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MALAWI INDUSTRIAL RESEARCH AND
TECHNOLOGY DEVELOPMENT CENTRE

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SALT TECHNOLOGY DEVELOPMENT

DP/MLW/88/033 - ESTABLISHMENT OF AN INDUSTRIAL RESEARCH AND TECHNOLOGY DEVELOPMENT CENTRE

FINAL REPORT

K. KAFATIA

SEPTEMBER 1995

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1.0 SCOPE

This is the final report of the Salt Technology Development Project. The project was carried out by the Malawi Industrial Research and Technology Development Centre (MIRTDC) with the financial support from the United Nations Industrial Development Organisation (UNIDO).

Part A of the report presents the results of the project which was conducted in Chigweshe Village, Chikwawa District, during 1994/95. Part B gives a proposal for a pilot plant designed to produce 60 tonnes of salt per annum based on the developed technology.

PART A - SALT TECHNOLOGY DEVELOPMENT

2.0 BACKGROUND

The project was initiated in October 1994 after the signing of a contract between UNIDO and MIRTDC. Under this contract, UNIDO provided funds for the project whose scope of the contracting activities was as follows:

1- Fabrication of an improved salt extractor and the demonstration of its use.

2- Development and demonstration of controlled salt harvesting techniques.

3- Design and construction of a solar still and a preliminary study of its performance

4- Investigation of appropriate sources of energy

5- Study of material storage structures

6- Chemical analysis

7- Product marketing

3.0 METHODOLOGY

3.1 Community Participation

The salt technology development project was designed for high community participation in order to ensure maximum benefit to the people of Chigweshe village. These people have been producing low

grade salt through traditional methods since early eighties (see photographs 1-3). The project therefore, focusses at improving the indigenous methods in order to enhance the income generating capacity of those already engaged or interested in the salt production activity. In line with this thinking, a team of six traditional salt producers was identified through meetings held with the villagers. This team was used for the project activities.

3.2 Salt Harvesting

A twenty meter square area was identified and protected from people, animals and wind by fencing with reeds. This area was used for controlled salt harvesting.

The soil in the protected area was carefully observed and areas of high salt concentration (identified by the conspicuous grey colour) were scraped. The scraped soil was weighed and the area where it was scraped from measured.

3.3 Salt Extraction

An improved salt extractor was fabricated from timber and hessian cloth (see drawing No. 1-3 and photograph 4).

Special features of the extractor were a two stage filtration system and the use of sand as an additional filtering medium in the secondary (final) filter. The minimum thickness for the sand, which was washed clean before being used was 50 mm. The sand weighed approximately 40 kg per charge.

The filters were filled with weighed amounts of salt soil. Water, in the ratio of 2 kilograms of soil for every litre of water, was added to the soil and allowed to percolate through. At the end of filtration, the amount of filtrate was measured.

3.4 Sources of Energy

Sources of energy investigated included firewood, solar and biogas.

Visits were made to surrounding areas to locate sources of firewood.

Two temporary solar stills of 4050 mm by 3600 mm and 4050 mm by 1800 mm were constructed using bricks, cement, timber and plastic sheets (see drawing No. 4 and photographs 6-8).

The floor of the still was constructed of hard core and cement screed. A black polythene sheet was laid on the floor to absorb the solar radiation for brine evaporation. 150 mm high walls were constructed around the floor, using bricks, to form a trough to hold the brine as it evaporated for crystallization. The trough was plastered inside with cement mortar.

A roof was constructed over the trough using translucent plastic sheeting supported on a timber structure. A trap door was provided for salt removal.

Before charging the solar still, the filtrate was boiled for approximately thirty minutes to facilitate the removal of scum and other impurities. Small amounts of water treatment grade Aluminium Sulphate (half a teaspoonful per 80 litres) were added to enhance flocculation and sedimentation.

The boiled filtrate was poured into the still and the initial filtrate temperature and fill level recorded. Temperatures and liquid levels were recorded daily at selected times. Daily ambient temperatures were also recorded (see Table 1 and 2 for typical data).

An estimate was made for the number of cattle available in Chigweshe village to support a biogas plant. This was done through selected interviews with cattle owners and other people. A six cubic meter biogas digester is currently under construction.

