

INSTITUTIONAL AND GENDER DIMENSIONS OF ENERGY SERVICE PROVISION FOR EMPOWERING THE RURAL POOR IN UGANDA¹

By
May Sengendo
Chairperson
East African Energy Technology Development Network (regional level)
P.O. Box 5593 Kampala, Uganda
Email: Sengendo@infocom.co.ug

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Abstract

This case study examines how renewable energy service interventions at two sites in Uganda have contributed to the process of empowering women as well as addressing the different needs of women and men. The projects at the two sites sought to involve solar companies as private sector providers of energy services and aimed at addressing the differentiated needs of women and men at the household and small-scale enterprise levels. Various institutional arrangements for the provision of energy services were used in combination with a deliberate gender strategy. A government and private sector partnership was established by the Ministry of Energy and Mineral Development through the Uganda Photovoltaic Pilot Project for Rural Electrification (UPPPRE). Village banks were provided with a guarantee fund to support credit provision to the rural poor. This enabled solar companies to sell panels to solar users who expressed their need through demanding solar credit. The gender strategy enabled the project to target women for credit and sales, and through their involvement as the key users of solar energy and as technicians in the solar companies as well as owners of small enterprises. Replication of this gender strategy was then attempted but without government support through a partnership of a private sector solar company, the community and an NGO in a solar-wind project on Bufumira Island in Lake Victoria. A solar company sensitised communities so that they understood the importance of solar energy services to the needs of women and men in households and small enterprises. The NGO, the East African Energy Technology Development Network (EAETDN-Uganda), dealt with training on gender needs and power relationships between women and men. Then individuals purchased solar panels either through seeking funds from various rural and commercial banks or by using their own savings from the sale of fish.

The key finding is that a deliberate use of gender analysis with a specific gender strategy in energy interventions by governments, solar companies and village banks can result in significant benefits for both women and men. It can further support women's empowerment, especially if combined with support and encouragement for income-generating activities. The benefits for women as well as men included gains from their involvement in income-generating activities, the ability of spouses to pool resources and cooperate in repayment of solar loans and the increase in joint businesses between women and men. Training in maintenance, battery charging and usage for both men and women helped to ensure sustainability of both projects. Girls' education performance improved because they were able to study later at night after completing their domestic chores. The school also considerably reduced its expenditure on lighting.

Key words: Gender analysis, feminist political ecology, solar photovoltaic, solar energy services, institutional arrangements, private-public partnerships, private sector

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Executive Summary

One of the key concerns in efforts to develop sustainable outcomes for the energy sector in developing countries is providing access to energy services that take into consideration the differentiated needs of women and men. However, in most cases, decision-making rights do not balance with the responsibilities and tasks that women, rather than men, undertake. While women and men may have different ways of searching for income-earning ventures, these needs are not raised as priority concerns when demanding energy services. Energy service providers² consequently need to devise ways of integrating gender into their planning and implementation activities. The needs that are related to income-earning can easily be among the priorities if women, who provide most of the labour, are considered as key actors and guided in demanding such services.

Focus and Objectives of the study

This research was undertaken in Uganda and examines how energy service interventions by energy service providers can most effectively contribute to the process of empowerment of women as well as taking into consideration the different needs of women and men. It analyses gender in order to examine how energy service provision can enable women to increase their incomes and influence decision-making so as to gain access to such services in various ways that may be different from those pursued by men. The study considers both the household level as well as the small-scale enterprises found in such structures. The shift from public sector provision of energy services to collaborative and partnership ventures between the public and the private sectors is reflected upon as part of the institutional arrangements that now operate in Uganda. The study further highlights the prospects and challenges that the private sector energy service providers face in considering gender as a key change agent in their activities.

Lay out and scope of the study

The study has three chapters. It starts with an introduction that provides the background and a brief review of the literature. The two projects are then explained. Further more, the chapter explains the objectives of the study and research questions. In addition to this, an analytical framework is provided in ways that show how this study makes use of the feminist political ecology perspectives as well as micro-meso-micro linkages of Elson in order to undertake gender analysis. Chapter 2 explains how gender analysis is used as a methodology in the case study. A variety of methods used are explained including examining documents, questioning and listening, and observing. The selection of respondents at both institution/enterprise and household level is explained. Chapter 3 gives the field study findings and analysis.

The study was based on two sites in Uganda where solar energy initiatives sought to involve solar companies as private sector providers of energy services and further aimed to address the differentiated needs of women and men at the household and small-scale enterprise levels. The Uganda Photovoltaic Pilot Project for Rural Electrification (UPPPRE) had significant government involvement. However, its replication through a solar-wind battery-charging project on the Lake Victoria Islands relied more on the private sector companies and a non-governmental organisation. Both projects used a gender strategy to address gender concerns.

² In this case study, energy service providers include the solar companies and the village banks that provide solar credit services.

In terms of its scope, the UPPPRE project was undertaken to establish effective mechanisms for delivering energy services through involving private sector providers. These, it was believed, would work directly with the energy users. The project dealt with establishing financial mechanisms and institutional methodologies that could be used to enable poor women and men in urban and rural areas to have access to energy services. Having realised that gender was one of the key elements for effective project implementation; capacity building for gender planning in energy service provision was one of the interventions employed. Through the establishment of a financial mechanism, the project worked on creating linkages with micro-finance institutions and village banks to enable access to credit by female and male solar users. Solar companies were also facilitated to scale up their operations with loans that would enable them to cope with the demand for solar panels.

These financial and institutional mechanisms were replicated in a solar-wind project - the Bufumira Islands Alternative Energy Demonstration Project - in the Lake Victoria Islands. This project was designed to set up a demonstration wind-solar electricity generation system to provide power for a range of uses including battery charging, lighting for households and schools, and fish preservation.

However, the situation was not as simple as it first appeared to the energy service providers. This was due to the fact that, as energy initiatives were planned to address poverty and gender concerns, it became apparent that the energy users were not only the women and men in households. Access to credit for solar energy led to an emerging trend of women becoming involved in small-scale urban and rural enterprises, just like the men. The relationships between women and men were therefore more complex than first thought, since these involved not only household decision-making arrangements. Rather, this situation also involved the way women were engaging in enterprise-related activities and their participation in decision-making on issues of acquisition and utilisation of energy services.

Findings of the study

The level of awareness about energy technologies was high among both men and women, with much of the information gained from radio/TV programmes and from the local credit institution. The main reasons for choosing solar energy were that it was cost efficient and credit was available. For potential low-income users, the initial costs were lower than those for a grid connection, and credit made solar energy more accessible than the grid. Couples often pooled their resources to raise the 30% down payment and to pay off the loan since the income from one person in the household was not sufficient.

Both men and women received training in maintenance, battery charging and usage, but most of the solar energy technicians trained for repair work were men as this was considered “men’s work”.

External house lighting, entertainment and reading at night were perceived somewhat more as men’s household energy needs, while lighting for cooking was more of a woman’s need, and lighting for income generation and indoor lighting was used by both. In Bufumira, battery-charging was used to provide electricity for a variety of household, income-generating and community uses.

The study found both direct and indirect benefits in family relationships from solar energy. Direct benefits included improved lighting, reduced expenditures, and increased access to the mass media including to programmes on women’s empowerment and income-generating project ideas. These led to an increase in household-level income generating activities, often run cooperatively by both partners, and this led to increased trust and sense of co-ownership. Indirect benefits included reduced

expenditure by men on entertainment outside the home and more time spent with the family, and so better family relationships, which likely contributed to the above developments.

Girls' academic performance (the number passing in the first grade) improved during this period, catching up with that of the boys, and this was attributed to the extension of the working day so that girls, once they had completed their domestic work, could still have light to study (whereas boys, who have few domestic responsibilities, could always study earlier in daylight). The school also saved considerably in its expenditure on lighting.

Several commercial enterprises were set up following the availability of solar energy, including two widow-owned shops using lighting at night and refrigeration to attract customers, and three household enterprises, jointly owned and operated by husbands and wives, providing battery and phone charging services.

Village banks also benefited by increasing their number of clients and share capital, and gaining roles in other district projects, as well as earning "a good public reputation and trust". Staff members were trained to educate female clients about savings, women's empowerment, and how to start up their own small income-generating activities and obtain credit. This was encouraged based on women's existing good credit payment record (of 51 defaulters, only nine were women).

Expenditure on transport to get batteries charged was reduced (as well as the risk of loss and damage during transport) at one location; and at the other there were similar savings through a reduced need to go and buy paraffin and batteries for radios.

Income generating activities increased and diversified. In the battery-charging area, men took up night-time fishing using solar lighting, and many other, household-level activities were taken up by women such as shop/bar/eating place management, poultry and pig keeping, hairdressing and craft making. Both men and women contributed start-up capital but women generally did the work as the men were often absent. The improvement in reliability of supply through having battery-charging facilities near to hand was important for business sustainability. Women generally used their increased income to improve housing.

The income gaps between men and women decreased, with the solar installations nearly equalising their incomes. This is attributed to increased co-ownership and the increased number of household income-generating activities. New activities included shops, zero grazing of cattle, and goat, poultry and pig keeping. Poultry keeping switched from being a largely male-owned activity to a jointly owned and managed one when solar energy became available for chick brooding.

