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EVALUATION OF NORWEGIAN ASSISTANCE TO THE ENERGY SECTOR OF SADCC COUNTRIES

PROJECT PROFILE 4:

M O R O G O R O F U E L W O O D

S T O V E P R O J E C T

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T A B L E O F C O N T E N T S

L I S T O F A B B R E V I A T I O N S

CCT	-	Christian Council of Tanzania
CD	-	Community Development
EDM	-	Electricidade de Mocambique
GDP	-	gross domestic product
GJ	-	gigajoule (= 10^9 joule)
GWh	-	gigawatthour (= 10^6 KWh)
km	-	kilometre
km^2	-	square kilometre
kv	-	kilovolt
KVA	-	kilovolt per amp
KW (or kW)	-	kilowatt
KWh (or kWh)	-	kilowatthour
lt	-	low tension
m^3	-	cubic metre
MFSP	-	Morogoro Fuelwood Stove Project
MJ	-	megajoule (= 10^6 joule)
MW	-	megawatt (= 10^3 KW)
MWAP	-	Morogoro Women - Focussed Afforestation Project
MWh	-	megawatthour (= 10^3 KWh)
NARSE	-	New and Renewable Sources of Energy
NGO	-	Non-Governmental Organisation
NOK	-	Norwegian Kroner

SADCC	-	Southern African Development Coordination Conference
SIDA	-	Swedish International Development Agency
SUA	-	Sokoine University of Agriculture
t	-	tonne
TWh	-	terawatthour (= 10^{12} kilowatthour)
US$	-	U.S. Dollar
WTC	-	Women's Training Centre

4. MOROGORO FUELWOOD STOVE PROJECT

4.1 Background and objectives

The Morogoro Fuelwood Stove Project (MFSP) is one of the two projects in Tanzania selected for evaluation because of its status as an NGO - run energy project. It is located in Morogoro region, one of the 20 administrative units in the country, and in the vicinity of Morogoro town, about 200 km from Dar es Salaam.

At the last census (1988), the town had 117,000 inhabitants, whilst the Region had a total population of over 1.2 million. The main economic activity of the Region is agriculture and a few agro-based industries. The major source of energy for households, both in the urban and rural area, is wood consumed directly as fuelwood or indirectly as charcoal. Although the town is linked to the national electricity grid, electricity is used mostly for industrial and commercial purposes.

In the urban areas, families spend about 20 per cent of their income on charcoal for domestic cooking. The availability of fuelwood/charcoal for urban areas is a major concern in Tanzania. The Ministry of Natural Resources has a project with the World Bank to supply affordable sources of fuel to major urban areas in Tanzania. Fuelwood for rural areas is also a concern and there have been major campaigns and programmes to plant trees. Some of the surrounding villages, located on the steep hills of the Uluguru mountains, have difficulty in getting fuelwood. Even during the colonial days of the 1950's, deforestation, soil erosion and land shortage were serious problems on the slopes of the Uluguru mountains and these problems have steadily grown worse with increasing population pressure.

The MFSP evolved from initial ideas and subsequent research at the Sokoine University of Agriculture (SUA), located in the foothills of the Uluguru mountains in Morogoro Township. The SUA research was initiated in 1979 by Mr Ishengoma. It was further

developed by Dr. Irina Sensenig, leading to the development of two types of stove namely; a dual purpose ceramic charcoal/firewood stove (pangawe) for the urban and peri-urban areas and a fixed mud stove using wood for the rural households.

In 1984, Ms. Anne Sefu, the current Tanzanian Project Coordinator, Dr. Sensenig, and other university staff drew up a project aimed at decreasing the consumption of fuelwood and reducing the amount of time and labour spent by rural women in collecting fuelwood. The main emphasis was to be on further improvements to the two types of stove (ceramic and fixed) and on promoting the production of these stoves in the villages. A request for funding was presented to NORAD and by the end of 1984 NORAD granted MFSP Tz.Shs 450,000 (NOK 225,000) for one full year from special funds for women and development projects.

By this time, the project had shifted in terms of organization from SUA to the Christian Council of Tanzania (CCT). Initially the link was rather loose but, in 1987, it was incorporated fully into the CCT's Women's Training Centre (WTC). NORAD has continued funding the project and the current funding will ensure support for the MFSP until 1991. In the current phase, NORAD covers 80 per cent of the cost while the CCT meets the remaining 20 per cent.

4.1.1 Objectives

The original focus of the project was on the welfare and development of women and hence the objectives in 1984 were:-

i) to lower fuelwood consumption and reduce time and labour spent on collecting fuelwood, particularly in the rural areas;

ii) to disseminate fuel efficient firewood stoves in order to meet the objectives in (i) above.

Over the years, the objectives of MFSP have been modified and widened. Currently they appear to be still focused on the development of women and the reduction of their workload but with stronger links to environmental issues and the energy needs of urban households where there is a growing demand for more efficient charcoal stoves. The current objectives appear to be:-

i) training for the production of, and promotion of, an acceptable charcoal stove model for sale in urban areas;

ii) training for the production of, and the promotion among rural women, of an appropriate firewood stove with greater emphasis on the raising of the awareness of the advantages of the more careful use of firewood from both socio-economic and environmental aspects (Sefu, 1989).

Implied throughout the annual reports and other project documents are two other objectives, namely,

iii) to support the production of stoves as a form of income-generating activity for women in the villages around Morogoro;

iv) the creation of the awareness of environmental aspects of fuel-saving as well as the need for the conservation of forests and the need for tree planting.

All these objectives coincide with national policies both about women and the environment. They are also subjects of concern to NORAD. In order to achieve these objectives the MFSP has identified the following activities:-

a) the adaptation of existing stove designs (portable and fixed) to specific user wishes;
b) the promotion of stove production through demonstrations and

the training of potters;

c) the support of production units in villages through visits, the collection and the sale of the stoves.

d) the training of CCT participants in making fuel-efficient stoves.

e) working in cooperation with other institutions in devising training courses on environmental aspects of fuel saving stoves and on tree planting, as well as in promoting stoves.

f) preparing publicity materials.