3.5 Material Storage

Material storage structures were investigated. Places where bricks, sand, stone and fiber-cement roofing sheets could be obtained were identified and visited within a distance of thirty kilometres of the project site.

3.6 Market Study

A marketing study was conducted by the Technology Assessment and Transfer Department of the Centre. A report is included in appendix 1.

3.7 Laboratory Tests

The Malawi Bureau of Standards conducted chemical tests for the salt. Results are given in appendix 2.

4.0 RESULTS AND DISCUSSION

4.1 Community Participation

Community participation was highly successful in this project. The main reason being that the participants acknowledged the fact that they would benefit directly from the results of the technology development project.

The project started with six people (three men and three women; see photograph 4-5). Others joined in as the solar technology became more promising. The number increased to seven women and five men by the time of writing this report. More people are showing interest. It is anticipated that the group will grow larger after the biogas plant starts operating.

4.2 Salt Harvesting

Controlled salt harvesting was affected by drought. However, the study established that amounts of salt ranging from 2.7 to 11.1 kg could be recovered from 100 kg of soil. The wide variation in these figures is explained in part by non uniformity in soil moisture content and texture. Earlier studies and laboratory tests by Malawi Bureau of Standards report ***salt concentration levels*** of 10 percent.

The amount of salt soil scraped from within the controlled area ranged from 13 to 27 kg/m^2 with an average value of 22. Typical results of salt harvesting are shown in tables 3 and 4. The wide range in the results may again be explained by the difference in capillary rise by the salt water from the ground due to variations in soil type texture and moisture content.

4.3 Salt Extraction

The improved salt extractor worked very well; improving the concentration of salt in the saline solution by at least 100%. Hence from the traditionally achievable 10% salt solution concentration, the new filters produced solutions whose concentration ranged from 20 to 32% m/m. This was mainly due to the double filtration (counter-current) principle introduced.

4.4 Sources of Energy

Firewood is not available within Chigweshe village and very scarce in the neighbouring areas due to severe deforestation. The small amounts of firewood that were found were very expensive. Prices were further

inflated due to high costs to transport the firewood on bicycles over distances generally not less than thirty kilometres.

Chigweshe village has abundant cattle which provide large amounts of cow dung to support biogas plants. It is estimated that there are more than 2000 cattle.

4.5 Solar Still

Salt of high purity (consumption grade) was produced by solar evaporation. Chemical analysis by the Malawi Bureau of Standards supported this (see Appendix 2).

5.0 CONCLUSIONS AND RECOMMENDATIONS

The work done so far has proved that it is possible to produce better quality salt at higher yields using the improved filtration process. It has also shown that solar energy can be utilised to produce better quality salt and that in doing so, problems of deforestation and severe shortages of fuel for making salt will be overcome. Most important it has been demonstrated that it is possible to produce more and high quality salt while maintaining low levels of technology sophistication in order to ensure that the villagers benefit directly.

Arising from the study therefore, it is recommended that the salt making process be scaled up into a larger pilot plant combining the tested unit processes of filtration, boiling and evaporation.

The following section of the report therefore gives details of a proposed pilot plant with a scaled-up production capacity of at least one tonne of salt per week.

The development of this pilot plant combining all the processes together will form the basis for the transfer of the technology to other districts and areas in Malawi where saline soils or brine solutions exist. Some of these areas are around Lake Chirwa, in Chikwawa, Mzimba and Kasungu Districts. The transfer of the technology to other parts of Malawi will gradually substitute salt imports and provide sources of income to many Malawians.

PART B - DESIGN FOR A 60 TONNE SALT PER ANNUM PILOT PLANT

6.0 PRINCIPAL ASSUMPTIONS

6.1 Capital Budget

The capital budget has been based on a plant producing 60 tonnes of salt and operating for 300 days per annum. It assumes the plant would be integrated with a biogas digester which will provide the energy for boiling the salt solution to remove scum (impurities) before charging the solar still. The biogas plant is currently under construction through assistance from the Ministry of Women and Children Affairs.

The budget also includes a batch salt iodisation machine capable of processing up to 60 kilograms of salt per batch and up to 2000 kilograms salt per hour.