Spending on health also decreased for both men and women following solar installations: the clean solar lighting reduced diseases related to indoor air pollution.

Analysis of household decision making showed that women's involvement in decision making about the solar energy interventions was greater than their involvement in general household decision making before the installation. The study shows an example of a specific area of conflict which was reflected in the time of switching off the solar panel at night. Women's heavy workload meant that they wanted to use the TV and lighting later at night, while men wanted had finished their relaxation time and wanted it switched off to go to bed.

Although the solar energy was very welcome there were complaints about the theft of solar panels and the lack of the electric capacity needed for other uses. No-one had solar lighting in their kitchen. Some households planned to expand the lighting system inside the house, and would include the kitchen. Women especially were also very keen on using solar energy to run small-scale economic activities such as poultry keeping, welding and groundnut grinding.

Conclusions

The study presents several conclusions related to policy and programmes:

- Gender is a key variable in energy service interventions.
- Benefits identified by women include consumer-lighting; women staff in solar companies and village banks; and women as entrepreneurs in home-based activities. These latter benefits became possible through a deliberate gender strategy adopted by the solar companies and village bank in the project.
- Providing equal access by women and men to information and technical assistance as well as taking into consideration their different roles in the households were keys to the success.
- Attention to employment creation is critical in enabling changes in the gendered division of labour.
- The new energy services provided grounds for both cooperation and potential conflict between women and men, and bargaining and negotiation were key issues in the households. Men spending more time at home, and watching TV together, provided more opportunities for discussion of household issues (although women's participation in decision-making did not necessarily increase).
- Access to information helps women make more inputs to decision-making on energy services.
- Institutions play a critical role in determining whether energy services will be effective in meeting women's needs, by how they take into consideration gendered rights and responsibilities, and by using strategies that link energy service provision to activities that improve the livelihoods of both women and men.
- Energy services can also aggravate gender inequalities.
- Institutional arrangements that use gender analysis in planning and implementing energy service provision can contribute to women's empowerment.

1) Introduction and background to the study

a) Introduction

This case study looks at how renewable energy service interventions in Uganda have contributed (or failed to do so) to the process of empowering women and the extent to which they have taken into consideration the different needs of women and men. The study uses examples from two areas in Uganda where two projects (the Uganda Photovoltaic Pilot Project for Rural Electrification (UPPRE), and the Bufumira solar-wind battery-charging project on the Lake Victoria Islands) were undertaken that included energy service interventions. While the UPPRE project had significant government involvement, the Bufumira project relied more on the private sector. The study explains how each of them involved women in different ways. It looks at how the different interventions paid attention to gender concerns and the benefits that resulted from this. The key finding is that a deliberate use of gender analysis and a specific gender strategy by solar companies and village banks can result in significant benefits for both women and men and further support women's empowerment, especially if combined with support and encouragement for income-generating activities.

The study is made up of three chapters. Chapter 1 provides the introduction, background and a brief review of the literature. The two projects are explained as well as the objectives of the study, research questions. Gender analysis is used as the analytical framework and draws from concepts provided in the feminist political ecology perspectives, especially decision making and politics of knowledge. It also makes use of the micro-meso-micro linkages of Elson, in particular, the use of linkages between and among institutions. Chapter 2 explains the methodology of gender analysis used in the case study, which used a variety of methods including examining documents, questioning and listening, and observing. The selection of respondents at both institution/enterprise and household level is explained. The findings are analysed through use of quantitative explanations as well as quotes from individual respondents. Chapter 3 gives the field study findings and analysis. Background characteristics for the two sites are presented; an analysis of household decision making examined and gendered benefits explored.

b) Background and key issues from literature

Creating access to energy services, while taking into consideration the different needs of women and men, is a key concern in efforts to develop sustainable outcomes for the energy sector in developing countries. While women and men have different ways of seeking out income-earning ventures, such needs may be overlooked as priorities when demanding for energy services.

"I wish I had been consulted about the acquisition of the solar panel and the places where the lights would be installed. My decisions would have favoured the tasks I do, and where I spend most time. The solar company involved only my husband in discussions and provided him with the information about solar energy services. I have managed to influence my husband to put a light where I operate the poultry business - that has been agreed. Now we save more money on heating and lighting in the poultry business and there is increased income for me as well as benefits to the whole family".

A story by Kashe (not real name), a female respondent from Kabwohe

As indicated in Kashe's story quoted above, in most cases, the rights to participate in decision-making do not balance with the responsibilities and tasks that women undertake in different ways from men.

Energy service providers³ need to devise ways of integrating gender in their planning and implementation of activities. As indicated in Kashe's story, such income-related needs could easily be included in the priorities if women, who provide most of the labour, are considered as key actors and guided in demanding such services.

This case study examines how energy service interventions by energy service providers can most effectively contribute to the process of empowering women as well as take into consideration the different needs of women and men. The case study analyses gender⁴ in order to examine how energy service providers could enable women to improve their incomes and influence decision-making on the access to such services in ways that may be different from those undertaken by men. The study deals with the household level as well as with the small-scale enterprises found in such structures. The shift from public-sector provision of energy services to collaborative and partnership ventures between the public and the private sectors is reflected upon as part of the institutional arrangements that operate in Uganda. The study further highlights the prospects and challenges that private sector energy service providers face in considering gender as a key change agent in their activities.

i) Selected key issues in Uganda's energy sector and energy service interventions

With most of the households in Uganda using biomass (93%), and only 1 % and 6% using electricity and oil products respectively (Uganda energy balance, 2000), efforts are being made through the government and private-sector stakeholders to address the situation through rural electrification. As such, changes have taken place in energy service provision through partnerships involving private sector providers. There are various ways in which this type of institutional reform is undertaken in Uganda. These include cases where rural electrification projects, including some on solar photovoltaics, have tried to address the linkages between gender, energy and poverty. Sometimes, such linkages are not necessarily highlighted in the initial objectives of these projects. However, given the government's commitments to gender equality and poverty eradication, NGOs and activists concerned with gender and poverty related issues have continued to make demands on the various sectoral ministries to ensure that such issues become priorities in policymaking. Through such efforts, the energy sector has come to realise the need to include gender and poverty related interventions in the energy sector (EAETDN-U 2000). Such demands are also in line with the regulations of the gender policy as well as implementation of the Poverty Eradication Action Plan (MGCD, 1995; MFPED, 2001).

Since 1998, stakeholders in the energy sector have made efforts to take into consideration gender and poverty concerns through ensuring that energy service providers establish effective mechanisms to

³ In this case study, energy service providers are considered to include the solar companies as well as the village banks that provide solar credit services

⁴ The word "gender" is an important concept applied in this case study. The emphasis on gender guides the analysis in taking into consideration the fact that there are differences in the tasks, responsibilities and rights of women and men, which in turn reflect differences in their needs in terms of energy service provision. In Uganda, studies have indicated the challenge in researching "gender" since no direct translation exists in the local languages (Kiguli 2001). The meaning of 'gender' was discussed with the respondents and was considered to refer to the relations and social practices in the day-to-day activities, relationships, assignment of rights and responsibilities that communities ascribe to females and males. This is similar to theoretical definitions, which tend to see gender as the socially, culturally and historically constructed roles, rights, values and norms ascribed to females and males in a given society (see Young 1997, Smyth and March 1999).

address the needs of energy users. However, the extent to which such energy service interventions can effectively contribute to the process of empowering women is still questionable. While some have indicated that electrification is necessary to empower women (Clancy 1999), others such as Cecelski (2000) have pointed out that rural electrification should be promoted because it would meet women's needs in terms of labour saving, time saving, improved health, security and income. Others have noted problems in that rural electrification "has not necessarily resulted in extensive use of electricity" (Wamukonya 2002 p6). Furthermore, others have also pointed out that even with solar home systems, which are usually thought to be the easiest form of renewable energy technologies to be disseminated in Africa, the methodologies and financing mechanisms used will not help women if they are not targeted as users and beneficiaries since they would not be able to access such credit (Turyahikayo and Sengendo 2000).

In order to address the question of how energy service interventions can most effectively contribute to the process of empowering women, this case study focuses on two examples: the Uganda Photovoltaic Pilot Project for Rural Electrification (UPPPRE); and one in the Lake Victoria Islands where financial and institutional mechanisms were further replicated through a solar-wind project in the Bufumira Islands Alternative Energy Demonstration Project.

c) The UPPPRE and efforts to replicate it in the Lake Victoria Islands

The UPPPRE was undertaken to establish effective mechanisms for energy service provision through involving private sector providers. It was believed that these were working directly with the energy users. The project dealt with establishing financial mechanisms and institutional methodologies that could be used to enable poor women and men in urban and rural areas to access energy services. After having realised that gender was one of the key elements in an effective implementation of the project, capacity building in gender planning for energy service provision became one of the interventions (Sengendo 2000). Through setting up a financial mechanism, the project worked to create linkages with micro-finance institutions and village banks that would enable access to credit by potential female and male solar users. Solar companies were also facilitated with loans so that they could scale up their operations to cope with the demand for solar panels. This case study also focuses on one village in the Lake Victoria Islands where such financial and institutional mechanisms were replicated in a solar-wind project: the Bufumira Islands' Alternative Energy Demonstration Project. This project was designed to set up a demonstration wind-solar based electricity generation system for battery charging, for lighting for households and schools, for fish preservation, and for other uses of electricity.