The above objects did not have set targets in terms of the numbers of households to be reached, stoves to be produced or the number of potters to be trained. The objectives were very general and therefore the assessment of achievements in relation to the objectives also had to be very general.

4.2 Project implementation

4.2.1 Project organisation/OM

The MFSP became an integral part of the Women's Training Centre (WTC), in July 1988, whereas previously it has been merely under the umbrella of the CCT.

The CCT is a non-governmental organisation (NGO) which has activities in various parts of the country, the headquarters being in Dodoma. The WTC is located in Morogoro. It was set up ten years ago and runs two courses a year for women parish workers and for pastors' wives. A number of subjects are taught including tailoring, handicrafts, horticulture and livestock raising. Stove-making, tree raising and environmental issues were introduced to the Centre in January 1985 with the start of the MFSP.

The link with the CCT has enabled the project to obtain:-

i) offices, stores and training facilities, including a demonstration ground for the stoves;

ii) residential space for participants on special courses such as those attending the stoves and tree project courses;
iii) an interesting and promising target group of women leaders;
iv) a certain degree of autonomy.

Although located in the WTC, the project maintains a separate identity. It works outside the WTC courses, and is in no way confined to working in a religious context. The project is headed by a coordinator, Anne Sefu, who is also an extension officer. Her relationship with the staff of the WTC, the MFSP staff, other related institutions such as the Morogoro women-focused afforestation project (MWAP) and stove makers in the villages is a key factor in the smooth running of the project. It is the view of the team that any credit gained by the project is a manifestation of the coordinator's good relationship with the other agencies.

As part of the WTC, MFSP staff participate in a number of activities related to the administrative and special aspects of the centre. Much of this, though unrelated to stoves, is useful and informative for staff and student development, and promotes the acquisition of skills and self-confidence by the project staff. In turn, the different departments of the centre have cooperated with the project to save fuel and promote stoves, for example:-

- the sewing project uses the extra-large Morogoro charcoal stoves for tie-and -dye cloth preparation;
- the students cook on the Morogoro charcoal stoves for their cookery lesson practicals;
- the horticulture teacher demonstrates the use of fruit to make jam by cooking it on a Kilakala firewood stove.

MFSP also has links with the MWAP which is located under the umbrella of the Catchment Forest Project funded by the Swedish

International Development Agency (SIDA). The objectives of MWAP are:-

i) to ensure women's access to forest products;
ii) to arrest soil erosion.

These objectives are pursued through a range of activities, including seminars, to raise environmental consciousness, planting trees and visits to villages. The MFSP coordinator had participated in the formulation of the project proposal and it was understood that this would strengthen the environmental aspects of the project. MWAP was supposed to work side-by-side with MFSP in the villages where MFSP was already promoting stoves. This aspect has not worked out as planned but the partnership has continued in other areas:-

i) the sharing of knowledge and resources amongst the personnel of the two projects;
ii) the 3 women of MWAP have worked closely with the staff of MFSP in designing, running and evaluating the courses on stoves and trees.
iii) the MFSP coordinator is a member of the technical committee of MWAP, which has been set up to see how MWAP can participate in promoting tree planting.
iv) MWAP promotes the use of stoves in the villages where it is involved in assisting the villagers to plant trees as a measure to reduce fuel consumption and to protect forests.

Cooperation with the office of Community Development (CD), the major institution involved with rural extension services in the country, was tried in 1988 but did not last, partly because of the competing responsibility of the CD officer located in the project area.

On the whole, MFSP is a small-scale project with a very flexible and extremely loosely-defined organisation and plan of action. Organizationally there is an anomaly because the CCT is mainly interested in training its own course participants and in producing items for sale to support its own activities. The MFSP is interested in training and extension services in order to disseminate stoves and help village women to sell them in order to augment their income. Clearly, there is a major conflict and it does raise important questions about constraints faced by institutions which have multiple roles.

Apart from training, MFSP organises stove production in the villages. However, because of its small staff, MFSP has concentrated its efforts in two villages - Ruvuma and Kiroka. In addition, MFSP works to a lesser extent in promoting wood stoves in villages where MWAP has tree-planting programmes.

The size of the small staff, the wide scope of objectives and anomalies in functions between the parent organisation and the project, are serious organisational constraints that need to be looked into for the future well-being of the project.

4.2.2 Choice of technology and training

The project activities can be divided into 5 main categories: development of the stoves; training; stove production; promotion and marketing; environmental aspects.

4.2.2.1 Development of the stoves

The project team investigates the suitability of stoves developed or used elsewhere and makes appropriate modifications where necessary in order to suit local needs. For instance, the Kilakala fixed mud stove is based on a model from Mali known as trois pierres ameliore. So far the project has modified/adopted four models:-

i) a ceramic charcoal stove with a fixed grate for urban use;
ii) a ceramic woodstove, similar to the previous one but without a grate, for urban and rural use;
iii) a mud stove (the Louga model) burning firewood for rural use based on the Senegalese model;
iv) a fixed mud stove with three stones for utensil support, based on the Mali model.

At the moment only types (i), (ii) and (iv) are being promoted; the Louga stove has been abandoned. From time to time, the project staff use consultants to investigate specific problems such as the dissemination of Kilakala stoves, the problem of cracks in charcoal stoves, etc. Experimentation is also carried out in related matters, such as developing a more efficient kiln to fire the ceramic stoves. The kiln reduces the amount of firewood needed per stove for the firing from 6.4 kg. in the traditional pit-firing method to 4.1 in the kiln.

4.2.2.2 Training

There are two main types of courses: WTC general courses and special stoves and tree courses run with the assistance of the staff of MWAP. The courses are taught several times a year.

WTC General Courses

MFSP runs two courses a year for CCT trainees who are usually pastors' wives and parish workers. By June 1989 it had run 27 such courses. Besides stove-making, the stove sessions include environmental issues, tree-raising and related matters taught by MWAP staff. In both cases the type of stove made has been the Louga or more recently the Kilakala model suitable for rural households. The general aim here is to provide skills at making fuel-efficient stoves and raise consciousness about fuel saving among the participants, who are then expected to convey the message to their communities. The sessions are part of an extensive syllabus involving training in other subjects such as

nutrition and sewing.

