecting, organizing, analyzing and disseminating household energy information. In addition, the chapter will explore ways of having an on-going system of data collection, processing and analysis through a logical framework for the regular update of household energy information for effective energy and national planning.

4.2 General Essential Scientific Techniques

The success of the system or institutional framework developed for household energy information collection will depend on the understanding of the value for household energy information in policy-making and planning. Thus the use of essential scientific techniques in surveys to achieve reliable and adequate data is important. Known factors such as time, skilled manpower and funds for surveys will be considered. Based on proper sampling, efficient use of the existing resources can lead to ample coverage in the survey.

The need for the household energy survey to achieve this ultimate aim, that is ample coverage, depends on essential scientific techniques that will be applied in the data collection methods. For the system, some of these essential scientific techniques have been listed by Coda and Partners-Africa (1989:45) and are applicable. These include:

- How to focus on and collect relevant information
- How to focus on and collect up-to-date data
- How to focus and utilize any already existing information (given budgetary, personnel and other constraints)
- How to assemble data for specific policy-making decision
- How to analyze data

- Scientific model building to help in future forecasting, and
- How to prepare data into useful final documents for specific policy decision-making process.

It is important that the system collects the data that are needed for use in planning and policy-making. These are important guidelines that should be adhered to in data collection that will be used in the framework suggested. Adherence to viable scientific research methodological processes can lead to more accurate and reliable scientific policy research solutions and conclusions.

4.3 Data requirements by Policy-makers

The questions to administer in a household survey are crucial for understanding the needs of policy-makers. The generic questions relevant to this study which can be administered are presented in Table 4.1 below. It demonstrates some examples of data requirements on household energy use that policy-makers might need to have for policy formulation and will be applied in the development of the framework.

Table 4.1: Analytical and Statistical Issues for the Policy-maker
Source: Adapted from Leitmann (1988:10)

Questions for the Policy-maker	Data Requirements
1. What % of the population use biomass as their only fuel or primary fuel	Total population: rural, urban Type and amount of biomass energy used Type of use and user Frequency/quantity of use
2. Do consumers get enough biomass to meet their needs? Where are there deficits?	Minimum requirements per cap./year Actual consumption of biomass Regional disaggregation
3. Why are people using or not using a particular fuel	Socio-economic characteristics Prices, costs and accessibility Distribution system Fuel preferences and end-uses
4. Do people earn enough money to buy fuel and end-use equipment?	Income class Expenditure on energy Price and consumption levels Frequency of payments (daily, weekly, monthly)

These questions would help to answer the policy concerns through detailed analysis of the fieldwork.

4.4 Variables of Household Energy Consumption to be collected

The variables to be collected are divided into two categories:

- Core information that form the direct variables to be collected as shown in Table 4.2 below
- Peripheral information that form indirect information such as on social, economic, technical and environmental information related to household energy issues.

It is essential that the new framework takes into consideration all the necessary core variables listed below. This is because household energy consumption depends on interrelated variables that affect both the quantity and choice of fuels consumed. Thus, it is often common that many of these variables overlap and affect both demand and supply, hence there is no clear distinction between variables that affect demand and supply. For example, on the demand side, the cost of cooking equipment is linked to factors such as income, preferences for using certain fuels, and in some cases, taste in the case of cooking equipment. On the supply side, the end-use technologies, for example, gas-cookers that are often fuel-specific, are linked to supply-side factors such as the availability and price of fuels. For the purpose of the developed system, household energy consumption side is dealt with and often the discussion will include variables that overlap between demand and supply.

4.4.1 Core Information

Table 4.2 outlines the variables that are to be collected under this category.

Table 4.2: Household Energy Demand and Use
Compilation based on literature reviews of various sources

End-uses of fuels	**Household Energy needs**		**Number of Households using fuel type and end-use.**	**Constraints**
	Fuels Used	Devices Used		
1) Cooking 2) Space heating 3) Hot water 4) Lighting 5) Refrigeration and space cooling 6) Communication 7) Appliances 8) Micro-Enterprises	Firewood Charcoal Liquefied Petroleum Gas (LPG) Kerosene/Paraffin Grid Electricity Batteries Candles Agricultural residues Animal dung	Listing of devices used by different fuel types	Proportion of low income households using each fuel type for each end-use	Constraints that exist in the use of the fuels types for the different end-uses

In Table 4.2 above, household appliances are included on the side of end-uses of fuels. This means collecting data on the different types of household appliances (for example, radios and TVs), their needs and fuel types used by appliances; for example, energy sources may include batteries or grid electricity.

In addition, the following will also be investigated:

- Demographic characteristics of households
- Physical characteristics of housing units
- Fuel preferences

Each of the above parameters are explained briefly below:

Demographic/economic characteristics of households: Household energy consumption patterns are affected by the characteristics of the households and their choice of appliances. Household characteristics that can be considered include:

- Household size: the average consumption of energy is strongly related to the household sizes as measured by the number of people in the household.
- Income: the average consumption of energy tends to increase with higher incomes.
- Location of households from market or supply source, for example, village, town or city. It is often common that energy supply and demand patterns of households relate to specific locations; hence the energy supply and demand patterns vary by village, town or city. These variations are significant when regions or districts are considered. Thus information on these variations should be collected and analyzed for a more meaningful national planning.

Physical Characteristics of housing units: The physical characteristics of housing units' affects the choice of fuel types, appliances and amount of fuel used by the households.

Types of fuel used: Information on the percentages of households that use various combinations of fuels is important, first, the dominant fuel if there is, and secondly, the changing pattern of fuel use over time. The changing pattern of fuel use helps in detecting the impact of energy policies on fuel use and the underlying factors for the changing patterns.

Appliances (or devices) utilized: The pattern of ownership of energy appliances is one of the most important determinants of the amount of fuel consumption of fuel. The choice of appliances often determines which fuel is to be used and hence has a large influence on the demand for each fuel. Data on appliance usage is important for analysis. These data and percentages of households owning various appliances can be used to study the appliance penetration rates.

End-uses of fuel: There are usually five major end-uses of fuel in households, namely, cooking, lighting, water heating, space heating/cooling, and electricity. While use of fuel for cooking and lighting is universal, water heating, space heating and cooling are not. Water and space heating are restricted to colder regions, for example, in the hilly or mountainous areas, and cooling is restricted to certain segments of the population in the country. Electricity specific uses are restricted to electrical appliances such as refrigerators and irons which are used by higher income group population. However, LPG and paraffin can be used for refrigeration and charcoal for ironing. An investigation of households (income-group) using these energy sources for cooling and ironing need to be done to assess whether they are home-based businesses or not.

Fuel Preference: There is also a preference for fuels. It is important to point out that in many parts of the developing world, a majority of households use wood because it is accessible, affordable and gathered "free". However, when wood is scarce, a great effort has to be made to collect it. Consequently, less preferred fuels which are not abundant or easily accessible, are used instead. Household energy surveys can investigate and assess fuel preferences.

Constraints: As explained in Table 4.2, it is necessary to examine what constraints households experience with the use of the different fuels for the different energy services. This is to enable development of suitable policies to solve the constraints.

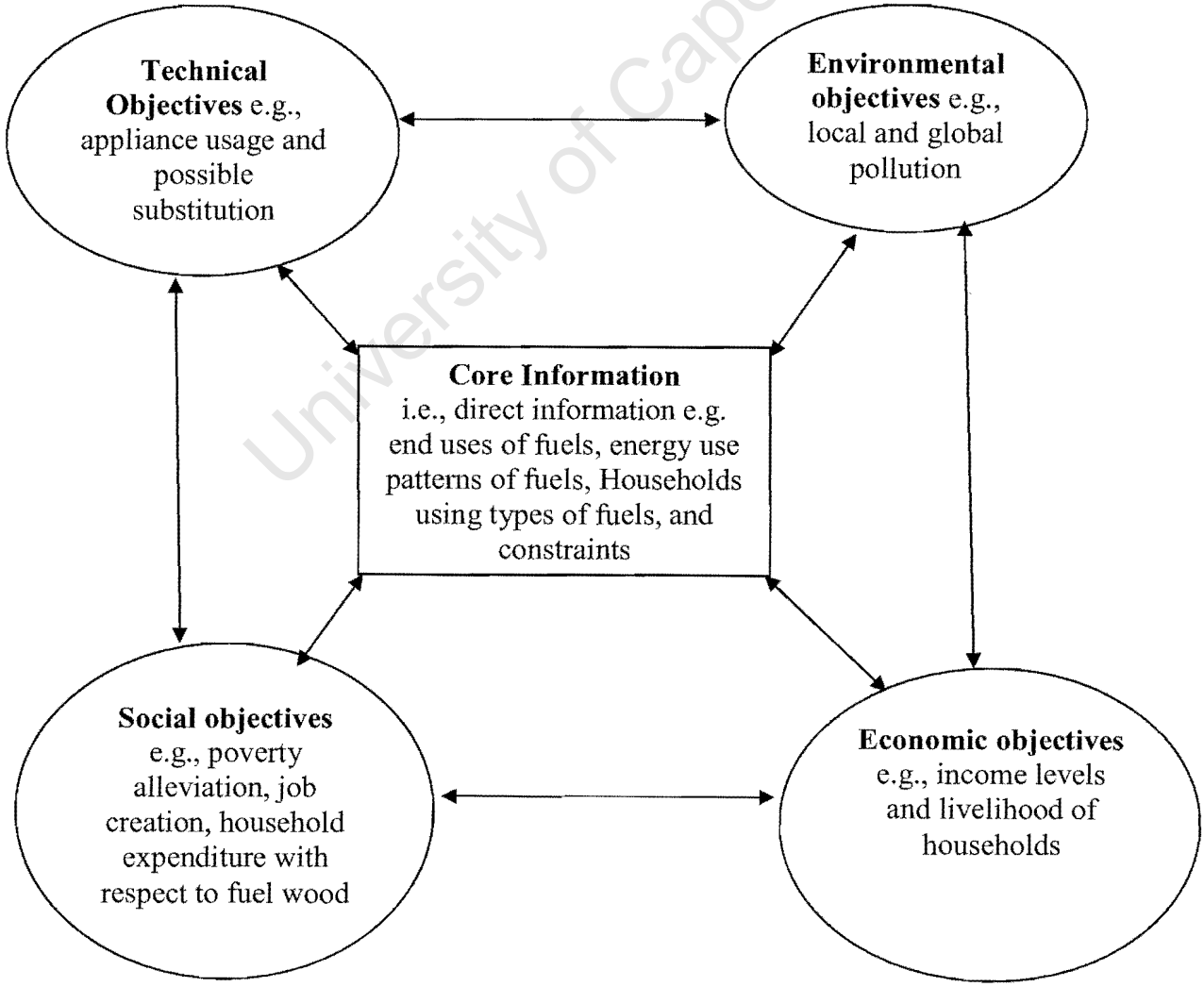
4.4.2 Peripheral Information

The peripheral information is indirect information on household energy information. They constitute the social, economic, technical and environmental objectives in relation to energy use that are important besides the core information and are essential components in household energy information system. For example, if information on appliance usage and possibility of substitutions is required, then technical objectives of a survey can be collected and analyzed for policy-making. Each or a combination of the peripheral information can be collected and analyzed but depending on the objectives of the survey.