The budget is reasonably accurate with respect to the process elements. However, it has been necessary to provide lump sums for items which can be more accurately estimated for once firm indications for funding are obtained. This is necessary because of the continuously rising costs of materials and transport.

6.2 Revenue

Calculation of revenue has been based on the current price of K5.90 per kg for imported salt. Indicative cash flows are shown in tables 5 and 6.

6.3 Process Technology

The process on which the budget is based comprises three stages.

The first stage is simple filtration. The second stage is boiling the filtrate for 30 minutes or less in order to remove scum and impurities. Small amounts of aluminium sulphate will be added to enhance the removal of impurities. The final stage is the solar evaporation of water to crystallize the salt. Iodization will be necessary for the high grade salt for consumption.

For boiling the solution, biogas will be used and a $6m^3$ digester is already under construction.

Solar evaporation and crystallization will be done using solar stills made of wood and glass for higher durability and efficiency.

The process technology chosen is very simple. This was done in order to keep production at cottage level to benefit the poor people directly.

The project is to be considered a pilot project from which verification of process parameters will continue. Thereafter, technology dissemination will take place to other districts of Malawi which have saline soils or brines.

6.4 The Product

Two grades of salt will be produced. These will be the grade suitable for human consumption, and that for industrial use. The calculations assume the prices for the two products to be the same.

6.5 Waste Disposal

Attempts will be made to find suitable waste disposal methods

6.6 Plant Capacity

The design is for initial production of 1 tonne per week (60 tonnes per annum) which represents approximately 0.2% per cent of the imported salt at 1994 import quantity. This is indeed a very small proportion of the national salt demand. Product quantities will become significant once the technology spreads to other potential areas of salt production.

The production capacity can easily be increased by uprating the units of the plant or by constructing additional parallel units.

6.7 Staff

Staff costs are for temporary staff who will be employed for a period of not more than 3 years after which they may be absorbed by the project or laid off. Direct labour will be provided by the people who will work as a co-operative. The product will be sold by the co-operative for their sustenance and operating costs.

7.0 PROCESS CALCULATIONS

7.1 Salt Harvesting

From salt harvesting:

1 m^2 of ground gives 27 kg salt soil.

From solar still results

27 kg of soil gives 0.72 kg of salt

Therefore to produce 1 tonne (ie 1 000 kg) of salt per week, amount of soil required is:

37.5 tonne

Ground area required:

Since 1 m^2 of ground gives 27 kg of soil and the same gives 0.72 kg of salt,

1 389 m^2 of ground is required for 1 tonne of salt

i.e. an area of approximately **37 m x 37 m**
However, the salt regenerates.

7.2 Solar Still Performance

22 kg salt was produced from a 4.6 m^2 solar still in 14 days.

i.e. 0.34 kg Salt produced per square meter per day.

or 1.71 kg salt produced per square meter per week of five days

To produce 1 tonne of salt per week, the area of solar still required, m^2, is:

$$m^2 = \frac{(1\ 000\ kg)\ m^2}{(1.71\ kg)} = \mathbf{585\ m^2}$$

i.e. a still of **24 m x 24 m**

or 39 stills of 1.5 m x 10 m covering 585 m^2

7.3 Number of Filters Required:

From filtration results:

Average filtrate produced per day = 70 litres

Average salt produced per litre filtrate = 0.20 kg.

70 litres of filtrate will have:

$$70\ l \times \frac{0.20\ kg}{1\ l} = 14\ kg\ salt$$

1 tonne of salt will come from $\frac{1\ 000\ kg \times 70\ l}{14\ kg}$

i.e. 5 000 l filtrate

7.4 Number of filtrations required for this amount of filtrate is:

$$\frac{5\ 000}{70} = 71 \text{ per week of five days}$$

i.e. 15 filtrations to be done per day

One filter takes 8 to 10 hours to produce 70 litres

Therefore **15 filters are required**

8.0 BUDGET CALCULATIONS

8.1 Fixed Capital

Batch Iodization Plant

Available through UNICEF, a rotary salt iodization machine, capable of processing 60 kg salt per charge. The machine can iodize 600 to 2 000 kg salt per hour. Powered by 5HP petrol engine or a diesel Gen Set.