Special Stoves and Tree Courses

The courses, lasting for about 4 weeks, are specifically aimed at stove-making and environmental issues. Topics include the relationship between stoves and types of fuelwood, the demonstration of fuel saving on project stoves, raising seedlings, tree planting techniques and practical sessions on all types of stove making.

An additional aspect of training is follow-up activities which is only possible for those trainees within close vicinity of the project. Fortunately, MWAP has been able to supplement MFSP follow-up activities in the MWAP villages through their village visits, if the trainees come from such villages.

Finally, MFSP has conducted informal training on stove and kiln making in the villages surrounding Morogoro town, especially in MWAP.

4.2.2.3 Stove production

For the ceramic stoves, MFSP has tried to organise stove production with women potters from villages around Morogoro. To-date the most viable unit is in Ruvuma village about 7 km. from Morogoro town. The group consists of 25 women who are related to each other. The only resource that they share is the kiln which was built on the advice of the MFSP staff. The organisation is rather loose. Each woman digs her own clay, makes her own stoves, carries her own firewood and fires the kiln herself. The sale of pots is also conducted on an individual basis.

The project coordinator uses the project vehicle to collect the stoves which are then sold at the centre on behalf of the potters. Apart from this unit, there are individual efforts among trainees in other places, e.g. Ifakara in Morogoro and Msanzi

village in Rukwa Region. One of the members of the evaluation team was able to observe at first hand the activities in the latter area.

4.2.2.4 Promotional and marketing aspects

The project has attempted to promote the stoves, both in the urban and rural areas, through its training courses, its campaigns, the production and dissemination of publications, and through a permanent display of the stoves to visitors, participants of seminars, etc. The MFSP has received good support both from the media, the government and the political party because of the promotional efforts of the project. There are obviously some problems as will be discussed in later sections.

4.2.2.5 Environmental considerations

These are covered generally in the WTC general courses and more specifically in the special course. The three members of the MWAP work closely with MFSP in designing, implementing and evaluating these courses.

MWAP also provides training in environmental issues through its own promotion of tree planting in the villages, such as Ruvuma, where stove-making is an important activity. Here, the stove-makers have planted a woodlot which, when mature, can be harvested to fire the stoves, thus highlighting the relationship between stoves and tree-planting. In other cases, MWAP promotes stove making (Kilakala stove) as complementary to its own programme of tree-planting, and MFSP staff have been involved in demonstrating the different stages of stove-making.

The close cooperation between MWAP and MFSP enables the latter to fulfil its objective of incorporating environmental issues in its training sessions as well as providing a rationale for fuel-saving stoves.

In addition to raising awareness of environmental issues, MFSP also attempts to contribute to saving the forests through its fuel-efficient stoves. This aspect is, however, dependent on the dissemination of the stoves - the more stoves used, the more forest saved. The dissemination has not gone according to plan. Nevertheless the stoves, particularly the charcoal stoves, do have the potential of slowing down deforestation if the technology becomes widespread. At the moment their contribution is minimal.

Given the size of the project staff, the scope of the activities is too ambitious. Already, the demand for training is more than the project can cope with. Why are there so few staff? Is the funding policy of CCT only for the training of a small group of church leaders?

The 1987 Evaluation Team had proposed a stronger link to larger organisations, such as the Department of Community Development (CD). However this would have affected the autonomy and flexibility of MFSP operations. If the link with CD could be established like the link with the CCT, but with more staff and resources, MFSP may be able to retain its autonomy and resources, and expand its scope to meet its enlarged objectives more effectively.

4.2.3 Actual implementation compared with implementation plans

The Evaluation Team did not see any formal plan of action. The general character of the project appears to be to "play it by ear". In some ways the informality of the project is its strength but it does make it difficult to assess "plans". The following aspects are therefore based on inferred plans of implementation.

4.2.3.1 Development of Stoves

The original objective of the project was to reduce the amount of fuel consumed as well as the labour used by women in collecting fuelwood. Most women in Tanzania live in rural areas and have the arduous task of carrying firewood on their heads, over long distances and often over difficult terrain.

Accordingly, the project's primary activity was to develop and disseminate firewood stoves amongst rural women. The main emphasis, initially, was therefore on a portable wood stove and the fixed mud stove, with three stones for utensil support, for use with firewood. A ceramic version of the mud stove was later added as a dual purpose charcoal/firewood stove for use in urban and peri-urban households.

After the first four years, it was found that the dual purpose ceramic stove was not appropriate since very few women habitually used both charcoal and fuelwood. Therefore, two separate versions of the portable ceramic model were developed; the Morogoro charcoal stove and the Morogoro firewood stove.

Similarly, for the mud stoves, it was discovered that the fixed mud stove, locally called Kilakala, was preferred to the portable one. The latter was more likely to break. It was also found that the two-door version was more efficient than the single door which tended to be smoky if not well-made. There have also been changes in the materials used to make the fixed mud stove. The mixing of grass with mud has proved to make the stoves more durable. In addition, shrinkage of the stoves during the drying process has been greatly reduced, and therefore the need to repair cracks at this stage has been largely eliminated.

Eventually three models have emerged and tests have shown considerable savings in fuel. One source found that the ceramic charcoal stove, when compared with the conventional metal stove,

saved about 13 per cent for dishes such as ugali and beans, to as much as 50 per cent for rice and vegetables. Overall, there was a saving of 25 per cent of fuel needs with the ceramic stoves and 18 per cent with the mud stoves (Muro and van Luigk, 1987). The project itself used three different experts to conclude that savings are of the order of 30 - 50 per cent. The objective of producing fuel efficient stoves has therefore been met.

4.2.3.2 Promotion and dissemination

The project currently attempts to promote three types of stoves: the Morogoro charcoal stove mainly for sale to the urban areas, the Ceramic firewood stove and the 2 door Kilakaka stove for use by rural women. (SEFE, Annual Report, 1988/89).