Social objectives could look at the energy needs of the poor as well as the levels of inequality in the energy sector such as rural households that do not have access to grid electricity. Household energy information on the core information such as household income levels, types of fuels used and household geographic location will greatly improve policy-making and planning for inequalities in energy access for the affected rural households. Further, the information can assist in addressing the question of environmental sustainability at the local and global levels such as global climate change, air and water pollution. Household energy data on fuel costs, cost of appliances and equipment are essential elements for rational energy policy-making and planning. Thus, the objectives of the peripheral information affect energy use and are essential to be addressed in the information system.

Fig. 4.1 below shows the relationship between core and peripheral information.

Fig. 4.1: Relation between Core and Peripheral Information



4.4.3 Precautions in the data collection

The collection of household energy data requires definitions to be clear and understandable to various stakeholders of household energy. This also helps in the task to design a common database to suit the data that other energy institutions and relevant ministries collect under different circumstances, by different researchers with different objectives and methodologies. Some of these are listed below which are important in data capturing:

- Household: The household's definition is vital in guiding proper collection of data on household size and energy consumption. Section 2.1 discusses the definition of the household which is necessary to be applied in data collection.

- Units of measurements: Units of measurements must be clearly presented in a study and should ever be standard units for ease of integration of data. It is common that recording consumption of fuels in their original unprocessed form normally does not pose any problem. For example, all the solid fuels such as firewood and charcoal are measured in kilograms and liquid fuels in litres. However, to estimate the total energy consumption of a household, all the different fuels must be converted to a common unit for analysis. Standard conversion tables need to be used in this case.

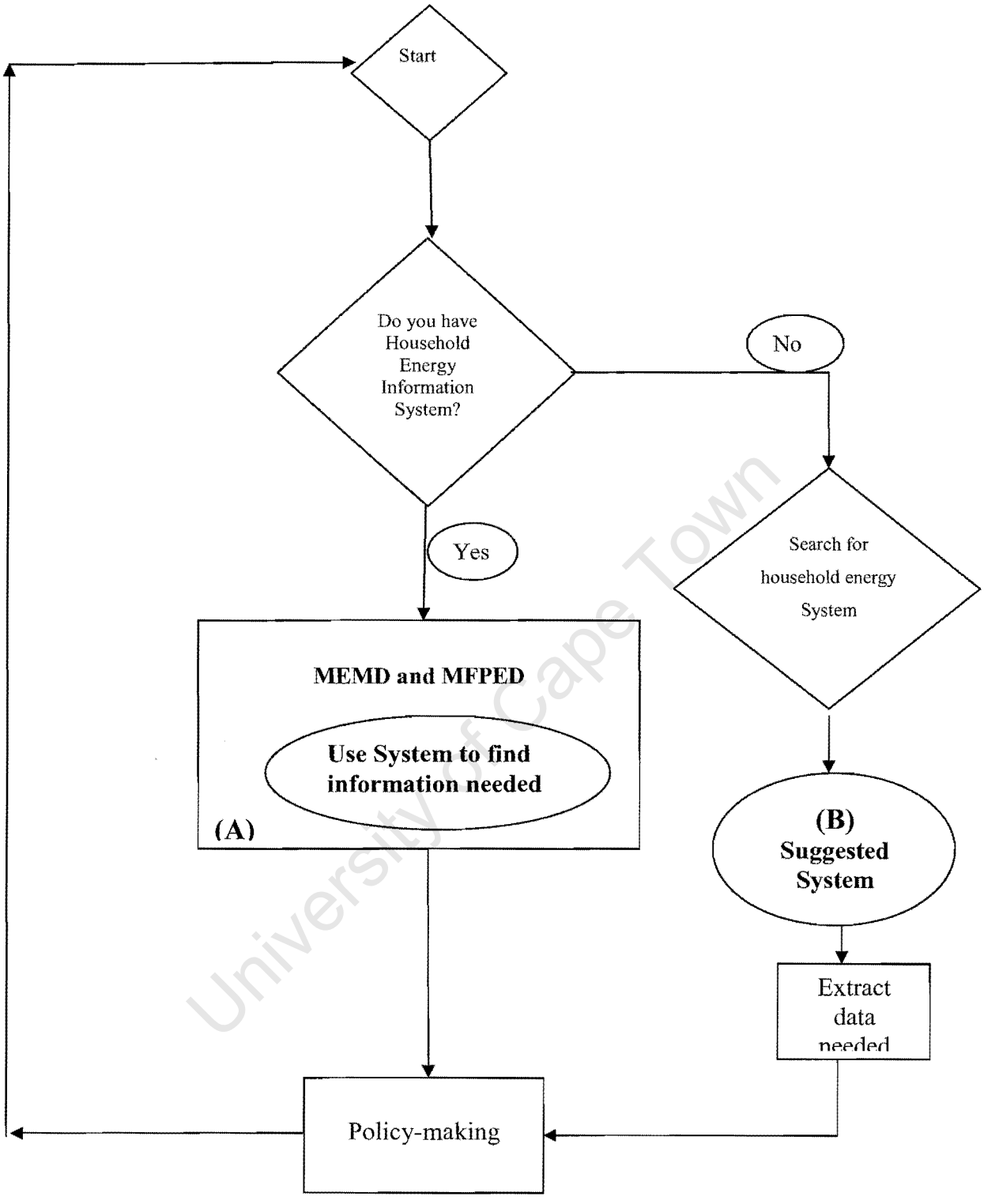
4.5 The System

The initial step to develop an information system is to find out if a household energy information system exists and whether the information available is adequate for policy-making and planning or not. The framework in Fig. 4.2 below describes the steps with two sub-routines shown.

Sub-routine "A" shows that there is an information system which can be used to search for the required data for policy-making and planning by MEMD, and MFPED. Thus, this shows that there is no need to develop a new system, as the existing one is satisfactory.

Sub-routine B shows that there is no adequate information system and no or limited data available to support policy-making and planning. Thus, the search for an information system to generate the required data for policy-making and planning becomes necessary. Fig. 4.3 presents the proposed household energy information system.

Fig. 4.2: Logical framework for Household Energy Information System



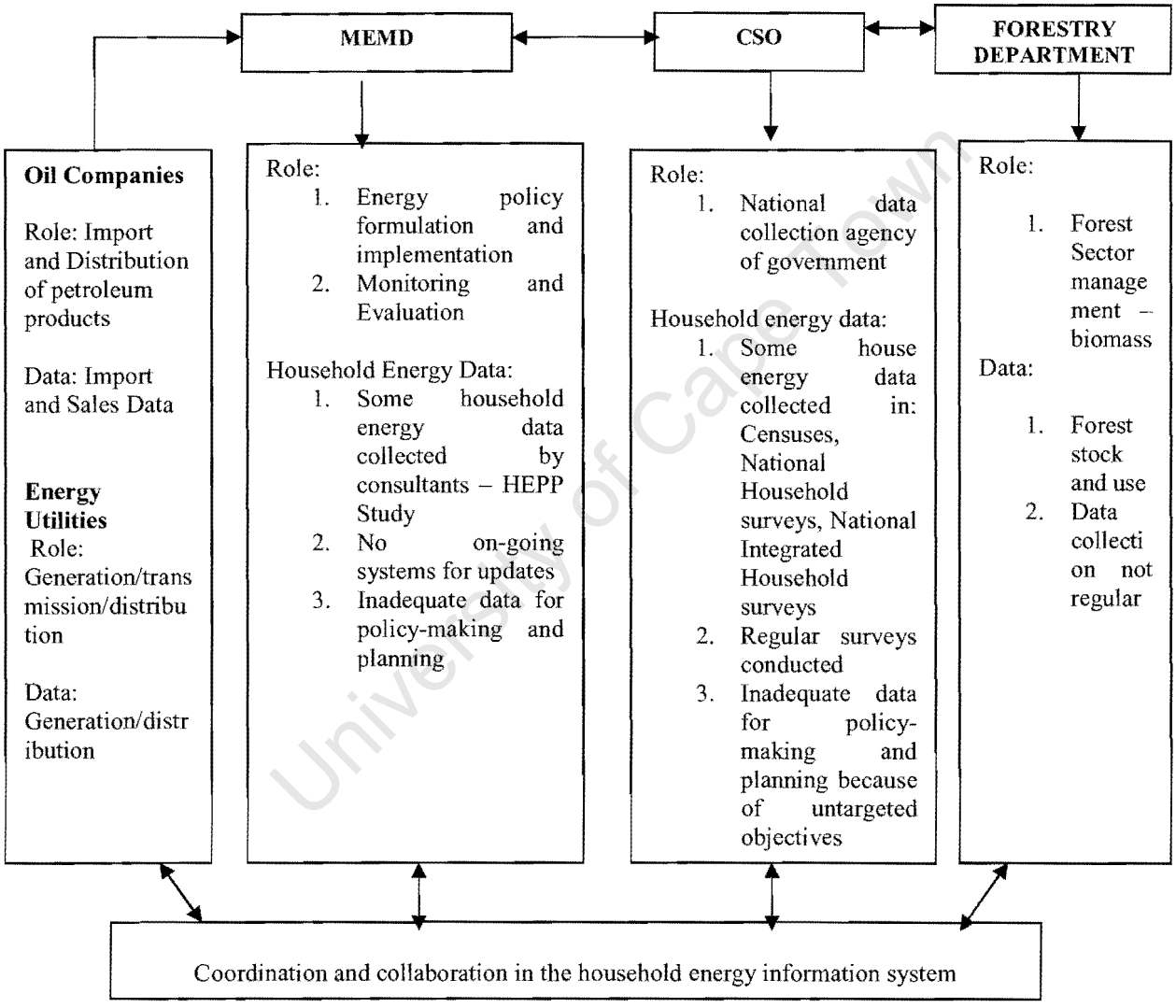
Thus each time a need for data for policy-making and planning arises, the framework is applied and the process becomes cyclical, hence an on-going system achieved.