However, the situation was not that simple for the energy service providers. This was due to the fact that, as the energy initiatives were planned to address poverty and gender concerns, it was realised that the energy users were not only women and men in their domestic lives. Access to credit for solar also led to the emergence of women running small-scale urban and rural enterprises, just like the men. The relationships between women and men were therefore more complex than first thought, since these went beyond household decision-making arrangements. Rather, the situation also involved the way women were engaging in enterprise-related activities and their participation in decision-making on issues of acquisition and utilisation of the available energy services.

d) The problem statement

Within the context given above, this case study examines how energy service interventions by private and public energy service providers can most effectively:

- a) Contribute to the process of empowering women.
- b) Take into consideration differences in the needs of women and men in ways that enable women to: (i) increase their incomes, (ii) be able to engage in new roles, and (iii) influence decision-making on access to energy services within households and at the level of small-scale enterprises.

e) Objectives of the study

1. To provide a case study that examines how energy service interventions by energy service providers can most effectively contribute to the process of economic empowerment of women and fulfilment of the differentiated needs of women and men.
2. To analyse the prospects and challenges facing private sector institutions in ensuring gender-responsive energy service provision that contributes to strategies for poverty reduction.
3. To provide policy- and programme- based recommendations that illustrate how attention to gender can be an effective change agent in energy service interventions in ways that contribute to economic empowerment of women as well as addressing the inequalities between women and men within households and the enterprises found in such structures.

The objectives point towards three levels of analysis. The research questions that address the objectives are in line with these levels of analysis.

f) Research questions

The research questions that were addressed include:

- i) *Energy as a change agent*: What effects do the energy interventions undertaken by energy service providers have on gender relationships and incomes within households and on enterprise development?
- ii) *Attention to gender as a change agent*: How do the benefits that are achieved from such interventions transform or contribute to changes in social status, roles and any other forms of economic empowerment, for women as well as for poor men
- iii) *Policy and institutional linkages*: What are the successes and challenges in addressing gender through reforms in energy service provision as an element of energy policy, especially the shift to private sector provision and the recognition of enterprise development in addition to household activities?

g) Analytical framework

Gender analysis is the key to this study. Analytical perspectives that could address the above research questions from a gendered perspective were therefore considered, and two analytical perspectives applied. One is the feminist political ecology perspective (Rocheleau et al. 1996), and the other is the micro-meso-micro linkage approach (Elson 1995). The feminist political ecology perspective emphasises the need to analyse gender while paying attention to the political dynamics involving material- and knowledge- (or information-) related struggles that women undertake in different ways from men. In order to reflect this, the perspective guides the analysis towards:

- The unequal power relationships and how women act in similar or different ways from men as they address conflicts over access to energy services. Efforts are directed towards finding out if these struggles over access to energy services have implications on the subordination and vulnerability of the poor.
- The institutional issues that govern energy service provision.
- Rights.
- Access to knowledge.
- The balance between gendered rights and responsibilities, as this is a key concern in this perspective, as well as the way these issues are integrated in the strategies for reducing poverty among the rural community.

Here, gender analysis will be used to assess any changes in roles and the division of labour, social status, types of activities undertaken by women and men, ownership of energy technologies by women and men, socioeconomic divisions of the types of users of the various energy technologies, decision-making by both women and men in households and enterprises.

The ways in which women organise themselves to challenge aspects of exclusion and discrimination in access to and control over energy services will also be examined. Further analysis will investigate the opportunities created for women and the way they make use of such space to engage in decision-making over the acquisition and use of energy technologies and services.

The household and the enterprise will be used as two spaces where women and men can be found. The power relationships that are embedded in the bargaining and decision-making aspects within these spaces will be analysed. Attention will also be paid to the achievements resulting from such interventions towards sustainable livelihoods.

2) Study methodology

a) Introduction

This section explains the methodology used in the research for this case study. This is achieved by illustrating the approach that was applied to investigate the problem issues as well the various methods that were used to collect the data. The study applied a gender-focused approach by using Gender Analysis as the main guide in searching for the information required to address the problem being investigated⁵. Three types of methods were applied in the research in collecting data. These were examining various documents for background information, interviews and observations. These are explained in more detail in Section 2.5 below.

b) Using gender analysis as a methodology

Analysing the gendered relationships as well as the roles, responsibilities and opportunities for women and men within the context of energy, was seen as a strange idea by the respondents. According to them, energy-related issues were naturally male-dominated. Respondents therefore wondered why there was a need to involve both women and men⁶ in questions to do with energy within the household and for enterprise development. The researcher therefore had to develop awareness to enable respondents to understand gender and energy issues before administering the questionnaires and activating focus group discussions. This process enabled female as well as male respondents to realise the need to pay attention to the gender relationships between women and men, and explained why female respondents were involved in energy-related issues that had previously been considered as male-dominated. Such experiences show that the ideology within a society shapes respondents' views on the research, and that this is also influenced by their attitudes. They also use these attitudes to view the researcher within the perspective of "personal identity and social location" as pointed out by Mbilinyi (1994 p35). Gender analysis as an approach, therefore, enabled the research to address the day-to-day experiences and roles of women and men as they interact and make use of energy services. It also enabled examination of the extent to which women and men are involved in decision-making within the household and in institutions that deal with energy service provision.

c) Research process and selection of respondents

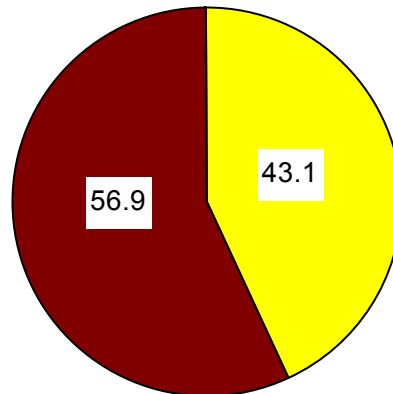
i) Location of study

The data was collected from two areas: a village within western Uganda in Bushenyi, where the Muhame Village Bank had provided solar credit services; and a village in Lake Victoria, Bufumira Islands, where other financial services were used to lay the groundwork for the replication of the solar credit system. A total of 102 respondents were interviewed from the two areas. Females made up 57% of the respondents while males comprised 43% (see Figure 1).

⁵ In gender-focused research, as in other fields of study, the term methodology is described as a set of ideas that explain the study (in relation to the theory applied), and analysis of the types of methods (Mbilinyi 1992:32). Methods are the techniques for collecting the data using specified tools.

⁶ The researcher was a woman, and moreover from the city of Kampala. As such, it was very easy to be considered not only as a woman but as an educated one who was looking for fellow women to interview. Efforts were made to ensure that one of the research assistants was a male from the cultural/ethnic group where the research was undertaken in the western part of Uganda. At both sites, the respondents knew the researcher (who had previously worked with them) as well as the male research assistant.

Figure 1: Proportion of male and female respondents



d) Research process

The initial stage of the study involved developing an understanding of Uganda's energy industry and more specifically the solar energy industry. This was achieved through documenting information from the Government and the Ministry of Energy. The next stage involved identifying the solar energy companies that were providing solar power on credit through village banks to rural households. Lastly, the village banks providing and managing the solar energy credit to their clients on behalf of the solar energy credit providing companies were identified. The village banks provided a gender-disaggregated list of all their clients who had installed solar power in their households through solar energy credit provision.

i) Selection of respondents

As noted earlier, the study aimed to obtain specific information from an identified population. Various selection techniques were used as explained below for each category of respondent. The study provided an opportunity to uncover the solar energy activities carried out, and their effect/influence on decision-making by men and women at household and institutional levels.

Interviews were organised with the manager and a loan's officer at the Muhame village bank in Bushenyi. They provided lists of clients that had installed solar energy as an outcome of the efforts made through the solar credit scheme. One of the lists contained male and female clients, while the other showed a list of institutions such as schools, hospitals/clinics and enterprises. Respondents were selected from these two lists as the follows:

i) Household level: From the list of village bank clients who had installed solar power in their households by taking advantage of the solar credit scheme, a selection of respondents at the household level was made using simple random sampling and snowball sampling techniques. At the end of the interviews with the selected households, the respondents were asked whether they were aware of any households who were using solar power to run an income-generating activity such as poultry keeping, a shop, video shows or providing computer services. If a respondent was aware of any, he/she was requested to note down the name of the household head and the location. The interviewer then

crosschecked with the list from the village bank to see whether the identified household had used the credit available.

ii) Institution and enterprise level: Since few institutions were listed, all were visited and interviews organised and conducted with one or two of their administrators.

e) Data collection

i) Data collection methods

Primary data were collected using questionnaires, key informant interviews and from already existing data/information on energy interventions in Uganda, with particular attention paid to solar energy interventions. Primary data/information was collected at household, institutional and company levels. In terms of secondary data/information, a historical overview of the various energy forms and their gender implications in terms of participation, energy programme awareness, decision-making and societal status change was developed.