There has also been a change in emphasis in the promotion of the different styles. The ceramic firewood stove has not been popular in the urban areas, where the real demand has been for charcoal stoves, nor in the rural areas where, there has been very little demand, in Morogoro District for improvement of the traditional three-stone fireplace. The woodstove, in fact, increased the labour time of rural women because the wood had to be chopped into small pieces in order to fit in the stove. The traditional three-stone fireplace could take firewood pieces of varying lengths and thickness.

The fixed mud-stove is more appropriate to the needs of rural women, but up to this point it has been adapted extremely slowly. The project staff feel that this is due to the current lack of perceived scarcity of fuelwood among the women in the project area. It is thought, however, that in villages where women have to walk longer distances, the fixed mud stove (Kilakala stove) would disseminate faster. The acceptable threshold is thought to be walking distances of 2km. each way; at distances above 2 km there is a perceived fuelwood scarcity. Hence, the mud stoves have not been adapted in Ruvuma village where collecting

distances are less than 2 km. In fact, in this village where, ceramic charcoal stove making is the majority activity of twenty-five women, they, themselves, do not all have improved mud stoves. In contrast the mud store is doing better in Kiloka where women have to collect fuel from distances in excess of 2 km.

Only the ceramic charcoal stove which started as a sideline has disseminated to some extent, reaching a peak of about 867 in 1986, and 757 in the following year. In all about 2482 stoves have been sold in Morogoro town by the project over the last 43 months. This production has come both from the project as well as from Ruvuma village, 7 km. from Morogoro Town. Outside Morogoro district stoves are being used in Ifakara, in Rudewa and Bulongwa in Iringa region and Msanzi, Katuka and Sumbawanga town in Rukwa region.

Although the coverage seems wide, in actual fact it falls far short of what the project had hoped to achieve even for Morogoro district (See section 4.3.2.4). The failure of the stoves to be disseminated in the rural areas means that the project has not succeeded in its objectives of reducing fuelwood consumption and the time taken by rural women to collect fuelwood.

4.2.3.3 Production

It is not clearly stated anywhere, but one assumes that originally, the stoves were meant to be produced by the rural women for their own use. A few stoves have been produced, but on the whole the production of the fixed mud stove has been negligible; the largest number produced, being at Ifakara where 70 units have been made.

With the lack of demand for improved stoves in the rural areas, and a growing demand for charcoal stoves in the urban areas, the greater tendency has been for the stoves to be made by rural

women for sale mainly to clients in the urban areas.

The team could not find any definite production targets in the documents made available to it, but Muro and van Luijk who assessed the project in 1987 refer to a target of 5 per cent of the population of Morogoro town, or 1000 households per year, eventually aiming to achieve a penetration of 10,000 households/year. In actual fact, the number of stoves produced is about 700 per year. Since 1988, this figure has declined because of the problem with cracks and the fragility of the stove, which deter prospective new users. Nevertheless there is obviously a demand for such stoves.

Thus, in addition to saving fuelwood, the project has incorporated the concept of the development of women through the making of stoves as an income-generating activity. Once the concept of income-generation is involved, other skills such as management and marketing are required. The project itself has undertaken the marketing of ceramic stoves, even to the extent of providing transport. This new development is commendable, but it does change the character of the project from production for own use to training for an economic activity that should be economically viable.

4.2.3.4 Training and follow-up

Originally, it was planned to train all women since the primary objective was to reduce the labour burden of collecting fuelwood. Basically the target groups were the CCT regular trainees (pastors' wives and other church leaders) and special groups, including potters who would then spread the stove making skills to rural women in their respective communities. It soon became apparent that in the case of stove-making, the short WTC courses and the special Stoves and Trees courses were too short to provide stove making skills to non-potters.

It was therefore felt that more could be gained by using the 'training of trainers' concept. In the case of mud stoves, village women potters would be taught the necessary skills, and they in turn would make the stoves, for their neighbours for a small fee. In the case of the ceramic charcoal stove, it was also felt that a training in pottery was a pre-requisite and that these potters would then make stoves for sale particularly to the urban households. In spite of this however, training courses still include a number of non-potters, who get less from the training than those with skills in pottery.

Originally, too, it was envisaged that the project would concentrate on Morogoro district in order to enable the project staff to do a follow-up of their trainees. However, due to pressure from institutions, donors, etc., the training has had to accept participants from a very wide geographic area, making a follow-up of trainees very difficult, and also changing its original status as a pilot project. For the special courses, participants have come from the following eight regions: Arusha, Kilimanjaro, Tanga, Morogoro, Rukwa, Dodoma, Singida and Mara. In addition, there have been participants from Zanzibar. Participants of the general WTC courses have come from an even wider geographical area. Some participants have successfully replicated the stoves once they returned to their home villages or town.

While the greater geographic coverage is commendable for the dissemination of knowledge, concentrated follow-up is necessary to promote the production and the dissemination of stoves.

Nevertheless, although the stoves have not been disseminated as planned, the concept of fuel-efficient stoves and the ability of the project to reach out and spread the information about the technology has been quite impressive. For the size of the project with its limited resources, this coverage is quite

remarkable, and shows that, as far as training is concerned, the project has been quite successful.

4.2.3.5 Comparisons between plans and achievements

The project has not achieved all it set out to do, but given its limited scope, it has had some notable successes. The main observations are:

i) it has managed to develop appropriate firewood and charcoal stoves with about 30 - 50 per cent savings in fuel consumption.

ii) it has been able to stimulate production of charcoal stoves to well over 2480 stoves between December 1985 and June 1989, or an average of 700 stoves a year for Morogoro town alone. It is very likely that it would have sold many more were it not for the development of the technical problem of cracking.

iii) it has not reduced rural women's labour time in collecting fuelwood, but it has provided some women an income-generating activity. To what extent it can contribute to the development of women is rather an open question and needs more attention in terms of organisation, marketing etc. However it does offer the rural population cash incomes whilst at the same time satisfying urban energy needs. In the long run, and if well disseminated, it can cut down on urban energy demands and this in turn would reduce the destruction of forest now taking place through charcoal production.

iv) it has raised awareness about environmental as well as women' issues.