For the proper collection and management of household energy information, an orderly method that encompasses all relevant energy institutions requires to be developed for the collection and analysis

of the core and peripheral information. This leads to a modification of the current uncoordinated framework shown in Fig. 4.3 below.

Household energy information system shows that the major stakeholders in energy issues are MEMD, CSO, and Forestry Department. Fig 4.3 below presents what can be obtained from each of these bodies and how they interact with one another. The chart greatly enhances the conceptualization of the system.

Fig 4.3: Stakeholders in Household Energy Information

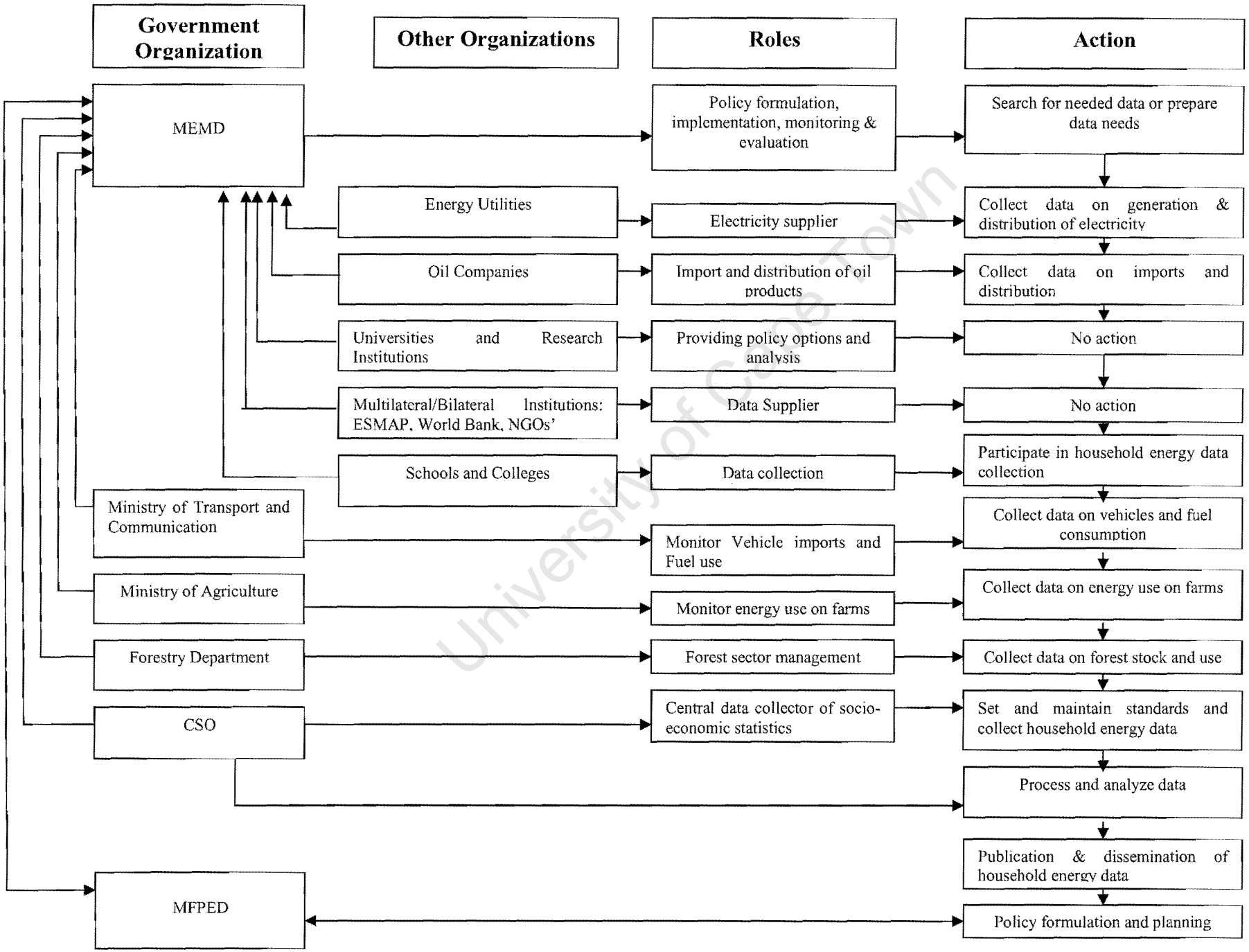


The chart in Fig 4.3 shows that though energy institutions act independently in the data collection and processing, they have great potential in working together in a coordinated framework thus providing opportunity for a possible system development.

In policy-making and planning, consistent and adequate data is required which can be better obtained through a coordinated framework of all energy institutions. For this reason, Task "B" in

the framework of Fig 4.2 is implemented as shown in Fig. 4.4 below. It is a conceptual framework of household energy information system for the collection, processing and analysis of household energy information by energy institutions.

Fig. 4.4: Suggested Schematic System for Household Energy Information



The schematic system of Sub-routine "B" of the framework in Fig.4.2 shows a continuous loop for household energy collection and policy-making and planning. This is because policy formulation and implementation is a cyclical process which requires an up-to-date and adequate data for effective monitoring and evaluation of the performance of the household sector. The schematic system shows that the system for household energy information is on-going from the data requirement by MEMD and MFPED for policy-making and planning to the need to review the existing data by the same government ministries. This process is cyclical due to dynamics in socio-economic aspects such as demographic changes and income levels which regularly need review to understand changes in energy use types. Fig 4.4 shows that using the scheme can increase the amount and quality of household energy information as the respective energy relevant institutions shown in Fig 4.4 are involved in data collection, data and policy analysis, policy formulation and planning.

The schematic household energy information system presents strategies to improve on the existing weak collaborative effort amongst energy institutions (see Fig. 4.3) and to facilitate understanding of the dynamics in the household energy sector, especially how people are shifting between use of different fuels and the underlying factors behind the shifts. The objective of the system is to strengthen the weak collaborative effort through the proposed coordinating framework and to have an organized data on household energy information system that is adequate and suitable for effective planning.

The flow chart shows that effective coordination among energy institutions, government ministries, bilateral/multi-lateral organizations and NGOs', and MEMD can be realized if the system is implemented. As shown, various energy actors have a possibility to feed the government Ministry of Energy and Minerals with the required energy data. In addition to the national household energy survey that are often conducted by CSO, other sources such as energy institutions, government ministries, Universities/research institutes, and schools and colleges are possible sources of a wealth of household energy data for MEMD and MFPED.

An important feature of the system is the proposed use of schools and colleges (Visagie, 2002) in data collection. It is argued that for cost effective data collection, schools and colleges are preferred firstly as the data are reliable and secondly the exercise provides opportunity for schools and colleges to learn about energy issues and the necessary skills for surveys.

The CSO is important in the system especially in providing high quality services in data collection. Besides, it can promote standardization in the collection, analysis and publications of household energy statistics. This is to ensure uniformity in quality, adequacy of coverage and reliability of household energy information.

The MEMD that is fed with the essential data for policy-making and planning is responsible for coordinating all energy use in the country. It also liaises with other government ministries and energy supply industries for the necessary data for policy-making and planning. Though it is concerned primarily with commercial energy sources, non-commercial energy sources have also gained significance in government due to the need to curb on inefficient use of biomass resources (MEMD, 2002).

The universities and research institutions will provide technical advice in relation to policy options and analysis of data for MEMD and MFPED. The multilateral institutions will be data suppliers to MEMD where possibly household energy information may be obtained for policy analysis and formulation.

In countries that have no crude oil deposits, the oil companies are responsible for the importation and marketing of oil products. Examples of the renowned oil companies include Shell, Caltex, Total, and Mobil which also collect energy data that is useful for the Ministry of Energy and Minerals development. Within Energy utilities, Electricity Distribution Companies are responsible for the management and distribution of electricity. The distribution company is a source of household energy information for MEMD.

4.5.1 Functions

It is essential to define clearly the functions of the various institutions that play a role in energy data The functions of the system include data collection, organization and storage, data analysis, policy analysis and formulation. These functions are described below.

4.5.1.1 Data Collection

The key player in the data collection on behalf of MEMD as shown in the system above is the CSO. The CSO constitutes the principal data collecting and disseminating agency responsible for co-

coordinating, monitoring and supervising the national statistical system and thus it is the agency that can be entrusted with the household energy data collection of the core information required.

However, all energy related institutions should collect the core information. Other institutions that are potential sources of energy data for MEMD include:

- Government ministries such as:
  - Transport for data on fuel consumption on all modes of transport such as land, air and water, and
  - Agriculture for data on energy use on farms.
- Energy institutions such as:
  - Electric utilities for data on electricity consumption and
  - Oil companies for data petroleum products consumption.
- Universities and Research Institutes also collect energy data as well as provide policy options, and
- Schools and colleges that can provide cost effective data collection.

The above institutions can collect and feed MEMD with the necessary data for energy policy-making and planning. However, it is essential that all energy institutions and the related ones collect the core information but depending on the objectives of the survey. Besides, peripheral information should be collected as well.

Before conducting any actual field data collection, it is appropriate that initial steps be taken by CSO, government ministries, energy institutions, and universities/research institutes to review the existing data sources. It is probable that the required data can be produced from secondary sources such as existing statistics, published and unpublished reports, macro and sectoral plans and programmes for the household sector.

The documentation review method has some advantages. It will provide comprehensive and past information on the household energy sector since the information may already be in existence. Besides, there are few biases about information. The constraints with this method are that the documentation review often takes much time, information may not be complete and the review is not a flexible means to get data. More importantly, one needs to know clearly what one is looking for (McNamara, www.mapnp.org\l).

In view of the above, primary data on energy use pattern is still important and needs to be collected. Thus, in this case, the design of questionnaires and surveys by the CSO becomes essential and within the scope of the prepared data needs of MEMD. Precaution needs to be taken into account in the design of questionnaire, as the collection of primary data on household energy is often difficult especially for non-commercial energy sources. Primary data on end-use energy consumption by households by fuel source and demand category such as cooking, lighting, cooling, and space heating are included. Prior to the main survey, it is essential to test the applicability of the questionnaires through a pilot survey. The purpose of the pilot survey is to try and understand the most important parameters for tapping information and data on household energy use. It is also to establish the flow and consistency of the questions.

Questionnaires usually generate significant results in household (energy) surveys as lots of information can be obtained quickly and easily from people in a non-threatening way (McNamara, www.mapnp.org\). Further, questionnaires can be completely anonymous, they are inexpensive to administer, relatively easy to compare and analyze, can be administered to many people and give lots of data. In addition, many sample questionnaires already exist which can be modified to suit situations (McNamara, www.mapnp.org\). The end-uses of fuels, household energy needs, household characteristics, and number of households using different fuel types for different end-uses can be obtained through questionnaires.