Four types of data collection methods were used as follows:

- i. ***Householder interviews using questionnaires:*** Questionnaires were used to seek out information about the householders' backgrounds, the person responsible for decision-making at household level, sources of information about solar energy, benefits gained by men and women due to solar usage, the type of solar energy training received by both men and women, awareness by men and women of the size of solar panels installed on their households and the socioeconomic status and welfare of the men and women before and after solar energy installation within the households.
- ii. ***Key informant interviews using checklists:*** These were conducted with members of the Ministry of Energy and Natural Resources, village bank staff, and men and women at the household level. At the ministry level, the key informant interview was aimed at identifying the village banks that were operating the solar energy credit scheme countrywide. This enabled an appropriate village bank to be identified for the research.
- iii. ***Observations:*** This approach was used mainly at the household level. This dealt with observing and noting down the various activities engaged in by men and women. It helped in bringing out what respondents did not speak of, or report, directly.
- iv. ***Focus group discussions*** were held with female-only and male-only groups. This helped to cross-check information and to gather information in areas where women preferred to talk without the presence of men and vice versa.

ii) Data collection at three levels: household, institution and company

i) Household level

A questionnaire was designed and used during interviews at the household level. The questions addressed awareness of the various forms of energy interventions, and more specifically solar energy, energy needs, solar energy activities, type of training received, decision-making authority, socioeconomic status and welfare. The questionnaire was divided into five sections.

The first section covered household identification in terms of location. The second section contained questions about the respondent's background and socioeconomic characteristics such as sex, age, marital status, education level and the person responsible for decision-making within the household. Knowledge about solar energy usage, training, awareness of other energy interventions, solar energy related activities engaged in by men and women, reasons that led to choosing solar energy and the benefits gained by men and women from the household solar installation were covered by the third section. The fourth section was designed to acquire information on the household's socioeconomic status and welfare, and the fifth sought knowledge about institutional/enterprise solar usage.

Case studies were documented where there was a need to analyse specific examples; in-depth interviews were carried out with some respondents and participant observation was undertaken. In participant observation, the researcher and the respondent interacted together, usually after the questionnaire interview, in a bid for the former to observe day-to-day household experience.

ii) Institutional level

Key informant interviews were organised and conducted with the administrative members of appropriate institutions. In Uganda's western region, interviews were conducted with the Muhame financial institution's bank manager and loan's officer; while in the Bufumira Islands interviews were conducted with solar energy service providers. In schools and hospitals, interviews were carried out with one or two administrative members; while in enterprises such as shops, fishing businesses, bars and eating places, interviews were conducted with the enterprise owners. At the solar energy service providers, information was sought about the number of clients who received solar energy services, type of solar energy training received by the staff members, whether the institution addressed poverty and gender issues with clients, the number of men and women credit defaulters, the mode of credit payment and the benefits the institution had gained as a result of running solar energy programmes. In enterprises such as schools, hospitals, shops and bars, information was sought about the solar energy driven activities and the benefits the enterprise had gained from solar energy installation.

iii) Company level

In a similar way, key informant interviews were undertaken with solar companies in Kampala and at any operational branches in the two study areas. The knowledge holders in the companies were seen as mainly the managers plus the technicians who were installing solar panels. These were therefore the ones focused on within the companies. The questions put to them mainly focused on solar energy service provision: the extent of provision in terms of numbers sold through a credit system, and the benefits and challenges in using this mechanism to both the company and to women and men as users. The solar companies were able to provide information about the number of clients who received solar

energy services, the type of solar energy training received by staff members, how the company addressed poverty and gender issues related to the solar users.

f) Data analysis

The data collected was input into a computer using the EPI6 software package and exported to the SPSS software package for analysis. Since both qualitative and quantitative data were collected, various analysis methods were adopted including univariate analysis in a bid to study the frequency and distributions of the variables under study. Bivariate analyses were also used to assess the relationships between two selected variables that would in most cases be linearly related. The Pearson Rank Correlation test was also used. Furthermore, hypothesis testing using the Chi-Square test was carried out at this stage of the analysis. The qualitative data were analysed using the SWOT (Strength, Weaknesses Opportunities and Threats) approach.

3) Field study findings

a) Respondents' backgrounds and characteristics

In terms of age distribution, the data that were collected from the two areas of the study (Bushenyi and Bufumira Islands) showed that the female and male mean ages were thirty-nine and forty-two respectively. In terms of education, there were significant gender differences. Of the female respondents, 57% had never been to school whereas only 15% of men were in the same situation. Twenty percent of males and 24% of females had attained only a primary level of education.

Forty-seven percent of the men and 18% of the women had been education to O-Level standard. None of the females had stayed on for A-Levels whereas 19% of the men had, and some had progressed further to a tertiary institution⁷.

In terms of marital status, more than 80% of all the respondents were married. Of the remaining 20%, two women were widows, and two males as well as two females were unmarried and described themselves as "single". It was further noted that the widowed and unmarried women categorised themselves as "heads of households" because they considered themselves as the sole decision-makers on household expenditure and the acquisition of energy services.

b) Knowledge and awareness of solar energy services by women and men

The level of awareness of various energy technologies and services was high. All the respondents were aware of solar energy as well as of the following energy services: (i) electricity from the main grid, (ii) biogas, and (iii) charcoal stoves and the traditional three-stone fire. All the females and 80% of the male respondents were aware of modern fuel-efficient cook stoves. The major sources of knowledge about solar energy were reported to be radio and television programmes on energy. This was reported as a source by 64% and 77% of the female and male respondents respectively. Slightly more than 80% of the male respondents had acquired further information from the Muhame Credit Financial Institution (Table 1). The credit scheme occasionally held community sensitisation workshops and seminars about solar usage and maintenance for its clients. Village women's groups had conveyed solar-related information only to women whereas the local men's groups had benefited both men and women. Other reported sources of information about solar included friends and, to a lesser extent, the church.

Table 1: Sources of knowledge on solar energy

Source of knowledge about solar energy	Female (n=58)		Male (n=44)		Total (n=102)	
	Freq	%	Freq	%	Freq	%
Radio/TV	37	63.8	34	77.3	71	69.6
Muhame ⁸	31	53.4	36	81.8	67	65.7
Women's village groups			27	61.4	27	26.5
Female friend	24	41.4	21	47.7	45	44.1
Male friend			25	56.8	25	24.5
Men's local group	17	29.3	13	29.5	30	29.4

⁷ The education system in Uganda involves seven years of primary education (P1 to P7), four years of Ordinary Level education (to O-Level), two years of Advanced Level education (to A-Level) plus Tertiary (University and College) Level education. The number of years spent in a tertiary institution depends on the course undertaken.

⁸ Muhame: micro-finance scheme

Despite the other energy technologies available within the study areas, respondents had opted to use solar energy for the following reasons:

- (i) Solar energy seen as cost efficient,
- (ii) Fewer health hazards,
- (iii) Solar energy service was brought nearer to the people through solar companies,
- (iv) A more 'friendly' mode of repaying solar energy credits,
- (v) Training about solar energy use received, and
- (vi) Spouse and friends influence.

Seventy percent said they had installed solar power due to its cost efficiency⁹ and credit availability. Village banks, in collaboration with solar energy companies, installed solar energy systems in the client households on credit. Before installation, the client was expected to make a 30% down payment towards the total solar panel purchase price. After the down payment, the solar energy system would be installed and the client would be required to repay the remaining balance within twenty-four months at an interest rate of 1.5% per month. The total solar energy credit received by a client depended on the number of light bulbs desired within the household and the consequent size of the solar panel to be installed. The solar panels offered would light up to a maximum of eight bulbs.

Previously, the daily costs of paraffin, candles and dry cells for radios were high, and the respondents also desired to watch television like their rich neighbours. However, due to their low incomes, they could not afford to access hydroelectric power through the main grid. Other, cheaper, energy technologies such as biogas and charcoal stoves could not satisfy all their wishes. Sixty-two percent of the respondents viewed solar power as an alternative to the grid for people with low incomes. By obtaining a solar system, the lighting inside and outside the house was improved, fuel and dry cell expenditure reduced, and television watching became possible. Moreover, there were no monthly power bills to worry about as explained by a respondent in Kabwohe.

.....What enticed me into installing solar energy in this household was the mode of payment. Who else will give you credit with two years to pay it back? That is as good as giving you the money. After two years of payments, I will be enjoying free solar power without the bother of monthly electricity bills.....

Male respondent - Kabwohe

The Muhame Credit Financial Institution was close by (within walking distance) and regularly supplied the residents with adequate information about solar energy usage and the availability of credit. Further, compared to other energy sources such as biogas and grid electricity, solar energy was seen as having fewer health risks by 93% and 88% of the male and female respondents respectively. The above reasons, plus the low household incomes and the desire to live a better life, were among the main reasons that led solar energy to be selected as the best household energy service out of the options that were available.

Some respondents claimed they had never taken part in any decision-making process about solar energy selection and installation in their households. Twenty-nine percent of the female respondents asserted that their husbands had installed solar power in the households without their knowledge as illustrated in the extract below.

⁹ Expenditure on solar energy in comparison to expenditure on other energy services such as charcoal, paraffin and hydroelectric power was low.

To begin with, I wasn't happy with the way in which solar was brought to this household. I had gone home to visit my parents for a week and, when I came back, I found solar power in the house. My husband never consulted me; he undermined me. Anyway, I was used to this type of treatment.....