		MK
	US$ 2 000	31 000
Diesel Gen set 5KVA (EX-UNICEF)	US$ 4 000	62 000
Installation sum		10 000
Quality Control equipment (EX UNICEF)	US$ 368.67	6 000
Motor Vehicle (Pick/up)		400 000
Buildings		
Working area		30 000
Storage shed		50 000
Office/Toilets		60 000
Equipment shed (see 8.1)		30 000
Filters 15 x 1000		15 000
Solar stills 40 x 5000		200 000
Total Fixed Capital		**MK 894 000**

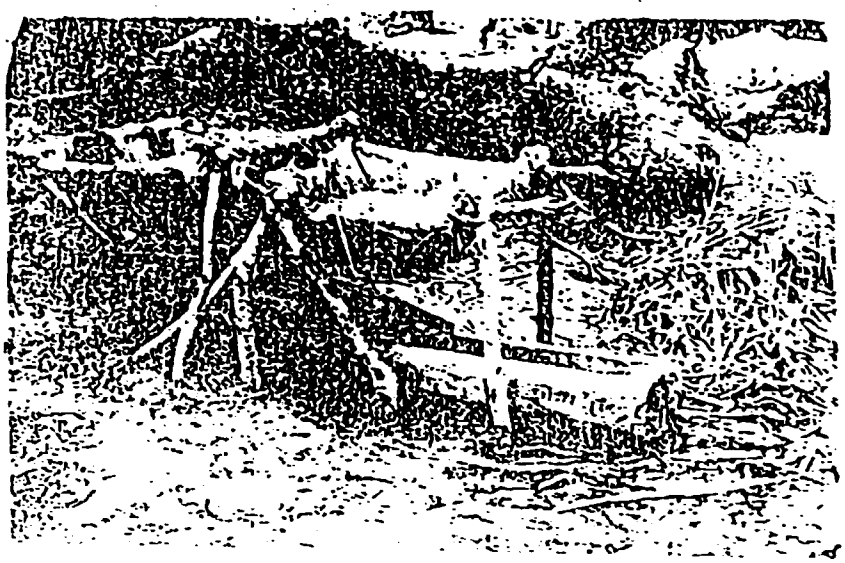
NOTE: US$1 = MK15

8.2 Working capital

	MK
Wages for six months (500 x 6 x 10)	30 000
2 supervisors (1000 x 6 x 2)	12 000
Replacement glass (sum)	5 000
Timber and nails (sum)	4 500
Process material	
Soil @ K10/tonne soil (three months)	4 320
One month's product (stock)	5 900
$Al_2 SO_4$ @ K25/tonne salt (three months)	380
Tools & Equipment (three months)	10 000
Fuel (three months)	10 000
Other (Paint, Plates Sacks etc) (three months)	10 000
Total working capital	92 100
TOTAL WORKING CAPITAL PLUS FIXED CAPITAL	**MK 986 100**