A combination of interviews and questionnaire techniques are the best ways of collecting the required household energy information. As many countries in Africa have similar experiences, tools for data collection like the questionnaires could be standardized across countries. Further more, countries could collaborate more in terms of compatible databases, data analysis and dissemination models through regional agencies such as New Partnership for Africa's Development, NEPAD, and the African Energy Information System.

Interview methods can only be applied in household energy data collection where the overall purpose of using this data collection method is to fully understand the household's impressions or experiences with, for example, the various fuel sources, appliances used and/or constraints with the fuel sources and appliances. Further, the interviewer can learn more about the respondent answers to questionnaires in order to aid in building some qualitative data.

There are advantages and disadvantages by using interview method. The interviewer obtains a full range and depth of information (McNamara, www.mapnp.org\) on households, and fuels and

devices used in the homestead. The method also allows flexibility in interviewing the households, and in addition, helps in building a relationship with respondents for future surveys. Fuel preferences and constraints in using the fuel types for different end-uses can be obtained through interviews for the advantages that interview method has.

Conversely, there are problems with the interview method. The method takes much time to cover all the sampled households in the survey. The interview results from various interviewers can be difficult to analyze and compare if the overall purpose is to understand someone's impressions or experiences. This is because this approach will generate qualitative information which may be difficult to compare. Moreover, the exercise can be costly in terms of personnel and documentation involved, and generally the interviewers can influence household responses.

In light of the above, the method of data collection on household energy use and patterns in relation to socio-economic variables vary not only from one type of survey to another but also with the different fuels.

4.5.1.2 Data Organization and storage

Data must be organized in a format that will facilitate the manipulation and analysis tasks that will be required. A suitable approach should be used that categorizes data, for example, into various socio-economic characteristics such as energy use patterns and income groups. However, this is fully dependent on the source of data.

The CSO is the central institution that could be responsible for organizing the data collected from surveys. This is because the institution has the required technical skills and experience in the area of processing data. Thus, it can provide high quality work in organizing the data into appropriate tables and graphs for analysis. Organizing data gathered in a comprehensive and consistent way for analysis and eventual policy-making is more or less the final stage in generating household energy information.

Storage of organized data is essential for easy retrieving. Appropriate computer software and database development is necessary for storage, especially, of large volumes of national data.

4.5.1.3 Data Analysis

The organized data has to be analyzed in order for it to be meaningful and applicable to policy analysis and formulation. Data management system such as "Domestic Energy Use Database" proposed by Afrane-Okese (1998) can help the users to manipulate data without extensive knowledge of computers and computer programming.

MEMD, CSO and Universities are institutions that can carry out the analysis jointly as they have the necessary skills and experience in data analysis. What the data seems to be saying can be discovered by using simple arithmetic and easy-to-draw pictures to summarize data. For future consumptions, probability method can provide a mechanism for measuring, expressing, and analyzing the uncertainties associated. Thus, the amount of energy consumed by the various sectors and in this case, the households, is determined by calculating the energy used in households over a given time period. Estimates of annual consumptions can be derived from the consumption patterns of households.

4.5.1.4 Data Publication and Dissemination

The statistical information collected and produced on household energy by the responsible institution has no value unless it is disseminated to stakeholders, that is, consumers, investors and NGOs who are the recipients or drivers for energy information collection. In the new information system, the public should be allowed to discuss the survey results before they are published for dissemination. Public participation in the discussion of the results is essential for the public to express their opinion about the survey results before it is documented for dissemination to the energy stakeholders such as relevant government ministries (Transport and Agriculture), private sector, and financiers. Public participation may help in clarifying controversial issues.

Stakeholders/potential users must be made aware of the existence of such statistical information on household energy and the available capacity for production of information. According to Visagie (2002:8), the dissemination of energy data is a crucial aspect of the statistical endeavor. Visagie (2002) argues that any national statistical body has a public duty to disseminate its output as it is funded from the public purse, so they have a right to expect to see the fruits of their investment. Furthermore, Visagie (2002) argues that ordinary citizens who contribute to supplying the data, from which the statistics are compiled, will be more cooperative in the data collection process if they can see how their contributions are used and valued – and perhaps even derive benefit from the statistics themselves. Visagie's observation is good and could generate useful results.

A variety of dissemination formats will be required, covering different levels of detail as well as different media. This study suggests adopting the existing format of developed countries, for example, a study manual of the Energy Information Administration, US Department of Energy, on "Energy Characteristics of United States (US) Households 1993" (See Appendix 5). This is one of the ways of disseminating household energy information, as it is easy to read the publication. Similar publications will be required for Uganda and other African countries too. This manual could provide useful pointers for the development of a local standards manual for Africa in general. The information manual should be such that later expansion is possible without having to change the structure. Instead of the traditional approach of dissemination of results of surveys, that is, reports and workshops, African countries could adopt the appropriate publication format for dissemination that is applied by US for its "Residential Energy Consumption Survey" information dissemination.

To demonstrate this suggestion, a brochure containing detailed illustration and maps presenting key survey findings and explanatory information on household energy consumption survey could capture stakeholders' attention more than the traditional method. Applying the proposed format of dissemination in Uganda and Africa in general would forge ahead a standardized dissemination format, and with this, African countries would find it easier to compare their household energy issues, and also compare the physical characteristics and energy use patterns of homes of the different countries in Africa, the size of households, equipment and appliances the households have. In such cases, the manual or brochure would provide at a glance, comprehensive information on energy use in households in Africa. The information should be packaged to suit the information needs and influence different target groups.

4.5.1.5 Energy Policy Analysis

This is to be done by the universities and in particular research institutes based on analyzed energy data by MEMD, CSO, and universities. Analysis of energy policy should be made part of the core of the research institutes and universities. The three main areas of particular emphasis at these institutions are *accessibility, inequality and poverty.*

The universities and research institutes should build an active forum for energy policy debate through its working papers and workshop series.

4.5.1.6 Energy Policy Formulation

The formulation of a comprehensive energy policy is a basic prerequisite to the development of efficient energy sources and use patterns. Policy formulation must often take into account competing peripheral socio-economic and environmental goals *(for example, poverty alleviation, job creation, local and global pollution)* for the households. Such a policy will require as basic input, reliable information regarding existing and potential energy sources, interactions with other sectors as well as the security of supply of these sources. The role of the designed information system is to enable policy makers see how people shift between the use of different fuels and thus plan on the basis of the factors allowing the shifts.

MEMD and MFPED are core participants in the process of policy formulation. In the MPFED, an Energy desk officer exists to coordinate energy policy issues between the two ministries. MFPED is also the seat for budget allocation for MEMD and budgeting is done according to policies formulated by the two ministries.

Policy formulation is possible from an organized framework point of view of energy institutions, as depicted in the developed system which ensures availability of a great amount of data for both commercial and non-commercial energy sources. Once the data becomes obsolete or inadequate due to dynamic changes, the logical framework in Fig 4.2 is applied by MEMD and MFPED, as it is a cyclical loop, to check the validity of the existing information. Hence an on-going system for household energy information is achieved for policy-making and planning.

The relationships between MEMD and other government departments (Transport, Agriculture and Forestry Department) and NGOs' are crucial to its ability to coordinate and manage energy sector-wide policy issues. Thus cooperation and coordination amongst all institutions will promote the success of the system for household energy collection and analysis for policy-making and planning.

4.5.2 Possible Constraints of the System

There could be constraints in the system which could be caused by having a number of energy institutions collecting household energy data. These include:

- **Possibility of conflicting energy data**

It is possible that data collected under different conditions by different researchers with different objectives and survey methodologies can be conflicting and confusing. In this system, the energy institutions, government ministries and bilateral/multilateral bodies may capture data in different formats and units and this can cause confusion to MEMD and MFPED especially on how to integrate and apply the data to policy-making and planning. In certain cases, it is also possible that units may be ignored to be inserted in the data collected presumably that all energy institutions and users of the data know it, thus causing confusion and time wasting to verify the units.

- **Conformity of data to the required standards may be a problem.**

This would require some manipulation in order to fit into a common form for the data from all other studies or submissions. This may lead to estimation that may have negative impact on policies made if the estimates are far from precision. Thus, normal statistical problems of estimation and units of measurements may be common in the system that may affect proper planning for the household sector as it is currently the case. Thus coordination in energy data is essential to solve these statistical problems.

- **Lack of focused objectives**

This can cause omission of important data in a study and can result in the collection of information that is not required. For example, supply-oriented information could be collected instead of end-use data. Data such as on energy use by lighting and cooking may not be collected yet they are essential for planning.

- **Lack of representativeness of data**

In the case for surveys, the sampling methods used in the study may not be indicated in the data presented, and besides the sample size and the population from which the sample was selected may not be stated. Thus, it becomes difficult to establish representativeness of the data presented, hence affected the use of it for policy-making and planning.

5.

Application of System to Uganda

5.1 Introduction

The system for household energy information developed in Chapter 4 is applied to Uganda as a case study so as to demonstrate the potential of the system in supporting policy-making so that the purpose for which it is designed becomes meaningful. The system seeks to increase the level of integration amongst of energy institutions. To achieve this, ample time is needed to test the viability of the system. This would have to be incorporated progressively. However, because of the many shortcomings in Uganda that were highlighted in Chapter 3, the system needs to be applied with care so that it can take care of the shortcomings of the existing structure in the energy institutions in the country.

Two options are available for the application of the system. One is to operationalize the system by retaining the existing structure of MEMD and adding responsibility to the existing energy divisions. However, this will depend on the capacity of the ministry to handle the additional tasks. The other option is to create more units to take care of the system.

There are problems associated with both options which are dealt with in Section 5.2 below and possible solutions suggested. The adaptation of the system to Uganda depends on the current structure of MEMD and its capacity to handle the requirements of the system.