4.3 Potential of the MFSP in reducing deforestation and improving the environment

When the project started, the belief that the stoves (charcoal and firewood) were going to save forests was predominant. It

has by now been realised that this was a misconception. This was for a number of reasons, principally concerning the facts that the reasons for deforestation are well established and do not include firewood for domestic purposes. The main reasons for deforestation are land clearing for agriculture, uncontrolled grass burning and wood collection for non-domestic uses such as bakeries, commercial beer-brewing, brick-making, tobacco-curing and charcoal production. It should therefore be clear that deforestation cannot be solved through piece-meal interventions such as the stove project.

It should however be acknowledged that the different interventions, however minor, could add up to a sizeable contribution if operated at a wide scale. For example, to have any impact at all, the stove project must move to mass production and utilisation. Comprehensive statistics on the stoves produced and disseminated during the life time of the MFSP could not be obtained at the time of writing. But informal sources indicate that between 1984-87 the total number of stove sold by MFSP was 1,370 and, by September 1989, some 2,500 stoves had been made and sold. The life span of the stoves is estimated at between 6 months to a year. From the number of stoves made calculations of the amount of wood saved are necessary. This requires an understanding of the efficiency of the stoves.

Tests have been carried out to determine the efficiency of the stoves made in Morogoro. It is estimated that the charcoal stoves save between 30 - 50 per cent of the fuel input compared to the traditional metal stove. This seems to indicate that considerable savings could be generated particularly where long cooking is involved. But Muro and Luijk (1989) note that, in statistical terms, the variability of the actual results differs so much that the apparent saving could be due to the small sample size used in the tests. They, however, acknowledge that the average amount of fuel used by the MFSP models in the tests

is less than that of ordinary stoves.

Villagers in Ruvuma village also said that the Kilakala stoves used much less fuel compared to the traditional three-stone stoves. It is estimated that the stoves use 30 per cent less fuel compared to traditional three stone stoves. But it has to be borne in mind that the amount of fuel saved depends on the type of meals cooked. Also the apparent saving could be influenced by pre-conceived bias on the part of the user.

It will therefore be apparent that the role of the stoves in reducing deforestation remains quite uncertain but through the implementation of further projects, a significant contribution towards reducing the extent of deforestation could be made. An example, of these related activities is the sister project, the MWAP.

The original objective of MWAP was to increase the awareness of women to forestry issues. More objectives have since been added and they include:

- to ensure women's access to forest products
- to arrest soil erosion in mountain areas.

These objectives are being pursued through a range of activities including seminars, courses to women on trees and stoves, teaching in schools about tree planting and visits to villages.

Some villages are visited twice a week while others are visited twice a month. These activities are concentrated in 11 villages.

MWAP has already produced visible effects in terms of trees planted by farmers in their own fields and around homes in Ruvuma village, where a wood-lot has been established to provide firewood for stoves thus eventually saving the forest. The

firing of 30 stoves uses approximately 90 kg of wood which is cut and brought down to the kiln from the top of the mountain. However it is suggested that the equivalent of the wood used to produce stoves is quickly made up (4 days have been indicated) when stoves are used. Agroforestry is also being introduced through demonstration plots in schools and villages. Acceptance of agroforestry is slow due, among other reasons, to a lack of a clear understanding of its role, and an extreme shortage of land in mountain areas (Ideally this should be an incentive to agroforestry).

Thus the potential of the MFSP in reducing deforestation and improving the environment should be looked at both from a long term perspective and as a package of programmes embedded within the framework of the project. The potential cannot be restricted to activities such as stove development and dissemination. In other words these isolated activities should not be looked on as ends in themselves as far as environmental conservation is concerned. On the other hand, the various activities should be viewed as a package. Also the different activities, such as the stove programme, should be a means of reaching other objectives within the philosophy of women's development and environmental conservation.

4.4 Social aspects

4.4.1 Background

The project was originally aimed to be a pilot project in Morogoro district with the immediate beneficiaries being women in the villages around Morogoro town where the project is located. The people in this area are the matrilineal Waluguru whose main activity is agriculture. There is the same division of labour as is prevalent elsewhere in Tanzania. The women are heavily involved in productive activities while at the same time being almost entirely responsible for socio-reproductive activities. Being matrilineal, however, the women have their own fields and

keep their own cash income as far as possible.

The main occupation of the women is agriculture, followed by brewing, which is used for ceremonies, as payment for agricultural labour, and for sale. Brewing requires about 2 - 3 times as much fuelwood as that used for domestic purposes. Under current socio-economic conditions in the rural areas and the gender-related options for earning cash available to women and men in these areas, brewing is a very important source of income to women, second only to the sale of crops, and sometimes even taking precedence over such sales. Women are also engaged in handicrafts such as pottery.

Fuelwood is collected once a week by women and children; a trip that takes 3 -5 hours (Ruvuma village, 7 km from Morogoro). The usual practice is to collect dead branches and twigs, or to lop live branches when dead wood is unavailable. A whole tree is seldom cut down. Extra trips are necessary when brewing takes place. In the Uluguru mountains, women walk up the steep slopes to the rain forest to collect wood, as the rest of the slopes are used for cultivation.

4.4.2 Labour saving benefits to MFSP

The project hoped to address the development of women in two ways:-

a) through a reduction in fuelwood consumption;
b) through a reduction in the time currently used in fetching fuelwood for domestic use.

Reduction in fuelwood consumption was expected to save not only women's time and labour, but also to conserve the natural forests.

The stoves developed by the project have the ability to save fuelwood - the savings ranging from 30 - 50 per cent for the ceramic stoves and 20 - 30 per cent for the mud stoves. For rural women the two ceramic models are not appropriate. The predominant (only) source of fuel is wood, therefore, it is totally unrealistic to expect rural households to adopt this model. The wood stove requires wood to be cut into small pieces which tends to increase rather than reduce the time spent on getting fuelwood to the fireplace.