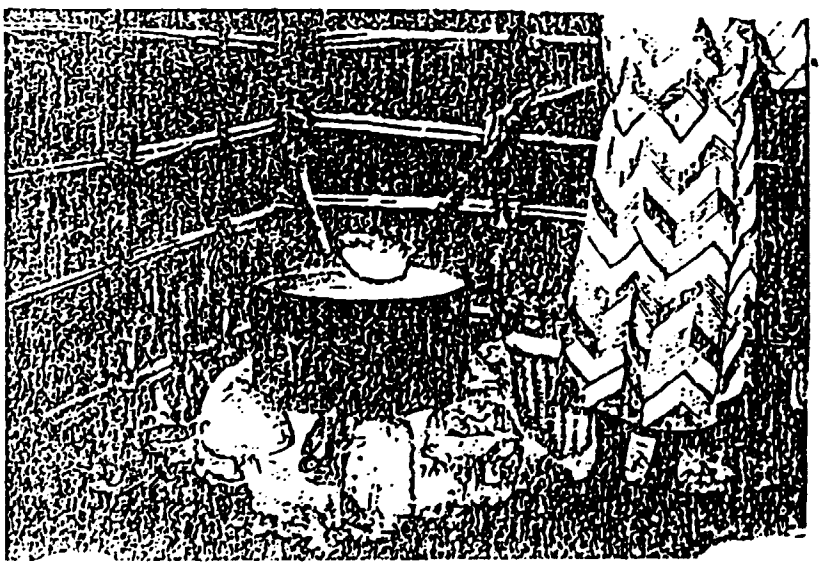
BIBLIOGRAPHY

1	J A Sonia, 1985	-	Salt Project Report No. 1
2	MIDAS Consulting Ltd	-	Salt Mining at Chikwawa
3	Intermediate Technology Publications, 1992	-	Energy Options
4	IDRC TS8E	-	Compost, Fertilizer and Biogas Production from Wastes in the Republic of China.
5	World Bank & Indian Institute of Technology	-	Solar Distillation. A practical study of a Wide Range of stills and their designs.