5.2 Structure and Capacity of MEMD

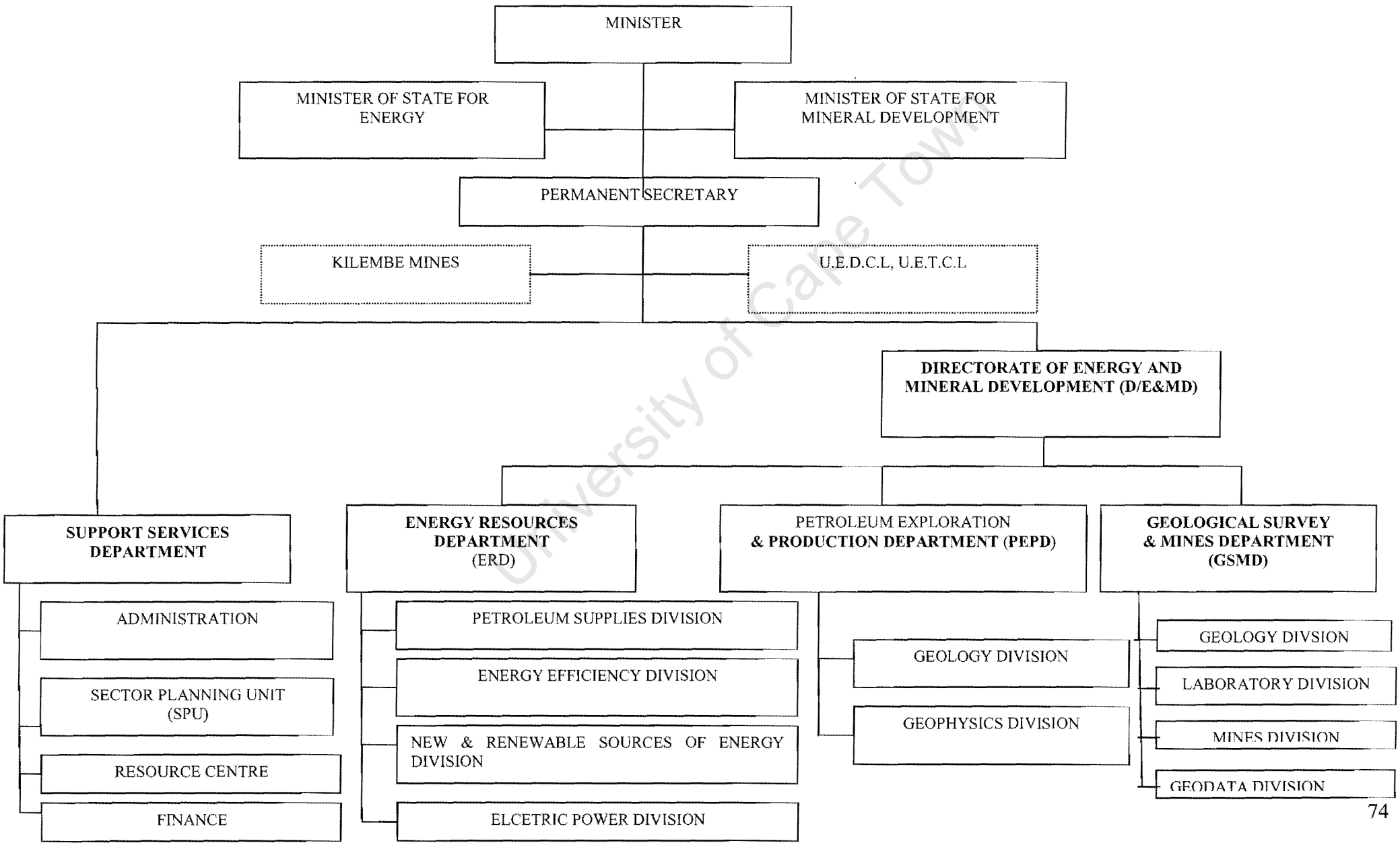
MEMD is responsible for the energy sector, dealing specifically with energy policy formulation, implementation and monitoring. Thus its role for household energy information collection is minimal.

In Fig 5.1 below, there are four departments in MEMD, namely, Support Services, Energy Resources, Petroleum Exploration and Production, and Geological Survey and Mines Departments which are further sub-divided into divisions responsible for respective issues. Fig. 5.1 shows a general organogram and Appendix 6 shows a detailed organogram for Energy Resources Department.

Figure 5.1

EXISTING ORGANISATION STRUCTURE: MINISTRY OF ENERGY & MINERAL DEVELOPMENT

Source: MEMD (2001)



The organograms raise certain questions. These are:

- How can the suggested system fit into the existing MEMD?
- Does MEMD have the capacity to handle the system developed?

It is necessary that the suggested system be fitted into the existing MEMD. This depends on the capacity of MEMD to handle the system developed. The current roles of the respective divisions of Energy Resources Department and the capacity of MEMD are important factors that determine the absorption of the system.

Energy Resource Department is important in relation to the system as it houses the divisions of New and Renewable Sources, Electric power, Petroleum Supplies, and Energy Efficiency (MEMD, 2001) that handle energy related household energy.

5.2.1 Role of Energy Resources Department

The application of the system to Uganda can be examined in relation to the roles of Energy Resources Department. Table 5.1 below summaries the key objectives and some salient functions of the divisions of Energy Resources Department. A critical analysis of the functions of each division shows that each division is occupied with their respective functions and thus would have limited time for additional requirements of the household energy information system. Even though Energy Efficiency Division has some elements of household energy information as indicated in the functions in Table 5.1, it is mainly for efficient use of energy resources hence dealing with one aspect of household energy information, that is, traditional appliances such as cook stoves. Thus, the functions of the division exclude major issues such as energy use patterns of households, as highlighted below which the designed system could adequately handle and upon which policy-making and planning could be based.

Table 5.1: Summary of Functions of Energy Divisions

Source: MPS (2000)

Division	Objective of Division	Functions
New and Renewable Sources of Energy (NRSE)	To ensure that new and renewable sources of energy are effectively developed and applied	1. Identifying suitable sources of energy to be adopted or developed 2. Encouraging specialized institutions to research into and develop NRSE 3. Mobilizing resources and technical assistance for development of NRSE 4. Coordinating activities of various institutions/Local Government in relation to NRSE 5. Coordinate and supervise Government projects on the development of NRSE
Electric Power	To ensure sufficient, reliable and low cost electricity supply in the country	1. Identifying opportunities for development of electric power supplies and encouraging private sector and other institutions to take up development 2. Monitoring and coordinating operations of various power development, production and supply organizations 3. Mobilizing resources and technical assistance for the development of electric power supplies. 4. Providing technical and operational support to National Electricity Regulation Board
Energy Efficiency	To ensure efficient utilization of energy in all sectors of the economy, including industry, commercial buildings, institutions, households, transport and agriculture	1. Setting efficiency standards for utilization of various types of energy sources 2. Monitoring efficiency of energy utilization in all spheres of activity 3. Providing advice and technical guidance to energy users on improving efficiency of utilization and minimization of environmental pollution.
Petroleum Supplies	To ensure adequate and reliable availability of petroleum supplies in all areas of the country, at the least cost to the economy	1. Provision of data for use in National plans for supply planning 2. Forecasting petroleum products requirements 3. Monitoring and advising on petroleum supplies to ensure sufficiency and availability 4. Monitoring and guiding activities of Oil Companies to ensure compliance with National policies, legislations, standards and plans

As observed in Section 3.2, household energy information cuts across the divisions of electric, energy efficiency, and New and Renewable Sources, implying that no division is directly responsible for household energy information. Hence directing household energy issues and policies becomes a problem for the new system. Considering the importance of household energy

information (see Chapter 2) and because all the existing divisions are doing their respective jobs, it is suggested that two separate new units be created which would be responsible for implementing the designed system. One of them is to be responsible for household energy sector, both for core and peripheral energy information. This unit could named the "Household Energy Information Unit" (HEIU). The other unit could be the "Policy Unit".

The HEIU is necessary for the following reasons:

- To organize and coordinate the activities of the existing units in respect to household energy issues and hence take care of the cross-cutting household energy issues
- To be a household energy information center thus takes care of the current scattered reports on household energy.
- To act as a focal point for MEMD, MFPED and energy institutions for household energy information for policy-making and planning
- To be responsible for household energy

Thus, the HEIU is to coordinate the activities of the existing "Energy Resource Department", with the aim to improve the household energy information capabilities of MEMD for informed decision-making and besides, improve the availability and timeliness of household energy information. These activities are to be conducted in collaboration with the energy divisions of Energy Resource Department in MEMD such as NRSE Division, Energy Efficiency Division, Electric Division and Petroleum Supplies Division and other energy institutions and government ministries for the use of harmonized statistical concepts compatible with internationally recognized statistical standards. This can contribute to the development of reliable, standardized and customized national household energy statistics and indicators that are needed by policy makers and planners, analysts, decision makers, and researchers.

The Policy Unit will be responsible for policies on household energy. MEMD (2002) states that "The State shall promote and implement energy policies that will ensure that people's basic needs and those of environmental preservation are met" The policy unit is currently non-existent and thus the need for the Policy Unit becomes apparent not only as a Constitutional requirement but also for directing of government programmes related to household energy.

The specific roles of the Policy Unit would include:

- Formulation of policies on household energy issues such as access to modern energy sources.
- Policy analysis.
- Form a framework for effective institutional linkages for policy-making bodies.

Through the creation of these units, the roles of each division is likely to be streamlined and thus avoid the cross-cutting issues of household energy and make it easier for policy-makers to direct policies to the appropriate energy divisions for effective implementation.

5.2.2 Capacity to Handle the System

The broad sectoral issues in Uganda show there are inadequacies within Government institutions to plan for and monitor the energy sector due to the following (MEMD, 2002):

- Understaffing in key areas,
- Budgetary constraints, and
- Lack of appropriate curricular in energy studies at institutions of higher learning.

These are generic problems that are common in most government institutions in Africa that negatively affect the operations of the sector. The existing technical capacity of MEMD shows that for all the four energy divisions combined, the current capacity of Energy resource Department stands at 15 personnel with one Principal, ten Seniors and four Energy Officers (MEMD, 2001) who are distributed in the four divisions. There are three vacant positions that still require filling in order to increase the capacity of the department.

For the purpose of this study, technical capacity refers to the availability of personnel especially in the Energy Resource Department to implement the system and carry out household energy collection in line with the proposed system. Availability of personnel from the rank of energy Officers to the Principal Energy officers is considered important as this cadre are presumably well versed with energy issues and terminologies when training of enumerators is considered. The current capacity of the Energy Resource Department shows that it is understaffed. Besides, these officers have their respective jobs to do. Thus personnel for the two units created should be recruited if the country is to benefit from the system, competence maximization and the opportunities that exist for coordination within the energy resource department and related energy institutions.

For the HEIU, a Principal Energy Officer, two Senior Energy Officers and three Energy Officers would initially be required for the system and to back up the existing staff for the following reasons:

- To set up and maintain the unit in line the system developed.
- To execute the system.
- To be the focal point for adequate co-ordination and information sharing among CSO, MFPED and within MEMD.
- To re-organize the scattered reports and generate adequate information on household energy consumption for the country.