Female Respondent – Kabwohe

The above extract portrays the gendered discrimination against women as far as household decision-making is concerned.

c) Differences in Factors that enabled the respondents to install solar panels

Although various factors were reported as having enabled respondents to install solar power within their households, two were pivotal: these are (i) the awareness of the solar energy credit project raised by the village bank/cooperative, and (ii) spouse support. Sixty-three percent of the male respondents and 32% of the females reported that although credit was available, they had never individually had enough income to make the 30% down payment needed to qualify for a solar energy installation loan. Rather, together with their spouses, they had pooled their funds to raise the down payment and both worked hard to meet the loan repayments. Four women had been surprised¹⁰ when their husbands asked them if they would contribute towards installing solar energy within their households as indicated in the extract below.

.....We have been married for almost twenty years now..... Until recently, my husband had never asked me for any money. One evening, he came home unexpectedly early and called me to the bedroom..... At first I thought something had gone wrong. He told me that he wished to install solar power in our household like our neighbour but he was lacking the Ushs.50 000 for the initial payment..... he asked me give him some money if I had any..... I was surprised.....but I had Ushs.30 000 and I gave it to him. Since then, he has been open with me on all matters concerning our household income and expenditure. Within two years of working together we have repaid the loan.....

Female respondent - Kabwohe

None of the respondents (male or female) claimed to have ever participated in either the selection or installation process of the solar energy system in their household. Their role was just to pay the 30% down payment to the village bank.

d) Household energy needs and usage by gender status

There was a range of energy needs at the household level. Table 2 reveals that all the respondents needed energy for lighting inside the house at night. Outside lighting at night was regarded as a need by 74% and 89% of the female and male respondents respectively. Seventy-one percent of the females, compared to only 61% of the males, wanted solar energy for entertainment purposes such as television and radio. Although 64% of the males felt that their spouses required solar energy for kitchen lighting, only 40% of the females reported such a need. The use of solar power for running economic activities,

¹⁰ Culturally, the man is supposed to provide money for the woman. Women were not expected to engage in income-generating activities, and were expected to live on the man's earnings. Secondly, a man asking a woman for money was seen as taboo. The implication being that the man could no longer support his family financially, thus reducing the man's pride.

either during the day or at night, was valued more by women than men (Table 2). It should be noted that men had occupations away from the home and therefore, it was the women who desired solar in a bid to run some income-generating activities while at home.

Table 2: Perceptions of Solar Energy needs at household level by men and women

Energy need	Female (n=58)		Male (n=44)	
	Freq	%	Freq	%
Inside house lighting	58	100.0	44	100.0
Outside lighting	43	74.1	39	88.6
Entertainment	41	70.7	27	61.4
Reading at night	26	44.8	23	52.3
Kitchen lighting to ease cooking	23	39.7	28	63.6
Daytime income generating activity	25	43.1	19	43.2
Night-time income generating activity	14	24.1	9	20.5

During the evening hours (7:00 – 10:00 pm) women are generally in the kitchen, and none of the households had solar lighting installed there. The available sources of lighting such as the tadoba (a *paraffin tin lamp*) and the wicker lamp are poor and have a negative effect on vision as reported by one female respondent in the extract below.

I installed solar in 2001, before that I was using a tadoba [throughout the house] for lighting. I was always straining my eyes and normally went to a clinic for an eye check-up every three months. But recently, ever since solar was installed in this household, I have gone for an eye check-up only once.

Female respondent - Kabwohe

At the solar home systems varied in size from 20W to 100W. Given the small outputs, they were mainly used for lighting and powering a radio and/or television. The institutional solar panels were bigger but not so significant for this specific study. None of the households used solar energy for cooking or kitchen lighting. Most females (76%) were not aware of the size of the solar panels installed on their houses. This was attributed to the refusal by their husbands to inform them of the size and the fact that solar companies did not involve them in on-site training over the maintenance of the solar panels.

e) Gendered benefits from energy service interventions

The contribution of any energy service intervention to women’s empowerment can be illustrated by analysing the benefits derived from accessing and being able to use the energy service. The initial reasons for solar installation at the household level were to have better lighting at night, to listen to the radio and watch television if affordable. Various benefits were derived from these activities. These included increased household incomes, improved academic performance and better interpersonal family relationships as explained in more detail in the subsections below.

i) Household decision-making and access to energy services

One of the issues that the study examined was the extent to which solar energy interventions had led to women’s empowerment in terms of being involved in decision-making at the household level. The study found out that traditionally, decision-making in terms of energy acquisition at the household level was mostly undertaken by men. However, 5% of the women who were married indicated that they

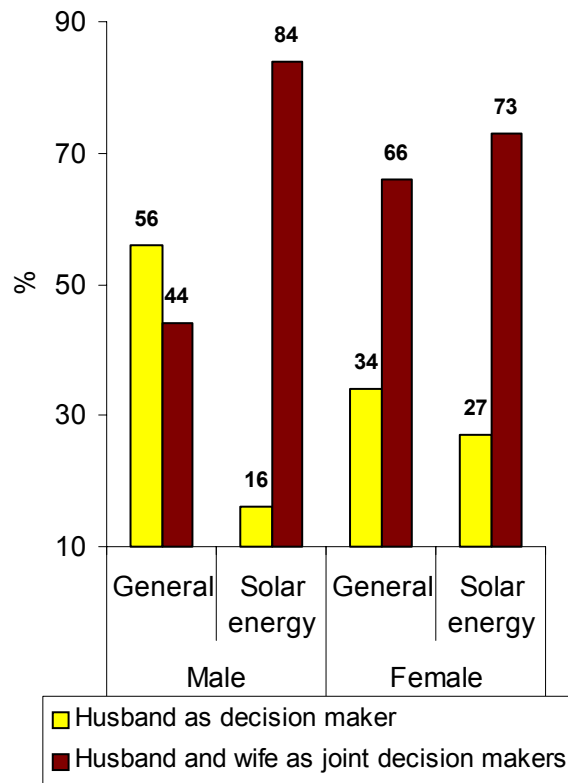
managed their household's income and made decisions on acquisition and utilisation of energy services. In-depth analysis revealed that these either had their own sources of income (especially small-scale enterprises at the household level) or had received gender-awareness training and had access to information on available energy services. This enabled them to lead the decisions on this specific issue within the household.

It was also seen that there were male interventions in decision-making even within female-headed households¹¹. In combined group discussions, both female and male respondents felt that the dominance of male authority in decision-making within households was mainly due to the low level of women's education, which results in them lacking access to information about energy services. However, most of the women in the "women-only focus group" felt that it was the lack of their own income and cultural norms that constrained women from becoming decision-makers on energy services¹². The study found that in cases where the solar energy service provision did involve awareness creation and training on gender and energy for women, as well as for men, that such interventions did lead to some involvement of women in decision-making at the household level together with their spouses. For example, in both Bushenyi and Bufumira where such training had been undertaken, 73% of the women respondents indicated that the husband and wife jointly made the decision to acquire solar energy. This was significantly higher than the number of men who claimed that general household decisions were made jointly (44%) (see Figure 2). It was also noted that the proportion of the male respondents who considered the views of their wives during the household solar installation process (84%) was much higher than that of males who did not put into consideration females' views (16%).

¹¹ Women who were heading households explained that although they made decisions, there was a tendency to rely on a male relative for advice. There was tendency to request the views of the elder son, a male friend or a friend's spouse.

¹² Most of the male respondents believed that, in the Kinyakole tradition, the man is the decision-maker due to his responsibility to provide for the needs of the household since he is supposed to be the income earner. In such a context, the woman is supposed to listen and put into action whatever the man tells her without question. Female focus group discussions revealed that such beliefs were just part of the subordination tendencies that are practiced by men towards women in society.

Figure 2: General household decision making in comparison with decision to install solar energy



Examples of incidences where the gendered roles in decision-making were evident were given. These included decisions about the location of the lights within the house as well as the time at night when the lights would be switched off. The quote below by Maria is typical of what most of the women said they experienced:

Depending on the need for light, the switching on of lights in the evening is usually decided upon by all members of the household. However, the decision to switch off lights is made by my husband and this sometimes results in quarrelling. We have different ways of using time. I stay in the kitchen, busily preparing supper, while my husband is in the sitting room listening to the radio or watching TV. By the time I am through with the kitchen work, he is tired and wants to retire to bed. So when do I have the opportunity to sit down and watch TV or listen to the radio in a well-lighted room? He sends orders through our children to switch off the lights just after having supper.

Maria - female respondent

Such conflict rather than cooperation in decisions on household use of energy services and utilisation of time was reported by half of the female and 40% of the male respondents. Another aspect where conflicts arose was over who should clean the solar panel. Where there were disagreements on whose

responsibility it was to clean the panel, the task was often left to children. Children would take on the task of cleaning the panel when they had time over the weekend.

ii) Increased knowledge from solar energy training

Residents who received solar energy credit always received training on various aspects of solar energy. This training was always conducted in the villages. Fifty-two and fifty-eight percent of the female and male respondents respectively had received some solar energy training through village meetings. The areas covered included solar system maintenance, battery charging and usage. None of the solar energy clients had received technical training such as on solar energy panel repair and installation. Eight women had received training on solar usage from their husbands, and five from their children.