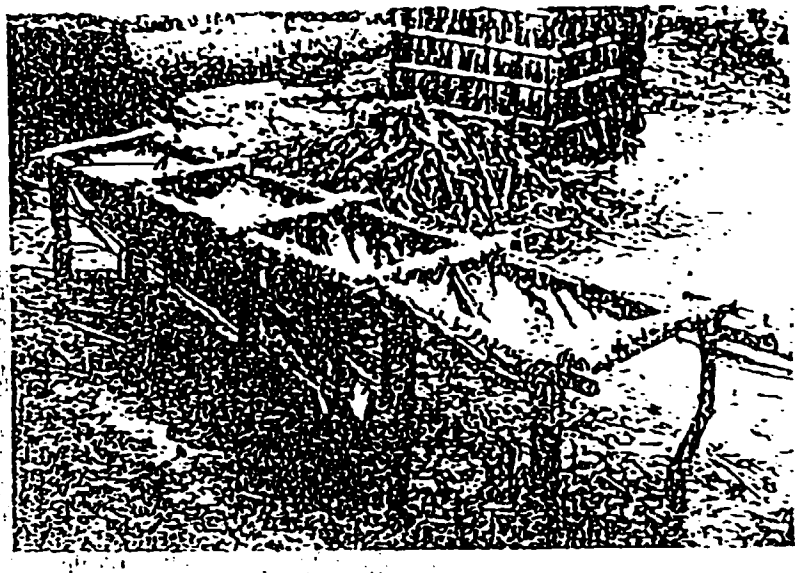
PHOTOGRAPH 1. TRADITIONAL SALT FILTER

WOODEN FILTRATE COLLECTOR SHOWN UNDER THE FILTER BETWEEN THE TWO POLES TO THE FAR RIGHT OF THE FILTER

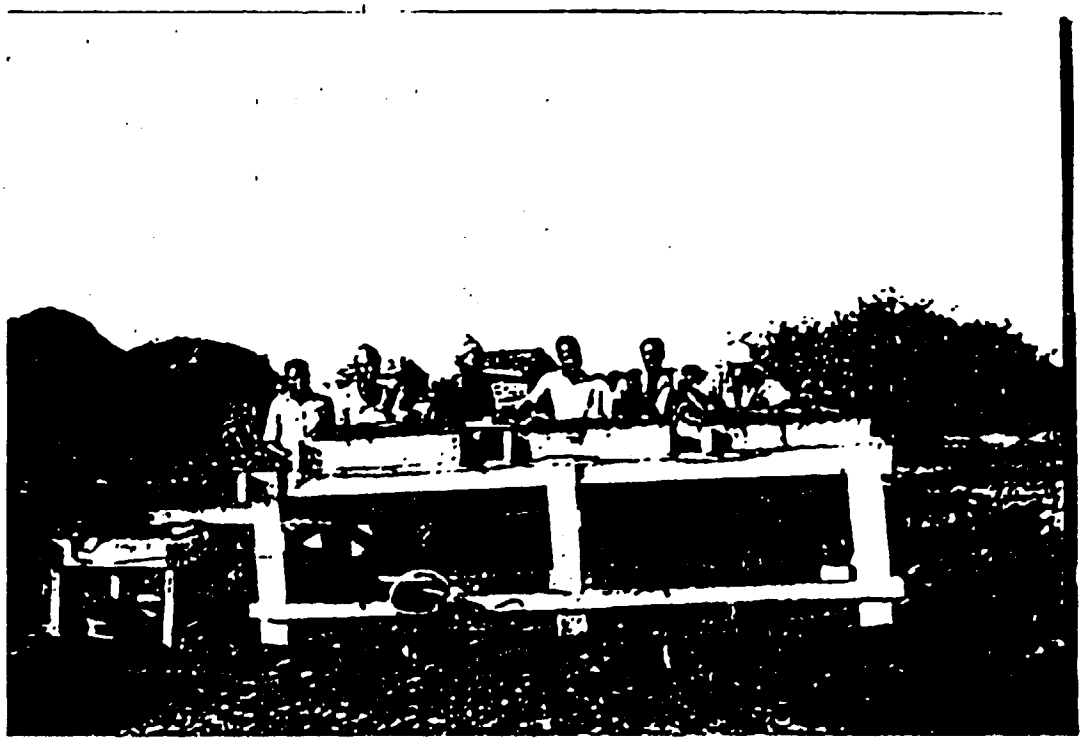


PHOTOGRAPH 2. BOILING THE SOLUTION

THE LADY IS SHOWN, SCOOPING SOME SALT CRYSTALS

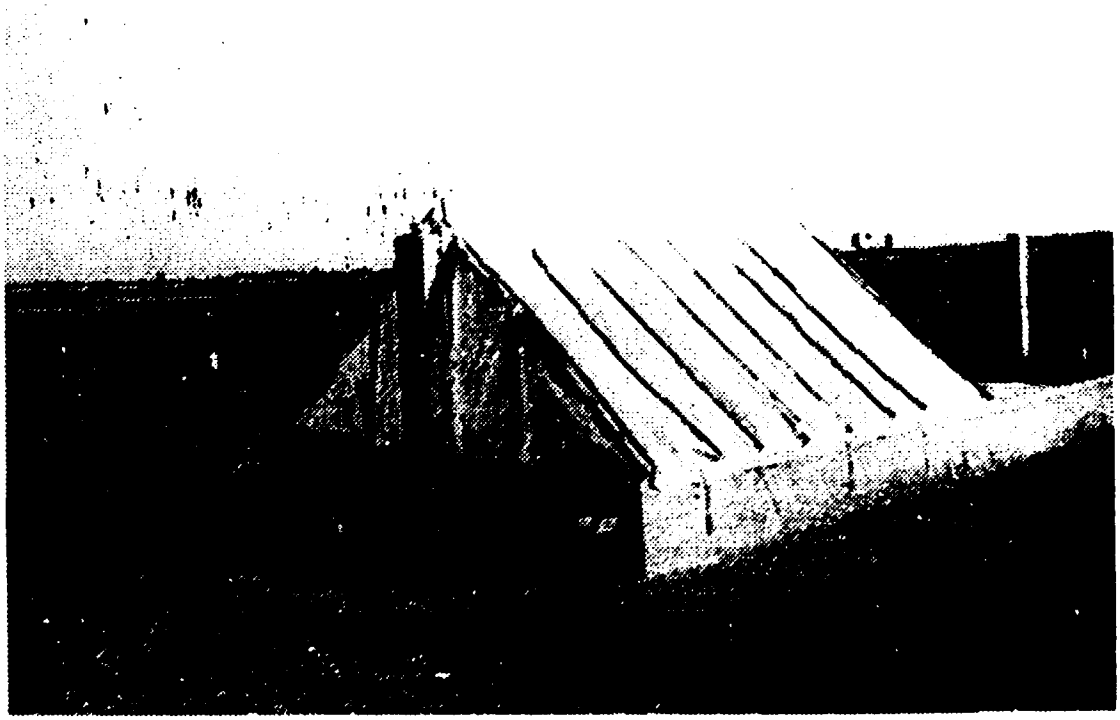


PHOTOGRAPH 3. TRADITIONAL SALT FILTER.
FOUR FILTER COMPARTMENTS SHOWN



PHOTOGRAPH 4.
AN IMPROVED SALT EXTRACTOR

PHOTOGRAPH 5: PART OF THE TECHNOLOGY RECEPIENT GROUP



PHOTOGRAPH 6 TEMPORARY SOLAR STILL - 4050 MM X 3600 MM

APPENDIX 1

MALAWI INDUSTRIAL RESEARCH AND TECHNOLOGY DEVELOPMENT CENTRE

MARKET RESEARCH REPORT FOR SALT PROJECT

PREPARED BY : J R KAMANGA

RESEARCH OFFICER (MARKETING)