A similar number of personnel for the Policy Unit are essential to streamline the existing policy attempts.

In order for the new units to operate efficiently and play their respective roles in the socio-economic development of the household sector, government support is vital to strengthen and streamline household energy information and related policies. To achieve this objective it is necessary for government to:

- Strengthen the roles and functions of the new units and involve the various institutions in the energy sector for the development of the units
- Create a transparent legal framework for the units
- Build capacity especially for the policy unit for better formulation and implementation of household energy policies and programmes, and
- Involve all stakeholders in the formulation of new policies in the household energy sector.

Adequate funding of the units by government through re-allocation of funds from defence (*political coffers*) to the units would enhance the support for the units as outlined above. This would be for the betterment and livelihood of the households.

5.3 Energy Resource Center

There is provision for Energy Resource center in the structure of MEMD. However, it is not active, as the positions in the center are not yet filled (MEMD, 2001). Hence there is neither a library nor a resource center. The positions in the Energy Resource Center need to be filled and the center made operational for the functions described below. Probable reasons for the inactive center are:

- Restrictions on the recruitment of civil servants, and

- The failure by MEMD to realize the importance of a Resource Center for the ministry.

These factors could have contributed to the scattered reports in the various energy divisions and other government institutions.

In the system developed, Energy Resource Center is necessary to carry out the following functions:

- Receive and maintain a database of all reports and surveys done by MEMD.
- Maintain related energy information from government ministries such as Transport and Agriculture.
- Be a center for energy information from all energy institutions such as electric utilities, and oil companies.
- Solve the problem of scattered reports thus improve hard copy information storage, and
- Be a public resource center as a way of disseminating household energy information.

Thus the above suggestions made require to be implemented by government in order to be able to apply the system to Uganda. This is likely to solve the policy issues as well the information base on household energy for policy-making and planning. Due to the limited time, the system could not be tested thus this needs to be done.

6.

Policy Implications of the System to Uganda

The study shows that adequate and comprehensive data for policy-making and planning can be generated in an economy with a system that promotes coordination and collaboration among energy institutions, and that sound energy policies and planning can be effectively achieved from the information system.

Though the policies that exist can be applied in the country, they require strengthening in order for the system to work. The measures discussed below can be made effective through legislation or indirectly. Below are suggestions that can make the system work.

- **Acceptance of the system**

Government should establish acceptance of such a system for policy-making and planning. In this way, government acceptance can lead to the implementation of the system.

- **Enforcement of data collection and analysis by respective bodies**

Government should get a policy to ensure that all related government ministries collect and send the energy data to Ministries of Energy and Minerals Development, and of Finance Planning and Economic Development. Thus, a mechanism should be set up by government that enforces energy data collection and analysis of household energy an ongoing and permanent feature (Ogunlade, 1985:88) for the system as energy use patterns are time dependent.

- **Sub-contracting of data collection and analysis**

Thus MEMD should seek legal power to sub-contract the work to other institutions such as universities which have analytical skills of data besides the generic collection methods in cases where MEMD does not have the capacity to conduct household energy information.

- **Registration of Organizations**

Government should make it mandatory for all energy-related NGO's private companies, through their registration, to supply energy information to government. Increased emphasis should be made for the need for the data as a condition for registration.

Energy projects/programmes by NGOs can be potential areas of data collection on household energy. Thus it would require regularizing the roles of energy projects/programmes to include household energy data contributors by administering generic questions such as those in Table 4.1 to the projects that target household energy use.

- **Funding**

Appropriate financing mechanisms to support the system should be established. Government should provide funding directly and indirectly for equipment and human resource. This would mean increasing the allocation of actual budget to MEMD from the National Budget to accommodate the necessary requirements.

- **Information Dissemination**

A mechanism should be set up for the dissemination of household energy information to the stakeholders, that is, consumers, investors, financiers and NGOs by the responsible institutions. Thus the information should be made available not only on computerized forms but also published for the stakeholders to use it. To enforce dissemination, MFPED should make it mandatory to have the information.

For the measures to be effectively implemented, regular meetings for MEMD and CSO and relevant institutions are important in order to constantly review progress of the system and probably modify it where necessary.

The list of policy measures may not be exhaustive due to socio-economic and political dynamics and besides additional measures may become necessary on testing of the system.

7.

Conclusion and Recommendations

The study has illustrated the importance for a consistent and regularly planned household energy information collection for energy planning and implementation for both policy-makers and planners.

The study has shown that Africa in general and Uganda in particular, does not have a structured and comprehensive household energy collection system. Instead ad hoc surveys that generate data that are not suitable for long-term planning process are common.

The study has also shown that information on household energy exists but are scattered in various energy divisions of the Department of Energy in the MEMD, as well as in other related energy institutions such as the CSO, government ministries and NGOs'. Further, the study has stressed that such information are not easy to integrate for planning purpose because of the different base periods. Lack of collaboration arising from lack of an organized scheme for household energy information was found to be a major factor hindering energy institutions in data collection and harmonization amongst African countries.

The study illustrates that energy sector and in particular household energy receives low priority in the development sector and thus limited funding allocation of resources to the sector for the improvement of the socio-economic conditions of the well being of the population. The study argues that if planning is put into practice, even the limited funding could generate valuable information on household energy. Further, recognition of the sector by donors, investors, policy-makers as well as planners is necessary.

The study has argued for the need for a comprehensive household energy information system for effective planning. Thus, this work has attempted to streamline household energy collection and analysis in Africa and Uganda as a case study by suggesting a system that involves collaboration and cooperation amongst all energy related institutions for effective policy-making and planning.

Cooperation in household energy information is seen to be the best possible option for collaboration and harmonization of household energy information. The study illustrates this through identifying

all the possible energy institutions in an economy that either collect or supply data for policy-making and planning.

For the system to work, the recommendations made in Chapter 6 are important and still apply to this chapter. In addition to those major policy recommendations, other recommendations include:

- The institutional structure be reviewed in respect to household energy information system developed and the suggestions made in Section 5.2.

- The system be tested at an appropriate time.

- MEMD and CSO to attain a collaborative effort and/or plan and work together towards conducting regular household energy surveys. This can be achieved or worked out through the preparation by MEMD her data needs and budget to CSO to carry out the household energy survey.

- Both CSO and MEMD be involved in the creation, management and updating of a database on household energy. Where external assistance is used, a package for staff training in survey work and data analysis in household energy is a necessary ingredient of the survey process, and once created, the database should be accessible and easy to up-to-date, for example, on a micro-computer with user-friendly software.

- MEMD to be a data collector as well as a policy-maker so as to be able to monitor the rational and sustainable use of energy resources by household sector.

- A comprehensive national household energy survey to be conducted to provide an overall picture of energy use and mix in the country. The information gathered and analyzed should be suitable for energy policy formulation, monitoring and evaluation.

- Household energy survey to be integrated into the household and socio-economic surveys conducted by CSO for continuous assessment of household energy use. This would enable minimization of the volume of resources needed for independent household surveys.

- Further study to be done to assess the applicability of the information generated from "National Domestic Energy Survey for Uganda" for policy-making and long-term planning which can form a basis for up-dating household energy in Uganda.

- Government to recognize household energy sector as a priority sector in the sector development plans and increase funding for the system developed. Besides, it is an area for poverty alleviation.

- Provision of training, skills and tools for formulating and implementing sound management interventions in the household energy sector be made.

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Appendix 1: **The Uganda Energy Balance 2001**

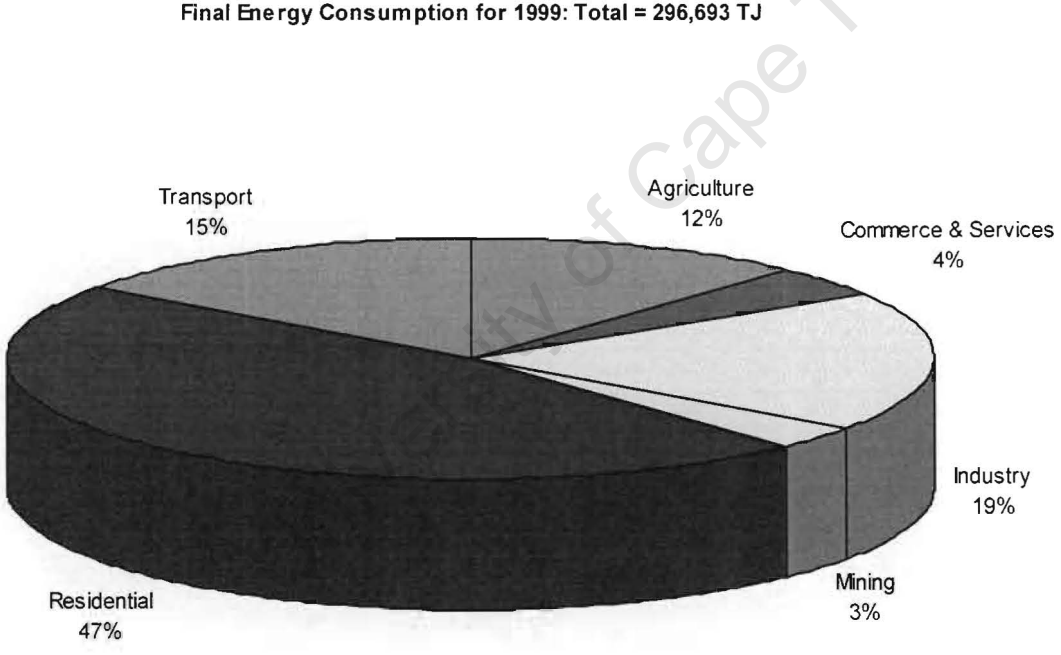
UNIT: Tons of Oil E1quivalent (TOE)

Source: MEMD (2001)