The fixed mud stove, Kilakala, is fuel-efficient and suitable for women in the rural areas. Users and non-users point out the following benefits:

.... uses less firewood
.... cooks food faster
.... is safe for children
.... retains fire and heat
.... gives off less smoke
.... blackens the pan less
.... holds the pan firmly for stirring, especially during preparation of the main staple, ugali
.... is cheap and attractive

Nevertheless, the new technology has made little headway in the rural areas around Morogoro Town. In Ruvuma village, where stove making for sale is an important visible activity, only three women have such a stove. In Ifakara, outside Morogoro District, wood stoves are made for sale to a hospital.

4.4.3 Possible socio-economic reasons for not adopting

The team did not have the opportunity to do a full in-depth study as to why rural women do not use the improved stoves. However, the following reasons are offered, based on discussions with the

project staff and a few rural women, as well as on direct observations.

The project leader feels that the women do not adopt the stove because they do not feel that fuelwood is scarce. Perhaps rural women do not see the connection between fuel savings and the reduction in labour time inputs involved in fuelwood collection because the task of fuelwood collection is not as difficult as, or no more difficult than, other arduous tasks. Indeed in Ruvuma village the women claimed that fuelwood collection was not very difficult. The project was based on assumptions that were not field-tested before the proposal was devised and implemented. It was only after the failure to disseminate the stoves that the project began to look for villages with a felt need for saving fuelwood. It is commendable that the project leader accepts this fact and has made some observations about what constitutes scarcity. According to Anna Sefu, the threshold appears to be a distance of 2 km. to be travelled each way; any distances exceeding would represent fuelwood scarcity. This would again have to be field tested.

A survey is needed to locate fuel-scarce villages in Morogoro district to understand the problems of collecting wood, and the threshold distance that women are prepared to travel before they consider that fuelwood is scarce. It would also be interesting to have a similar project in well known fuel scarce regions in Tanzania like Shinyanga and Dodoma District and compare dissemination rates.

A strong reason for promoting the stove was the fact that the women would save time in collecting fuelwood since the new stoves would require less. In fact, if the Kilakala stove does indeed save 20 per cent of fuelwood, it would save the women the equivalent of 10 weeks of collecting fuelwood (20% X 52 weeks,

assuming that firewood is collected once a week), or about 30-40 hours per year (assuming a collecting time of 3 - 4 hours a week) or less than an hour a week. These are not substantial savings given the current labour/time burdens of 12 to 14 hours a day and even more during peak seasons for planting and weeding.

In addition, the improved stoves also require the wood to be chopped up into smaller pieces than those used in the 3-stone fire place which offsets the time saved in collecting the firewood. If, on the other hand, savings in time were substantial, (as might be in a fuel scarce area) or they reduced the frequency of trips from weekly to fortnightly, the savings in time would be both visible and appreciated.

Secondly, the technology is not easily learnt by non-potters as is evident by the difficulties encountered by the participants of the special courses who had no experience of pottery. These courses are intensive two-week sessions; and yet the non-potters could not master the art. Therefore, it means that rural women would have to have their stoves built for them by specialists. The "training of trainers" concept described above, has two major implications:-

i) that the "trainers" have time to build stoves for rural women free of charge, each stove requires a labour input of about 4 person hours;
ii) the rural women pay for their stove, the current price being 80/= per stove. In principle, it would seem logical, as women purchase pots for cooking - so why not a stove? In Kenya women barter - a chicken for a stove, etc.

However, in a situation where 3-stone fireplaces as well as fuelwood and labour are not costed, it would take an acute fuelwood scarcity and the conviction of the absolute need to decrease fuelwood consumption to pay for an otherwise "free

good". Also the sum of Tz.Sh.80/= is a substantial investment for women whose incomes are quite low and the responsibilities are great. Cash is required for such basic items as food, clothes, school fees for children, hospital dues, money for grinding maize, etc. Obviously stoves cannot be promoted in a socio-economic environment where the priorities centre around the struggle for survival. There would have to be some strong reasons for the reduction of fuelwood consumption to compete with these priorities. The project would probably have had a greater impact in fuelwood scarce areas where women would better appreciate savings in time.

Also the stoves do not address one of the basic uses of fuelwood - namely for brewing. The portable or fixed mud stove built inside the house is too fragile to support the large 200 litre drum normally used for brewing. It therefore cannot be a substitute for a 3-stone fireplace which cannot only support such a drum but it can easily be dismantled when not needed and is usually outside the dwelling place. A mud stove would not survive the conditions outside.

4.4.4 Other benefits to women

The stoves are more popular in urban and peri-urban areas where fuelwood has to be purchased and therefore any savings are in the form of cash rather than time. This demand can have the following benefits for women :-

i) urban households and therefore urban women can realise substantial cash savings[1]. For instance, in 1987, users of the ceramic charcoal stove could save about 31 per cent of the cost of fuel per stove per month. The average consumption was 2-4 35 kg. bags per month @ 200/= c 800/=. Those who could not buy in bulk purchased small quantities

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1 The assumption here is that women can keep the savings.

of charcoal paying 30 shillings a day. Monthly savings could thus range from 125/= to 300/= with the poorer households saving more in absolute terms and as a proportion of their earnings.

ii) women in the rural and peri-urban areas can utilise the demand for such stoves to make them for sale. Income from this activity can average about 30/= an hour assuming labour inputs of 5 hours per stove and a selling price of 150/=. This income is higher than any returns from agriculture. Unfortunately, at present, rural women see stove making only as a seasonal activity because of the demands of food production. However, eventually, if well organised, the making of stoves could be a profitable activity that could result in substantial cash inputs into the rural areas. The demand is real, and it would be even greater if the stoves were strengthened through the use of a wire to hold the stove together after it has cracked. It would be better still if the cracking could be eliminated.

Another model for the higher income groups would be the stove encased in a metal body like the Kenya Ceramic Jiko. Its manufacture, however, would require joint ventures between the potters and the tinsmiths.