Not all of the men and women who attended training sessions on solar energy went on to have solar systems installed. Two main reasons were advanced for this: firstly, a lack of capital to meet the initial down payment and, secondly, the refusal by the husband to agree to installation of solar power. Although solar energy was available on credit, the credit terms and conditions were not sufficiently attractive for some people. The 30% down payment and the monthly repayments plus 1.5% interest were seen as too high for some householders who did not have a stable source of income. Some of the householders who were trained were women who mainly depended on the incomes of their husbands and so could not go on to purchase a system without their agreement. Further, the few women who did have their own incomes were not the final household decision-makers. In such situations, if the husband refused, there was no way that a woman could arrange for solar energy to be installed.

Given the lack of technical training in the solar energy field, if a solar panel breaks down, a technician most probably from the village bank will be hired to repair it. All the reported solar energy technicians were men despite solar energy technical training being offered to all village bank staff. It was mostly men who attended since most women felt that solar energy repair work was a man's task.

iii) Increased house lighting and improved family relationships

Directly, solar energy had mostly benefited the men and, indirectly, it has benefited the female respondents. Solar energy interventions have directly led to improved lighting inside and outside the houses, and the reduced expenditure on paraffin and candles plus the increased mass media information flow through the increased access to radio and television are also direct benefits. Through increased radio listening and television watching, the respondents had accessed mass media programmes aimed at poverty reduction and women's empowerment. These educational programmes have led to some of the respondents starting up income-generating projects such as poultry and pig keeping, and some have introduced zero grazing approaches.

Indirectly, solar energy interventions have led to a reduction in men's expenditures, and strengthened inter-family relationships. Before having solar installations, most men did not usually return home until after 10:00 pm due to a lack of things to do in the home at night. The wife would be in the kitchen with the children, and the husband would be alone bored in the sitting room. To avoid boredom, the husband would hang out with friends while taking beer and muchomo (*roasted pork or goat*); leading to an increase in household expenditure. With the solar energy supply, most of the female respondents reported that their husbands would come home before 8:00 pm. If the wife was busy, the television or radio would provide entertainment. This has led to a reduction in family expenditure plus stronger family relationships as illustrated below.

Solar has been a blessing in this household. I always quarrelled with my wife over paraffin and cell usage. She always nagged me for money to buy these items. I used to get home late in fear of the darkness and boredom. I would be with friends in Kabwohe town, drinking some little beer and some muchomo. When I installed solar, I bought a TV, and I now come home before 8 pm and my expenditure on beer and muchomo has reduced. I now often chat with my family and know better the problems facing my family. My neighbour is rich, he has hydroelectric power. I always admired him but never had the money to bring electricity to my house. Further, every Saturday and Sunday, my children and wife used to go there to watch TV. This made me angry but I could do nothing about it. I am better off than him now because I don't pay monthly electricity bills. I always laugh deep inside me when I hear him grumbling about the monthly bills. Maybe I should advise him to install solar energy.

Male respondent - Kabwohe

Solar energy installations within households, both directly and indirectly have led to an increased number of household income-generating activities. Through increased access to radio and television, some respondents have seen or heard programmes that explain how to start up economic activities such as poultry keeping and zero grazing, and often targeted especially at women. Women who developed interest in these programmes, discussed them with their husbands and, as a result, some income-generating activities were set up as illustrated in the extract below.

..... Furthermore, these days, I also listen to the radio. Before the solar installation, my husband always switched on the radio at the time for news and announcements. During this time, I would be busy with domestic work or cooking. We couldn't afford the cost of batteries to listen at will. These days, I can listen to the radio at will. I have learnt a lot from the radio programmes. For example, it was through the programme always aired on Radio West on Saturdays that I learnt about poultry keeping. Previously, we had only five chickens owned by my husband; these were not for sale but we would slaughter one whenever we received a very important visitor such as an in-law, or at Christmas. Now look in that kitchen house, there are nearly a hundred chickens! We used the solar light to brood them. We sell the eggs in Kabwohe town. When my husband takes eggs to town for sale, I am aware of the number of eggs he has taken, and thus aware of the amount of money he is to get. Previously I never knew his income, but now he tells me.....

Female respondent – Kabwohe

iv) Improved educational performance

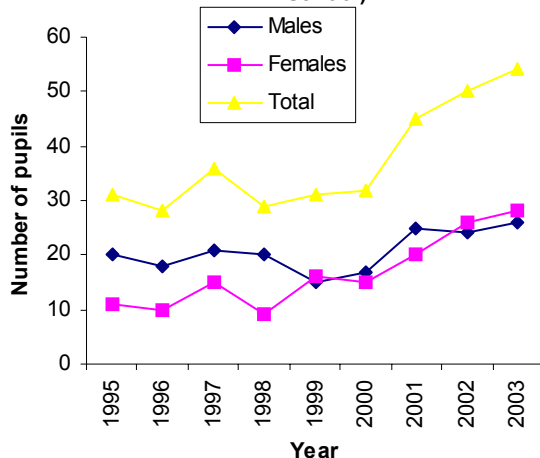
Solar energy intervention had led to an improved academic performance by girls¹³ during the period of the project. The improvement in girls' performance saw them catching up with the boys (see Figure 3). This was attributed to the extension of the working day enabling girls to complete the domestic tasks assigned to them in the household and then still be able to carry on with their studies using the solar light. Boys do not get assigned such domestic responsibilities, and so had always been able to do their homework earlier before it got too dark to study. The benefits in terms of academic performance were therefore more noticeable in the girls as commented upon by one mother in the extract below.

¹³ Number of pupils who passed in first grade

..... Before solar was installed in this household, my three children (one girl and two boys) rarely read at night. For my little girl, her studies were at God's mercy. She never had time to read at home. When she would be free, paraffin would be over. These days, after doing the domestic work, she goes to the sitting room and starts reading even if her brothers are already asleep. Last term she surprised me, she came top in her class, and even my boys performed better in their respective classes.....

Female respondent - Kabwohe

Figure 3: Number of students who passed in first grade from 1995 to 2003 at Kabwohe Secondary School)



In the two schools that were visited in western Uganda as part of the case study, it was reported that solar energy enabled the school to reduce lighting expenditure. In both schools, the headmasters reported that, prior to the solar power installation; their school had one pressure lamp which was used by all the teachers and students at night in the whole school. One head commented that the pressure lamp used approximately two litres of paraffin (Ushs.3200) and had to be repaired every Sunday at a cost of Ushs.2000. This suggests that each month a school would spend around Ushs.100 000 on paraffin for the solitary light. Since solar lighting was installed in 2001, the expenditure on lighting has fallen. In 2001 and 2002, the monthly repayment of the solar credit was Ushs.50 000 and a further Ushs.10 000 was spent on solar bulbs. Thus there was a monthly saving of around Ushs.40 000 which would rise to Ushs.90 000 in 2003 once the credit had been repaid. Prior to the solar installation, if the pressure lamp had a problem then, for that night, there would be no night studies. Now, a solar bulb has been installed in each classroom. The increased classroom lighting had contributed to increased school performance at primary level 7 as illustrated in Figure 3. The figure shows that the number of pupils, especially girls, passing first grade has increased tremendously since 2001 (average number of students per year is 63).

v) Commercial enterprises set up

Ten commercial enterprises were established as a result of having access to solar energy. These included shops, battery and phone charging services as well as video watching facilities. Among the clients of the Muhame financial institution were three households which were providing battery and phone charging services and these were all jointly-owned and operated by husband and wife teams. Due to lack of access to grid electricity (due to a limitation supply) in the rural areas, there were a limited number of shops with fridges. There are now two female-owned shops using solar energy for

refrigeration, and lighting at night, to attract customers. These shops have become substantial income sources and led to an improvement in their living standards as explained by one of the female widows in the extract below.

.....There are two ways I have benefited from having access to solar energy. It has helped me power my refrigerator in my shop and also enabled me work better at night. When evening falls, I get a lot of customers who want soft drinks, most especially local brew and beer. There are shops around here that have no fridges; their cold drinks are always hot. I take advantage of this, and most customers come to me. This has helped me pay school fees for my children and renovate my house. You know that when my husband died, I thought it was the end of life, but solar power has brought new life to me. This shop is everything to me and I am planning on building a shade around it, and putting in some chairs for my customers. That's what I have to say about solar, let me rush and attend to my customers.....

Female widow respondent - Kabwohe

Not only the households that had installed solar energy benefited. Surrounding households had bought car batteries and took them for charging to households with solar power. Those with mobile phones were also able to charge their phones with ease. Phone and battery charging became a source of income for some households as detailed in the extract below.

.....Before solar, I used to spend nearly Ushs.5000 per month on batteries for my radio but now I no longer buy cells. My neighbours have bought [rechargeable] batteries, which they bring here for charging. I charge them 1000 Ushs per battery. I also charge Ushs.500 for the mobile phone charging services that I provide. In a week, I can't fail to raise Ushs.5000 through battery and phone charging. I am planning to start up a small poultry project and use the solar for brooding.

Male respondent - Kabwohe

vi) Increased number of clients for the village bank

Village banks, such as the Muhame Credit Financial Institution, have also benefited through increasing their number of clients by eighty-nine members, of which thirty-six were females. Their share capital has also increased. They have earned a good public reputation and trust and are, at the moment, being asked to become involved in other district financial projects. At the time the study was undertaken, the staff members were receiving lots of requests to share their experiences with other micro-finance institutions in other districts so that they could learn from them.