	Fuel wood	Charcoal	Residues	Gasoline	Av gas	Kerosene	Diesel	Fuel Oil	LPG	Electricity	TOTAL	%
National Production												
Imports	8,618,831	0	384,585	0	0	0	0	0	0	136,931	9,140,347	
Exports	0	0	0	158,171	34,608	50,002	171,162	35,907	1,598	120	451,569	
	0	0	0	0	0	0	0	0	0	-12,479	-12,479	
Primary Supply												
% All Primary Supply	8,618,831	0	384,585	158,171	34,608	50,002	171,162	35,907	1,598	124,572	9,579,438	
	90	*0*	*4*	*2*	*0*	*1*	*2*	*0*	*0*	*1*	*100*	
Transformation	-2,510,561	351,479	0	0	0	0	-344	0	0	103	-2,159,324	
Prod+Trans+Distr.Losses	-290,870	-16,737	-18,314	-7,532	-1,648	-2,381	-8,151	-1,710	-76	-46,054	-393,473	
Net Supply Available	5,817,399	334,742	366,272	150,639	32,960	47,621	163,012	34,198	1,522	78,501	7,026,865	
%Net Supply Available	83	5	5	2	0	1	2	0	0	1	100	
Residential/Commercial	5,414,026	334,742	366,272	0	0	38,097	0	0	1,218	59,082	6,213,436	88.4
Industry	403,373	0	0	0	0	0	16,301	34,198	304	19,178	473,354	6.7
Transport	0	0	0	150,639	32,960	9,524	130,409	0	0	0	323,533	4.6
Agriculture	0	0	0	0	0	0	16,301	0	0	0	16,301	0.2
Other	0	0	0	0	0	0	0	0	0	241	241	0.0
TOTAL CONSUMPTION	**5,817,399**	**334,742**	**366,272**	**150,639**	**32,960**	**47,621**	**163,012**	**34,198**	**1,522**	**78,501**	**7,026,865**	
% All Secondary Energy	***82.9***	*4.8*	*5.2*	*2.1*	*0.5*	***0.7***	*2.3*	*0.5*	*0.0*	*1.1*	*100*	

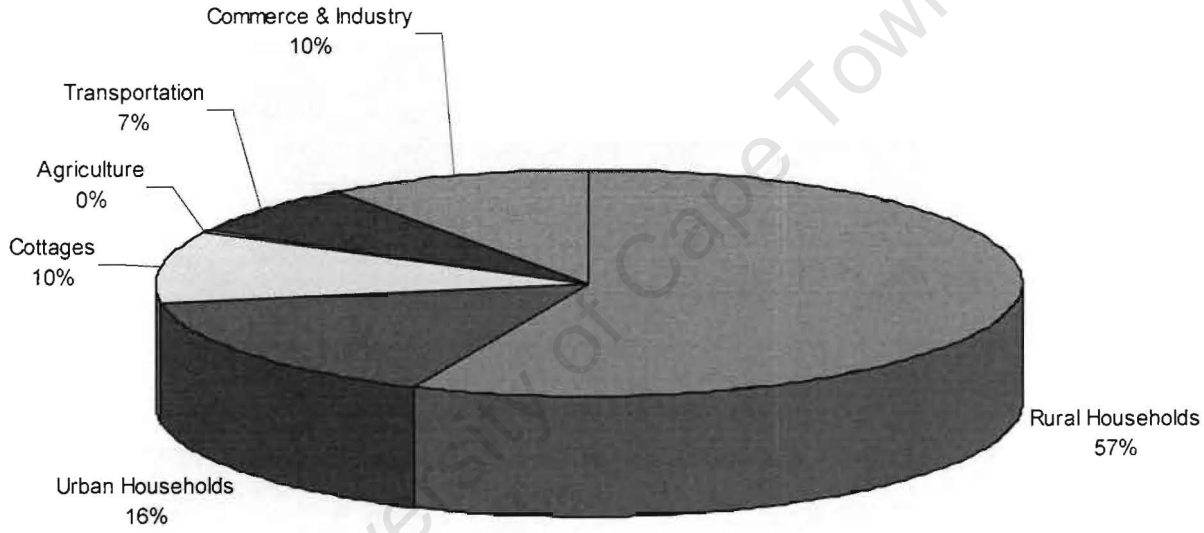
Appendix 2: Final Energy Consumption By Sector for Zimbabwe (1999)

Source: Adapted from Ministry of Mines and Energy, Zimbabwe (2002:9)



Appendix 3: Kenya's Total Energy Shares for All sectors, 2000.

Source: Kamfor Company Limited (2002).



Appendix 4: **List of Stakeholders Interviewed:**

1. Ministry of Energy and Mineral Development
   Amber House,
   P.o. Box 7270,
   Kampala, UGANDA

2. German Technical Cooperation
   Amber House, Room C201,
   Ministry of Energy and Mineral Development
   P.o. Box 7270,
   Kampala, UGANDA

3. NORPLAN
   Consulting Engineers and Planners
   Power and Renewable Energy Division
   Amber House, Room B205,
   Ministry of Energy and Mineral Development
   P.o. Box 7270,
   Kampala, UGANDA

4. Uganda Renewable Energy Association (UREA),
   Amber House, Room B201,
   P.o. Box 4236,
   Kampala, UGANDA

5. Forestry Department,
   National Biomass Study,
   P.o. Box 1613,
   Kampala, UGANDA

6. Forest Sector Co-ordination Secretariat
   Ministry of Water, Lands and Environment
   Bauman House, Parliament Avenue,
   P.o. Box 27314,Kampala, UGANDA

7. World Bank Office
   P.o. Box..
   Kampala, UGANDA

8. Uganda Bureau of Statistics,
   P.o. Box 13,
   Entebbe, UGANDA

9. Ministry of Finance and Economic Development,
   P.o. Box 8147,
   Kampala, UGANDA

Appendix 5: **Energy Characteristics of the United States (US) Households, 1993**

Residential
Energy
Consumption
Survey

Energy Information Administrati
U.S. Department of Energy
Washington, DC 20585

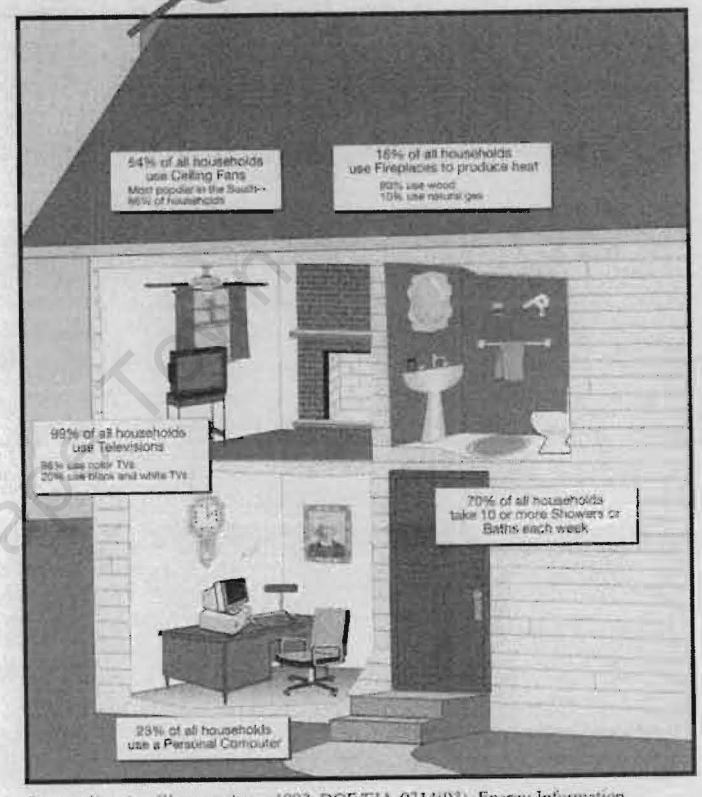
Energy Characteristics of U.S. Households

Note: Insulation data exclude apartments.

Source: *Housing Characteristics 1993*, DOE/EIA-0314(93), Energy Information Administration, Office of Energy Markets and End Use.

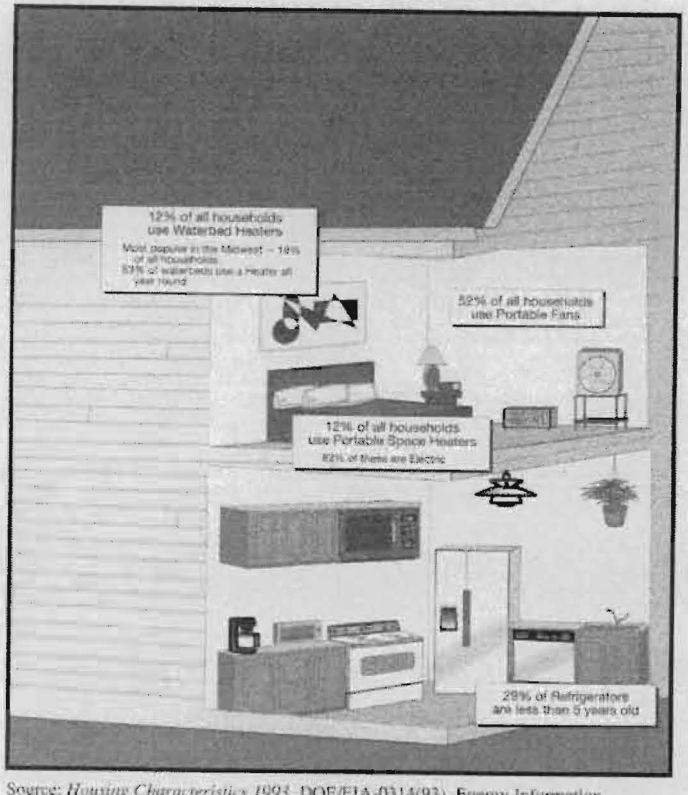
Prepared by the Office of Energy Markets and End Use, Energy Information Administration.

EIA RECS At a Glance



Source: *Housing Characteristics 1993*, DOE/EIA-0314(93), Energy Information Administration, Office of Energy Markets and End Use.

What are the physical characteristics and energy use patterns of homes in the United States? How do they differ by size, age, and type? How many occupants do they have? How are they heated and cooled? What equipment and appliances do they have? The answers are found in the Energy Information Administration report *Housing Characteristics 1993.*

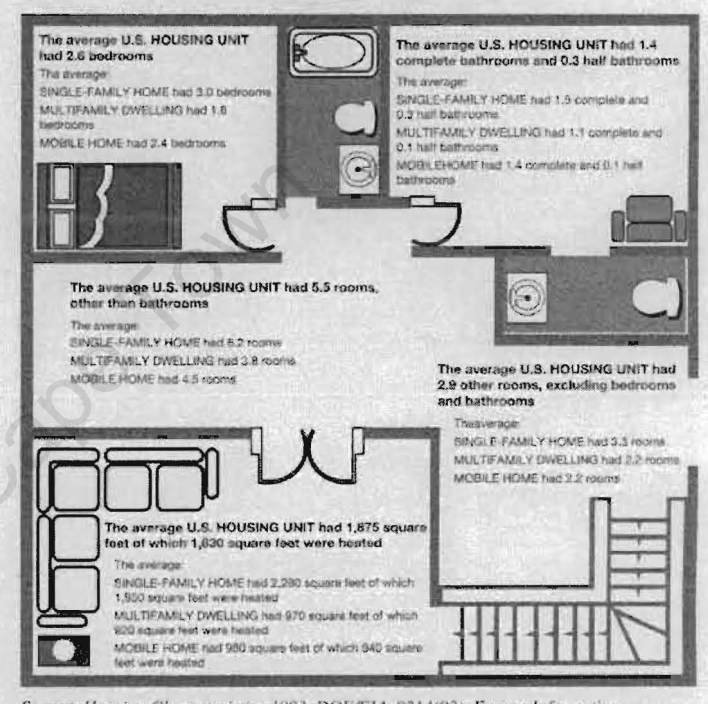


Source: *Housing Characteristics 1993*, DOE/EIA-0314(93), Energy Information Administration, Office of Energy Markets and End Use.