TAT DEPARTMENT

DATE : SEPTEMBER 1995

1 INTRODUCTION

The project is carried out at Chigweshe Village, T/A Ngabu, Chikwawa District. It is located in the outskirts of Nchalo Trading Centre within one kilometre to the South of the Sugar Corporation. Access road to the village is from Nchalo Trading Centre. The main product of the project is salt which is produced at cottage industrial level using solar and biogas energies. The production process is currently being operated by a functional group of seven people who have been imparted with local technological production processes by Malawi Industrial Research and Technology Development Centre so as to improve the quality of salt such that it complies with local standards. In view of complementing the technical support given to the functional group, a market research for the product was undertaken by Mr J R Kamanga under the supervision of Mr S Kachale.

2 BACKGROUND TO SALT MINING AT CHIGWESHE

It is believed that Chigweshe Village has for a long time been regarded as a sacred place due to the existence of salt soil which was thought to be a divine concession to the area. Historically, the area is reknowed for offerings which tribesmen made to their gods to plead for rains, death, misfortune etc. In view of this, the soil was left untouched.

With the passage of time, the tribesmen gradually developed an interest in the extraction of salt in smaller quantities for home consumption. This was rationalised as consumption of divine soil for the purification of the body.

Through the 1970s to the end of the decade, saw the immigration of people into the village after having perceived the commercial potential of salt. Chigweshe Village, originally with a population of less than 200 became gradually flooded with over 500 families who sought a piece of land where they could undertake salt mining.

It is worthy reporting that the history of the occurrence of geological salt cannot be remembered clearly although there is evidence that it has been the subject of oral tradition for more than 80 years. It can therefore be said that the exact history of salt eruption is estimated from time immemorial.

3 OBJECTIVE

The objective behind the market survey was to assess the product market share as well as establishing onto the village the pricing strategies for the product so as to penetrate into the market. The identification and assessment of the product market will be based on both industrial and domestic usage.

4 METHODOLOGY

The survey was carried out as per the underlisted:

- Analysis of the Business environment and target market.
- Assess the existing channels of distribution.
- Assessment and analysis of competitors.
- Quantification of annual data on supply and prices and ascertain current and future demand.
- Computation of opportunities and threats of the project.

5.0 MARKET & MARKETING ASPECTS

5.1 Demand Analysis

Salt is used for domestic as well as industrial applications. At the domestic level, salt is used to almost every dish which it is applied during cooking or on the table. It is also used in the preservation of food such as fish or meat. Further to the highlighted uses, it is generally applied to traditional herb medicines. Following to this domestic use, demand analysis for the product has been derived on the locational basis and based on the population of Chigweshe Village, Ngabu Traditional Authority and other neighbouring villages such as Makhuwira Traditional Authority and part of Nsanje District. The highlighted places register the total population of 149,862 with an average growth rate of 4.7% per annum and this ascertains the strength of the immediate local market. However, it is of worth noting that it is somehow difficult to quantify the level of demand based on the population statistics as the consumption pattern per an individual during a specific period of time is not uniform. On an estimation basis, holding all other factors constant, an individual annual salt consumption is estimated at 4 kg and this put the quantity demanded by the market of 3,644 people of Chigweshe Village at 14.6 tonnes while with

the inclusion of the neighbouring villages that register a population of 149,862 put an annual consumption at 599 tonnes.

As regards to industrial usage, below is a highlight of potential consumers:-

Lever Brothers	=	50 tonnes per month (600 t/annum)
Cold Storage	=	20 tonnes per month (240 t/annum)
Lirangwe Women Working Group	=	20 kg per month (0.24 t/annum)
MACOHA (Tie and Die Centre)	=	250 kg per month (3 t/annum)

Total annual demand for the product is 1 442.24 tonnes. This demand will be increasing annually due to the increase in population as well as economic activities which are now moving from Agro to manufacturing.