Staff members had received training about solar energy usage, installation and maintenance through the project. This enabled the staff members to acquire new lifetime skills. Due to women's existing good credit payment record¹⁴, as well as being the ones who spend more time at home than the men¹⁵, the training had included skills on how to teach female clients about savings, women's empowerment, and how to start up their own small income-generating activities and obtain credit. The trained staff members were able to incorporate these skills in advising clients.

¹⁴ Of 51 defaulters, only nine were women

¹⁵ In both Bushenyi and the fishing villages on the Lake Island

vii) Increased monthly income from income-earning activities

There were new and improved activities that women and men could engage in due to having solar energy. The improved lighting and information flows that were achieved through this energy service led to women's and men's involvement in income-earning activities such as running shops, zero grazing of cattle, goat keeping, and poultry and pig keeping in Bushenyi. In Bufumira, the benefits were mainly in terms of costs saved through a reduction in expenditure on transport and an increase in income from battery charging.

viii) Income earning from small-scale enterprises

In Bushenyi, only 14 households were engaged in poultry keeping before the solar intervention and were using paraffin lanterns for providing the necessary light. Such an income earning activity tended to be a male-owned one. Solar lighting was used after the solar installation and the number of households keeping poultry increased from 14 to 27. After solar installation, in all the 27 poultry-keeping households, this activity had turned one jointly-owned and managed by female and male members of the household. Further, the average monthly household income derived from such projects had increased from Ushs.3000 to Ushs.80,000. Solar energy was used mainly for chick brooding. Other income generating activities reported to have evolved from increased solar energy household energy lighting and information flow included goat keeping, piggeries, and battery and phone charging.

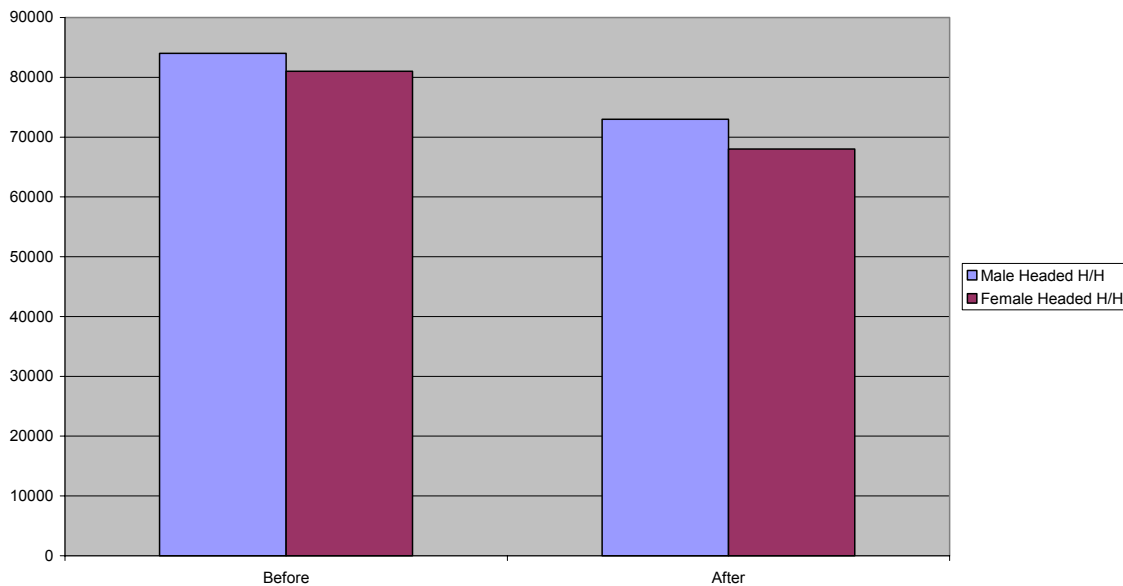
ix) Savings made after utilisation of solar energy services

By utilising solar energy services in the houses and for small scale enterprises, there were monetary savings made at the household level in terms of the money that used to be spent on purchasing fuel (paraffin and wood for lighting). Male respondents in male-headed households estimated that, before solar installation, they used to spend an average of Ushs.84,000 per month on fuel costs. Women, especially those in female-headed households, indicated that they used to spend Ushs.81,000 (see Figure 4).

After installation of solar panels and utilisation of solar energy services, respondents from male headed households indicated that on average they had saved Ushs.11,100 per month (84,000-73,000)¹⁶, which used to be specifically spent on lighting, powering the radio, television and cold refrigeration as well as provision of warmth (to poultry and other small enterprises). Those from female headed households had realised that on average they had saved Ushs.13,000 per month (81,000-68,000).

¹⁶ There was still some expenditure on fuel, especially paraffin and wood since the type of solar energy services that were available could not fulfill other needs that the households had (especially cooking)

Monthly Expenditures by Male and Female Headed Households Before and After Installation of Solar Panels



x) Income from battery charging

In Bufumira, battery charging using solar energy has led to increased diversification of economic activities. Apart from fishing, any other income-generating activities at the household level are generally owned and run by women. These activities include shop/bar/eating place management, poultry and/or pig keeping, hairdressing and craftwork. The electricity generated by solar panels was used to charge batteries for running fridges to cool drinks, such as beer and soda, in bars. Both men and women normally contributed to the starting capital required but, since the men were never around (out fishing), businesses/enterprises ended up being run by women. The women supervise all the business activities while the men simply keep an eye on them. Before the solar energy battery charging system was installed, business would frequently collapse because of the time it took for batteries to be returned from charging in Entebbe. With such a service now provided locally, energy-reliant activities can operate on a continuous basis. While fishing, the *mukene* (silver fish) are attracted using light; the fishermen now use a battery-powered light to attract the fish and this has increased catches.

With women becoming active in income-generating activities, housing conditions have been improved. Most fishermen and their families used to sleep in poorly constructed homes. Women now have access to income, and have been able to plan to use the energy services in ways that help in improving housing conditions.

xi) Reduction in transport expenditure

In the Bufumira area, respondents reported that the major benefit they saw was being able to get their batteries recharged at a relatively low cost and in a short time, and without them getting damaged in transit. Previously, the respondents had to travel long distances to get the batteries charged and, along the way, some batteries were stolen or damaged, and the whole process was time consuming. Now they

can have their batteries charged within the islands. Transport to Entebbe cost around Ushs.2000, and battery charging ranged from Ushs.1500 to Ushs.2000. Although the cost of having a battery charged has not reduced, the transport element is saved. This helped men more than women because it is the role of men in this area to provide energy services, especially ensuring that batteries are charged.

xii) Reduced household expenditure on health

The solar energy intervention has also reduced household expenditure on health, as less money is now spent on respiratory-related sicknesses, which used to be a significant household burden. Solar lighting is clean compared to the candle and paraffin lights that they used to use. In Bushenyi, the male respondents reported a monthly fall in average health expenditure from Ushs.9000 to Ushs.5000 after the solar energy system was installed. Similarly, the female respondents reported a drop in monthly health expenditure from Ushs.6000 to Ushs.3000.

It was discovered that in Bufumira, before the solar intervention, many batteries were not carefully disposed of. This resulted in soil and water contamination that posed a threat to the health of the inhabitants and the fish. On top of educating the people about battery usage, the solar project, BIDA, taught them how best to dispose off their old batteries. Such interventions improved the health situation of the respondents through reducing the occurrence of sicknesses that used to result from improper disposal of batteries.

xiii) Reduced expenditure on fuel and dry cells

Reduced lighting-associated fuel expenditures were reported. The average weekly household expenditures on paraffin and candles were Ushs.5000 and Ushs.1000 respectively before the solar intervention, and these figures reduced to Ushs.3000 and Ushs.500 respectively after the solar energy intervention. The weekly expenditure on dry cells for radios reduced from Ushs.2000 to Ushs.800 following the solar installations.

A specific example, based on a household in Bufumira, showed that a lot of money used to be spent on paraffin for household and shop lighting. On average, the household used to consume two litres of paraffin each week. Since each litre costs Ushs.1600; the average family was spending Ushs.3200 per week on lighting. A fully-charged battery lasts two weeks and costs Ushs.1500 to charge. This suggests a weekly saving of Ushs.2450 in fuel expenditure. One respondent reported ownership of a battery-powered radio that used ten dry cells, which only lasted for two days. Each pair of dry cells costs Ushs.500. This implies that in two days, the respondent spent Ushs.2500 on dry cells. Using a car battery to power this equipment, this would cost Ushs.1500 for two weeks representing a tremendous saving.

f) Problems encountered with the solar energy interventions

From the above sections, we can see that solar energy has to some extent led to a reduction in household poverty and to the empowerment of women. Despite this, there were problems encountered linked to the solar energy interventions. There were two cases in Bushenyi and two in Bufumira where solar panels had been stolen. Thefts were mostly done at night and household members would be threatened if they tried to report such acts. The thieves would climb on the roof, unscrew the solar panel and then run off as described by one of the male respondents in the extract below.