At the moment the greatest drawback to the production and dissemination of the stoves is the lack of transport and marketing mechanisms. The next phase of the project should concentrate on consolidating the training, by assisting prospective producers and exploring the ways of attracting middlemen, who would be prepared to go to the villages to purchase these stoves and sell them to the urban and peri-urban areas. The current cost of a stove is 150 shillings, but in 1987 it was found that even at 250 shillings the cost of the stove could be recovered within two months.

4.4.5 Stoves and the environment

In the course of the project, issues of environmental benefits were added to the objectives. Fuel-saving stoves were promoted as contributing to the saving of the forests as well as saving time for fuelwood collection. Awareness about environmental issues has been raised among the women such as the need to plant trees. However, the contribution of collecting fuelwood for domestic purposes to deforestation is somewhat doubtful. Domestic fuelwood is only a minor cause of deforestation. There are much more serious causes of deforestation such as the clearing of land for agriculture, livestock, constructional timber, uncontrolled burning, collecting fuelwood for tobacco burning and large scale production of charcoal. In the circumstances, it is unfair to pose as the solution for saving the forests, a reduction in the use of fuelwood for domestic purposes in the rural areas. Yet saving the forests is necessary for the welfare and development of the rural households in general and the women in particular, both from the point of view of avoiding land degradation, and for ensuring the availability of fuelwood within reasonable distances.

Charcoal burning is one of the contributory causes of deforestation and any increases in efficiency in this activity can contribute to saving the forests. The ceramic charcoal-using stoves are supposed to save from 30 per cent to 50 per cent of charcoal compared with the metal stoves currently in use. These are quite substantial savings. However, as the project stands, its contribution to saving the forests is minimal, mainly because the stoves have not been disseminated widely enough to make any meaningful impact. Should the stoves catch on, the savings could contribute to a wider national plan to save the forests through the reduction of charcoal burning. For urban and rural households, this would ensure the sustainability of a natural resource on which they depend for energy for cooking, and in some

cases, as in the Uluguru mountains, for heating during the cold nights.

4.5 Problems: Technical, Marketing and Implications

As with any project, the MFSP is not free from problems. As has been seen in Section 1, some of these problems are due to the lack of a sufficiently long pre-project period to identify clearly the objectives. As a consequence, some of the projects objectives were unrealistic, whilst others lacked clear definition. Other problems however, include technical and marketing issues.

4.5.1 **Technical**

Probably the most important technical problem facing the project is the cracking of the charcoal stoves when fired. The problem started in March 1988, in Ruvuma village, where 50 - 60 per cent of the stoves cracked during firing or in the first few days of use. This problem, however, is not peculiar to the Morogoro stoves. Similar problems have been experienced in Sri Lanka, Rufiji (Tanzania) and a number of other places. In Sri Lanka, they decided to live with the problem. In the case of Morogoro, a consultant was hired for three months to investigate the problem. He associated the cracking problem with the type of clays used and kiln temperatures. His investigation indicated that the type of clay used after 1988 (when the site was changed) had a lot to do with the cracking problem. It is felt that the potters should experiment with different types of clay until a solution is found. This mission also feels that the problem could be exacerbated by engineering aspects in the field of thermodynamics. This, therefore requires a more systematic technical investigation. Experiments carried out by the consultant indicated that stoves with thicker walls are not as susceptible to cracking. Preliminary experiments also indicated that the stoves most prone to cracking were are those fired at between 550 - 650 C. Both observations require further

investigation.

In the meantime the project is living with the problem. Although, the market for the stoves has been affected by the cracking, the defective stoves continue to be bought, albeit at a reduced scale. This was witnessed by the team in Morogoro town when a customer was seen to buy a cracked stove at the project's office. This probably indicates that the stove is intrinsically popular and the benefit of the stove outweighs this technical problem. It seems likely that more aggressive marketing could overcome this minor defect in of the product. An alternative explanation would be that the problem is not as serious as it is made out to be. With simple improvisation such as strengthening the stove with wires, the stove can still be used, despite the fault.

4.5.2 Marketing

Part of the production process is carried out at the project's workplace by both trainees and MFSP staff; the remainder is carried out by a group of women potters in the villages, mainly in Ruvuma. A small number of the stoves are sold directly to individuals by the potters and the rest are collected by the project staff with the aid of a car, the majority of these are sold in Morogoro town.

There have been attempts to encourage the potters themselves to deliver the stoves directly to the project. From January 1989 an incentive of 50 shillings was offered for every stove delivered. This was unsuccessful partly because there is no public transport from the villages to the town. Although there is frequent traffic to town for the delivery of farm produce, this is done on foot. It is unfair to expect delivery of the stoves to be on foot as they are quite heavy. This would mean walking the total distance to deliver at the most three stoves. A potter who has twenty stoves would have to make seven trips - this is

tiring, time-consuming and would have implications for the level of productivity.

Each stove is priced taking into account the degree of cracking. Orders are received from individuals as well as retailers and the retail price varies from 60 to 300 shillings including 50 shillings charged for transport. For comparison, the traditional metal stoves sell at between 250-500 shillings each. Thus, the Morogoro stove has a competitive price advantage, although there has probably been a reduction of confidence in the stove due to the cracking problem.

Returning to the problem of stove collection from the points of production, it should be emphasised that dependency on the project has far reaching implications, in that when, and if, the project comes to an end, the whole operation is bound to collapse. A system should be developed whereby the project can stand aside, advice and train. Probably the project should encourage private entrepreneurs to become interested in the marketing of the product by providing them with some initial guarantee. The project however needs to follow up the activities quite closely.

4.5.3 Assessment of costs and internal economics of the project

Since the start of project, NORAD has remained the main supporter of the project. By end of 1984, NORAD had granted the project a total sum of NOK 225,000. The grants for 1986 and 1987 are respectively NOK 226,000 and 112,000. The grants for the rest of the period (up to June 1991) are not available to the authors at the time of writing. But it is important to mention here that for the period 1st July 1988 to 30th June 1989 NORAD agreed to finance the project through NORAD covering 80 per cent of the expenditure and the remaining 20 per cent being covered by CCT.