Based on the 1993 Residential Energy Consumption Survey—RECS—the report provides information on energy use in residential housing units in the United States. It gives comprehensive information about the physical characterisics of residential housing, number and types of appliances used, number and characteristics of occupants. A second report features data on energy consumption and expenditures.

EIA RECS At a Glance

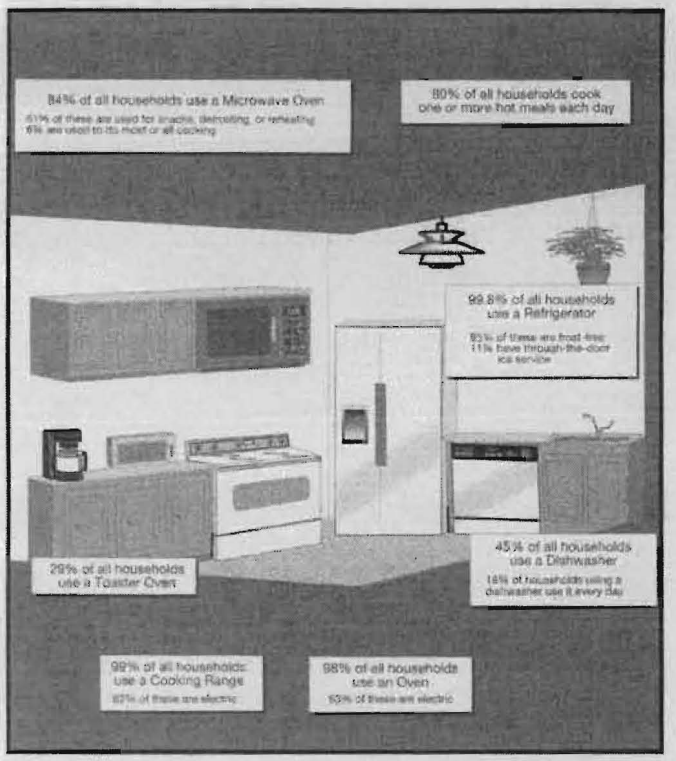
SQUARE-FOOTAGE AND NUMBER OF ROOMS IN U.S. HOUSING UNITS



Source: *Housing Characteristics 1993*, DOE/EIA-0314(93), Energy Information Administration, Office of Energy Markets and End Use.

There are some 97 million U.S. households — single family homes, multifamily dwellings, and mobile homes. The Energy Information Administration's 1993 Residential Energy Consumption Survey (RECS) covered a representative sample of over 7 thousand of these households. The most recent in a series of nationwide energy consumption surveys begun in 1978, the 1993 RECS includes new, detailed information about new home construction, emerging technologies, indoor and outdoor lighting, household appliances, equipment replacements, and energy efficiency measures. It also updates previous survey data, including information on air-conditioning and residential vehicles.

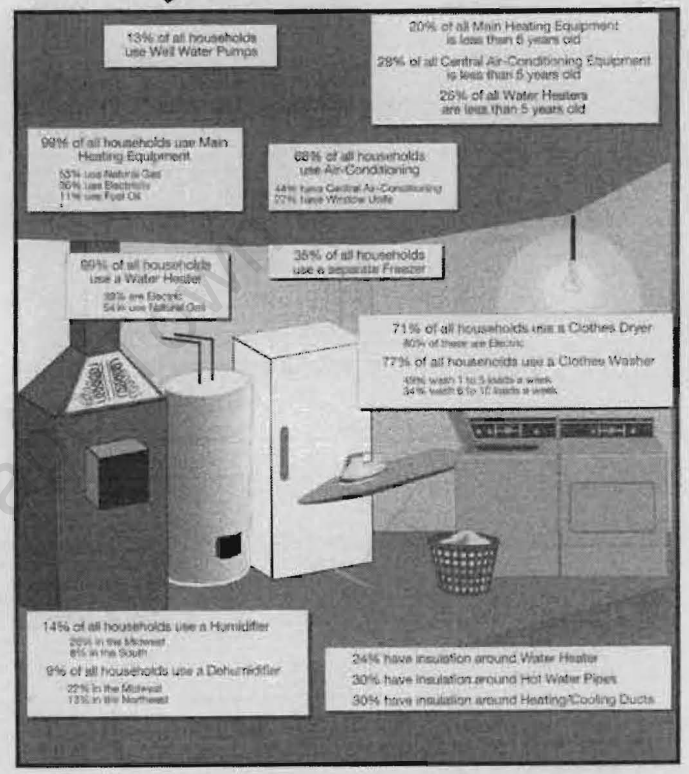
EIA RECS At a Glance



Source: *Housing Characteristics 1993*, DOE/EIA-0314(93), Energy Information Administration, Office of Energy Markets and End Use.

Housing Characteristics 1993 contains over 70 tables with regional and national data. More than 30 illustrations and maps present key survey findings and explanatory information. The report also includes Residential Energy Consumption Survey forms, methodology, geographic coverage, and information on related Energy Information Administration reports.

EIA RECS At a Glance



Note: Insulation data exclude apartments.

Source: *Housing Characteristics 1993*, DOE/EIA-0314(93), Energy Information Administration, Office of Energy Markets and End Use.

For Further Information...

National Energy Information Center, EI-231
Energy Information Administration
Forrestal Building, Room 1F-048
Washington, DC 20585

Phone: 202/586-8800
TTY: 202/586-1181
9 a.m. to 5 p.m. Eastern Time
Monday-Friday

Internet: infoctr@eia.doe.gov
http://www.eia.doe.gov

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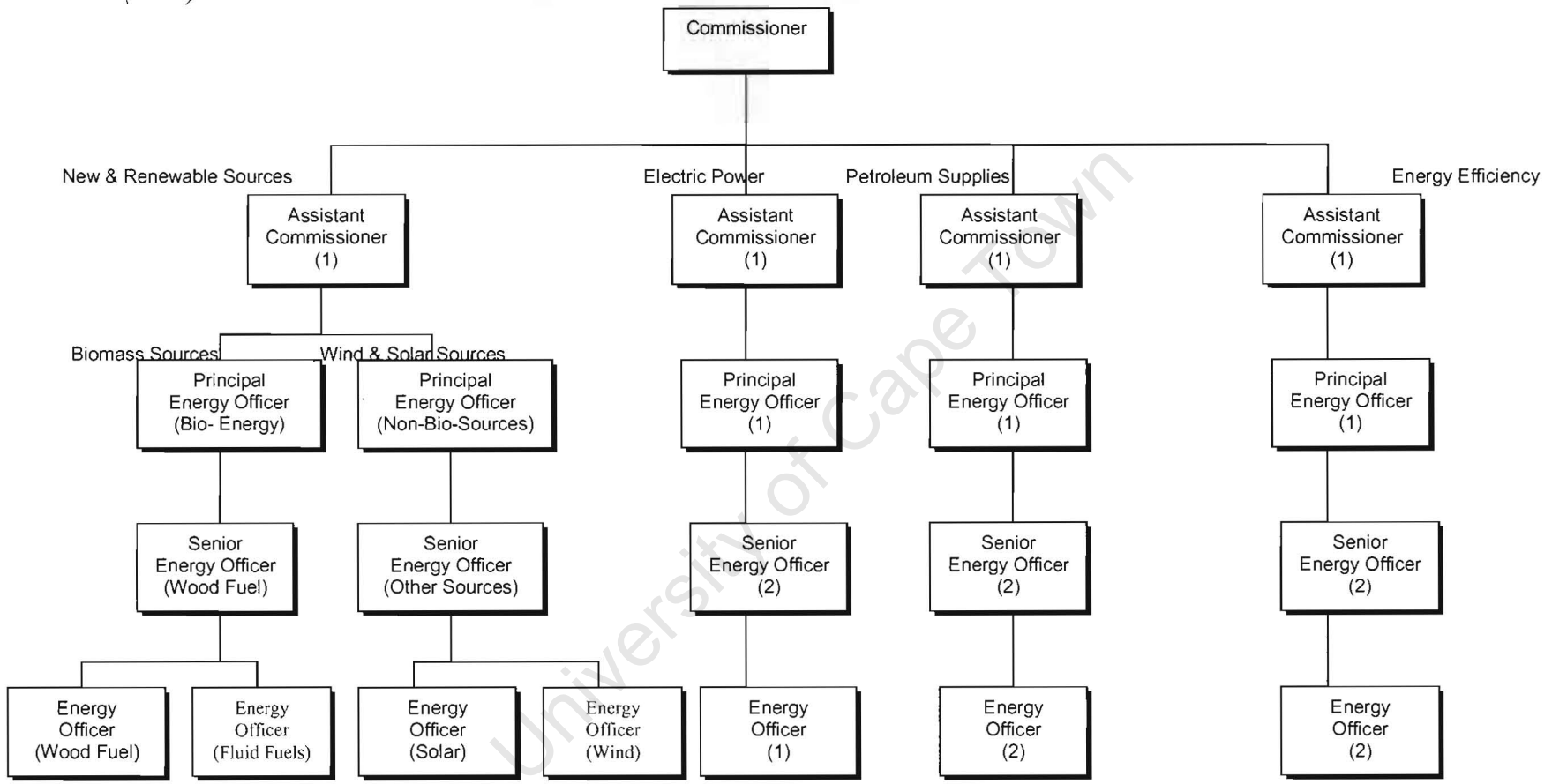
Appendix 6:

Source: MEMD (2001)

DETAILED EXISTING ORGANISATION STRUCTURE: ENERGY RESOURCES DEPARTMENT



Secretarial/Support Staff	
Personal Secretary Gr.II	(1)
Steno Secretary	(1)
Copy Typist	(2)
Drivers	(5)
Office Attendant	(3)