..... *My solar panel was stolen last year. I was fast asleep when three thieves woke me up and instructed me not to intervene with their activities or else they would cut me into pieces. Each had a sharp panga. Two thieves remained with me threatening to kill me if I made a noise and the third climbed on the roof and unscrewed the panel. They run off through the banana plantation never to be seen again. They had masks on their faces and I couldn't recognise them. Before my panel was stolen, my neighbour had talked of installing solar but, since then, I've never heard him talking about the issue. Maybe he got scared. I didn't report it to the police since there was no unique identification on my panel. I wish that the panels they install had unique identification numbers for such instances. I strongly suspect that that the thieves were the people who installed the solar or had direct links with them. Anyway the saddest thing in my life is that am back to using and a hurricane lamp for lighting at night.....*

Male respondent - Kabwohe

As noted in the extract above, this creates a major threat to the lives of householders with solar energy and this, in turn, discourages further installations. Lack of identification numbers on the panels complicates the issue further as it is difficult to identify stolen panels.

A second problem has been that the solar system purchasers were not supplied with proper solar energy batteries but only with cheaper car batteries. Car batteries last for only one or two years before wearing out whereas solar batteries can last for up to ten years. Although the initial cost of a car battery is low, over time it proves to be a more expensive option than appropriate solar energy batteries.

Thirdly, 80% percent of the women respondents reported that solar energy had led to quarrels at night over the issue of when to use the solar light. There was a conflict of interest since the distinct needs of women and men occur at specific but different times. While women wanted to listen to the radio or watch television after completing all their domestic tasks, men generally preferred these leisure activities earlier in the evening (while their wives were busy in the kitchen!) as noted by a female respondent below.

.....*Currently, the main problem I am facing is the time of switching off the lights. When I am cooking, my husband is in the sitting room either watching TV or listening to the radio. By the time I finish the kitchen work, he is tired and wants to eat and go to bed, while I want to eat and watch TV.....*

Female respondent - Kabwohe

Finally, none of the kitchens had solar lighting despite the kitchens being set apart from the main house. Women still cook in poorly lit kitchens. Some women planned to convince their husbands to extend the solar lighting system to include the kitchen. However, in most cases, this would mean moving one solar lamp from the main house to the kitchen. In male-headed households, such a decision requires skillful negotiation by the woman to convince the man about the importance of having light in the kitchen as observed in the extract below.

.....*My kitchen is not well lit like the main house. Since I now work hand-in-hand with my husband, I will convince him to put me a bulb in the kitchen.....*

Female respondent - Kabwohe

g) Conclusions, policy and programme recommendations

This case study has illustrated that analysis that takes into consideration the institutional and gender dimensions enables an assessment to be made of the political dynamics involving material- and knowledge or information- related struggles that women approach differently to men.

Using gender analysis and the feminist political ecology perspective has enabled the study to pay attention to the roles and needs of women and men, as well as providing an understanding of the political dynamics that involve knowledge acquisition and access to information on the utilisation of energy services. The study has illustrated the struggles that women approach differently to men. However, we have seen that there are women who participate in decision-making if they are provided with the information and skills needed on the importance and use of energy services. Any such decision-making is done in different ways from those adopted by men. The study has highlighted cases where there are conflicts over access to energy services. Future studies should address the implications of energy service provision on the subordination and vulnerability of poor women and men.

The study has shown that the effectiveness of energy service provision depends significantly on:

- The extent to which gendered roles and responsibilities are taken into consideration when institutions are planning such activities;
- The ability of these institutions to use strategies that link energy service provision to activities that improve livelihoods.

To sum up, the following conclusions are drawn from the case study and provide some key policy and programme recommendations:

- Gender is a key variable in energy service interventions.
- Benefits identified by women include as consumers using lighting; as women staff in solar companies and village banks; and as women entrepreneurs in home-based income-generating activities. These benefits were made possible through a deliberate gender strategy followed by the solar companies and the village bank in the project.
- Providing equal access for women and men to information and technical assistance as well as taking into consideration their different roles in the households were key to the success. Attention to employment creation is critical to enable changes in the gendered division of labour.
- The new energy service provided grounds for both cooperation and conflict between women and men, and bargaining and negotiations were critical in the households. Men choosing to spend more time at home, and watching television together, gave more opportunities for discussion of household issues (although women's participation in decision-making did not necessarily increase).
- Access to information helped women make more input to decision-making activities on energy services.
- Institutions play a critical role in determining whether energy services will be effective in meeting women's needs by how they take into consideration gendered rights and responsibilities, and by using strategies that link energy service provision to activities that will improve the livelihoods of both women and men.
- Energy services can also perpetuate gender inequalities.
- Institutional arrangements that use gender analysis in planning and implementing energy service provision can contribute to women's empowerment.

These are explained in more detail below:

i) Gender is a key variable in energy service interventions

The case study illustrates that gender is a key variable in energy service interventions as reflected in the following conclusions:

i) Energy services provide benefits to women

There are benefits that women gain as they participate in the acquisition and utilisation of energy services. Men, however, do not notice so much change and the realisation of benefits unless there is a major change in what they are used to. This is due to the fact that they have been the key target actors in the provision of energy services for a long time. Women identified the following as the key opportunities they have obtained:

- Women as users of solar panels for lighting
- Women as staff in solar companies, village banks
- Women as entrepreneurs in home-based small-scale activities such as zero grazing of cattle, pig rearing and poultry rearing.

These benefits have been possible where the solar companies and the village bank took into consideration the fact that gender concerns were key within the household, and with regard to small-scale enterprises that could be undertaken within this structure.

ii) Consideration of the gendered division of labour and valuing women's labour

The case study shows that solar companies, as well as the village bank, were able to take into consideration women's labour by providing awareness creation, information and technical assistance on the maintenance of solar panels to women who provide most of the labour within the household. Acquisition of such knowledge and skills enabled women to participate in the solar projects. Secondly, in some cases, the roles of women and men in household-related activities that required solar power were considered during the period of purchasing solar panels as well as the installation process. In cases where this was not done, conflicts arose between women and men in the same household.

The study concludes that the success or failure of energy service interventions depends on the extent to which women's status (gender equity), and especially valuing women's labour, have been taken into consideration when planning and implementing the interventions.

The main programme-based recommendation that such conclusions lead to is that efforts should be made to formulate initiatives that encourage employment creation in ways that result in substitutes for free-labour provision (such as hiring labour for farming or household tasks) so that women can engage in income-earning activities (such as rearing chickens or zero grazing cattle). The pressure created in the household on the use of women's and girl's time and labour by such new tasks sometimes led to tasks being transferred to other household members, especially boys.

iii) There is also need to take into consideration the work intensity and time allocation of women, and how these differ from those of men.

This would enable energy service programmes to realise the importance of the time and effort that women can save when they utilise services such as lighting and heat in income-earning activities; much of the information for which is gained from the radio and television.

iv) Recognition of the gendered differences in the right to access energy services contributes to improvements in the role of women as decision-makers

Bargaining was an important practice in many households. The energy services that were provided through the installation of solar panels provided grounds for cooperation as well as conflict between women and men. The case study has shown that there are instances where some of the women negotiated with their husbands to purchase solar panels so that these men could spend more time at home watching television or listening to news. As a result, they also had more time to discuss household issues, especially the education of their children as well as how to spend and invest the available funds in the household. Indeed, one of the men indicated that the acquisition of a solar panel enabled him to spend more time at home due to improved indoor lighting, and the information he could get from the radio and television influenced his decision-making and attitudes.

Although such examples show how women's tactics ensure that men work towards addressing their needs (of participating in expenditure decisions; of having access to light for various activities in the household), this does not necessarily indicate that women become decision-makers themselves or that a change in gender roles has taken place.

v) Access to information and knowledge on energy service provision enables women to participate in decision-making in similar and different ways as men

The case study shows that provided women have access to information and knowledge, they can make decisions on accessing energy services in similar and different ways to those adopted by men. Women who have high educational levels can engage in various ways within which they address conflicts over access to energy services. However, less educated women end up in subordinate and vulnerable positions, especially if they cannot easily read and interpret the information on the availability and acquisition of energy services.

vi) Consideration of gendered rights and responsibilities enables effective energy service provision by institutions

The effectiveness of energy service provision depends significantly on:

- The extent to which gendered rights and responsibilities are taken into consideration when institutions are planning their activities; and
- The ability of these institutions to use strategies that link energy service provision to activities that ensure improved livelihood.

vii) There are cases where energy service provision aggravates gender inequalities due to imbalances between the rights and responsibilities of women and men

The case study shows that energy service provision can aggravate gender inequalities in cases where there is an imbalance between the rights and responsibilities in the ways that energy services are acquired and utilised by women and men. The effects of such inequalities are reflected in the way that

women, in undertaking innovative ideas, face more hindrances than men. Such situations affect women's abilities to engage in income-earning activities using the energy services that could empower them economically.

viii) Institutional arrangements that use gender analysis in planning and implementing the provision of energy services can contribute to women's empowerment

The case study illustrates that in order to understand how energy service provision can reduce gender inequalities and contribute to women's empowerment, there is need to:

- Analyse the extent to which institutions integrate gender in their activities related to energy service provision;
- Identify the different ways through which the rights of women and men are exercised in enabling them to acquire and utilise the services; and
- Find out ways through which women can have access to the knowledge and information needed for their participation in the utilisation of energy services, especially in cases where they have been subordinated or excluded by men.

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