The main costs have been established as the project's workplace, transport, salaries to staff, recurrent costs, courses, seminars and follow-ups. As for the courses, food and accommodation is provided by WTC and paid from NORAD funds. The rest of the expenses are met by the institutions, except for incidentals.

4.6 Conclusions and Recommendations

4.6.1 Conclusions

The MFSP is noteworthy in its efforts to use an innovative approach in promoting efficient wood and charcoal stoves which are manufactured locally at the village level.

NORAD funds have been well spent in supporting this autonomous project based at the Women's Training Centre of the Christian Council of Tanzania. From its base at Morogoro the project has tried to spread all over Tanzania. However, there is growing evidence that within its present framework the project has reached its maximum level.

The original objective of promoting the stoves was to reduce fuelwood consumption in order to reduce the amount of time used to collect fuelwood. The primary focus was therefore easing the burden of women in providing their households with energy for domestic purposes. With the passage of time, the project has taken on additional objectives, without at the same time redesigning the project, increasing staff or considering other resource issues. This has caused some problems for MFSP in meeting all its objectives.

Several assumptions were made, including the one that rural women would want to save time in collecting fuelwood and would therefore quickly adopt the new stoves. Whilst the project has managed to develop/modify fuel-saving stoves, the rural women have not adopted them. Obviously considerable research is necessary to get to the root causes of the lack of response.

The stoves have also been promoted as a contribution to saving the environment. The assumption here is that forest destruction is caused by the high demand for domestic fuelwood and charcoal in the rural and urban areas. The largest amount of destruction of the vegetation cover in Morogoro region is the clearing of land for agricultural purposes, and the use of fire for clearing the land has accelerated the process of forest destruction. For Morogoro this is well documented. (White and Fosbrooke, Rapp, Temple and Berry etc). Nevertheless, any savings in the use of fuelwood and, especially, charcoal can have a substantial impact on reducing the destruction of the nearby forests. Therefore, it is rather disappointing that the ceramic charcoal stoves have not disseminated as well as they should have, given the low price of the stoves and fuel savings ranging from 30 percent to 50 percent.

Morogoro township is one of the most rapidly growing towns in Tanzania. Over the last three decades it has grown at over 6 per cent per annum. Therefore, if any significant reduction of charcoal use is to take place, it will have to be at a rate of 18 per cent to maintain the current level of use or higher in order to reduce it. Even in the rural areas, where the population growth rates are seldom higher than 4 per cent, the corresponding use of improved stoves is very much lower than this figure.

Problems associated with the production, durability, transport and marketing of the stoves have to be addressed. An important issue to be considered is how to balance the need for large-scale production so as to make an impact on the environment, with village production by a few women potters as an income-generating activity. It is well known that once women's activity is commercialised, it no longer benefits women directly. It is time that ways were found to change this trend in the case of the production of charcoal stoves.

The overall conclusion is simply that to bring meaningful change, generalizations about problems and their solutions have to be put into a context and then operationalised in detail within the context of local specifications. In the case of the MFSP, it will be noted that there is a general energy problem in Morogoro town and in some parts of the rural areas. In the urban areas, the fundamental problem is that low income workers have to pay a substantial amount of their wages to obtain fuel. In some parts of the rural areas, women and children have to spend a considerable amount of time collecting wood for domestic needs. The free use of wood and charcoal production has brought the degradation of resources including land.

A general technical solution is available in the form of three different types of stoves catering both for charcoal and wood. It is feasible for women to produce these stoves at a village level as has been demonstrated in the case of Ruvuma village.

To date, about 2,400 stoves have been sold in Morogoro town through the sheer dedication of a core staff of three and village potters. Impressive as this may be, it needs to be emphasised that after four years, less than 10 per cent of the residents of Morogoro town use improved stoves and the figures in the rural areas are even smaller. Therefore, the positive environmental, social and economic impacts anticipated from the project are unfortunately, negligible. The adoption rate has to increase if fuel-efficient stoves are going to be promoted in Tanzania to save the labour/time burden of women in the rural areas, to make stove production a viable income-generating activity for the rural women as well as to be a significant method of reducing the stress on the forests.

There are three basic problems which the project has to resolve. Firstly, there are simply not enough stoves sold in Morogoro town. Secondly, there have been complaints about the stoves

cracking, so a quality and marketing problems have been identified. Thirdly, women making the stoves have to face a major problem in transporting the stoves to Morogoro. All the above problems have to be faced. Equally important is the question, what is the optimum production to be expected from village women?

4.6.2 Recommendations

1. In spite of the failure of the MFSP to disseminate the stoves, the project has shown that the promotion of such stoves, both in the rural and urban areas, is one way of improving the energy situation. For this reason, the MFSP needs support to further develop this policy and to show the practical benefits of promoting fuel-efficient stoves.

2. There are a number of valuable lessons to be learnt from the MFSP. Basic assumptions have been made about fuelwood scarcity in the rural areas. More information is required as to the conditions that can facilitate the widespread adoption of stoves in the rural areas. One way of doing this would be to replicate the MFSP project under varying conditions of fuel scarcity and socio-economic conditions.

3. For the project itself, the training aspect is its strongest point. An issue that needs to be addressed is the question of follow-up. One way to achieve this is to reduce the geographic coverage of the participants so that the follow-up is more feasible. Another way would be to have sub-units in other regions/districts. This arrangement would also provide the data required in 1. above.

4. In Morogoro District the project could explore the possibilities of paid extension staff who would undertake to build a stove for those rural women who showed interest. Improvements in rural energy supply and consumption may need

to be initially subsidised in order to promote them.

5. Stove production for sale must be commercialised if it is to make an impact. It is not clear if the project, as it is run currently, is willing to undertake the task of promoting such commercialisation. If it is, it has to be strengthened with appropriate staff. This commercialisation should seek to incorporate the women potters in the surrounding villages and consider such aspects as "soft loans" and joint training and economic ventures with the urban smiths and traders. In Zambia, stoves are being promoted through the training of urban smiths. The MFSP was, however, set up as a project for the development of women. This original purpose should be incorporated as far as possible in the wider production and dissemination of the stoves.