4.2 Market Size and Projections

The historical salt imports statistics published in the statement of External Trade by the National Statistical Office in Zomba, showed the following import figures:-

Year	Quantity (tonnes)	Value (Kwacha)
1989	24 445.93	10 259 692
1990	21 883.00	9 950 044
1991	22 977.15	10 400 000
1992	14 566.47	4 394 200
1993	21 120.70	8 000 000
1994	39 268.00	15 158 040

The import figures show the potentiality of the market size and therefore the prospects of getting a market share are very high though the sites inspected were all small and probably would not contain sufficient reserves to produce the volume of salt necessary to significantly reduce the importation of salt.

It is a worthy noting that from 1989 to 1994, importation of salt has increased by 60.63% due to an increase in population and economic activities. In view of this rising trend it is therefore predicted that import of salt will continue to rise at not less than 10% per annum.

Currently salt production by the functional group is at an average of 15 kg per day which is 2.52 tonnes per month. This puts annual production at 30.2 tonnes with the assumption that all other factors are held constant. This shows that there is 15.6 tonnes in excess of the demand by the village but a shortfall of 568.8 tonnes if taken into account the demand of the neighbouring locations.

As regards to industrial usage, to meet Lever Brothers' demand for the product, the current production capacity needs to be increased by 20 times.

4.3 Product

The produced salt is course and compares favourably with imported one. It has undergone quality improvement such that moisture content has been reduced to standard level of 2.3% m/m while that of MBS specification, required maximum moisture content is 4.0% m/m, and this makes it look more whiter than it used to be. As regards to insoluble residues, the sample registers a figure of 0.4% m/m while the required maximum standard is 0.2% m/m. In view of this therefore, it can be said that the product has attained the standard 'eye and oral appeal' where it meets the needs and preferences of the customers. This has been evidenced by the comments put forward by the visited customers during the market research.

The salt as produced at Chigweshe is not iodised. There is a legal requirement in Malawi that salt intended for human consumption should be iodised. The salt produced at Chigweshe should be sold to iodisation plants if it is to be used for human consumption. Otherwise it is suitable for industrial use.

4.4 Pricing Policy for the Product

The market for the product is not price controlled. The price is determined by market forces of demand and supply. Currently, the product is sold at a ruling market price of K3.30 per kg while imported salt is sold at a ruling market price of K5.90 per kg. During the period of high product supply, the product price tends to go down and picks up during low supply. With the objective of penetrating the market, it is necessary to use a price penetration strategy where the sale price should be lower than the ruling price of the competing product.

Based on the existing project inputs, the break even price of the product is K1.57/kg on the assumption that cowdung will be free of charge. In light to the stipulated break even price, the current price of K3.30 per kg need to be analysed such that it should reflect production costs.

The established break even price will have to be compared to the ruling market price and the selection of a competitive price is a must.

4.5 Competition

It is worthy reporting that currently there is no factory in the country which produces salt. Thus all the salt found in the designated market area is imported. It can therefore be assumed that if the project gets off the ground, the imported salt might be substituted for by the local salt since it can hardly be distinguished from the imported one. The substitution of the imported salt would help the country in saving foreign exchange. To successfully substitute the imported product, the current product quality needs to be maintained and be priced at lower than the competing product.

Following the shop survey which was carried out, it was found out that 21.3 tonnes was and would be distributed at Nchalo Trading Centre. In line with the population of the area, it can therefore be said that competitors do meet the demand for the product. During the same survey, it was found out that the majority of customers preferred unprepacked as this could be sold in small quantities in order to conform with the income levels of the targeted customers.

In view of this observation therefore, if the product is sold through the intermediaries it has to be sold in bags of 20 kg and the intermediaries shall sell it in small quantities. This strategy would ease competition since the large proportion of the competing product is sold in packets which is being viewed by the customers as expensive.

4.6 Distribution

Distribution of the product needs to be through the existing distribution channels such as wholesalers, retailers and market vendors. The existing distribution agents sell the imported salt to final customers at recommended price by the suppliers as well as at market determined product price. The agents are well knowledgeable in the marketing of the product and therefore use of the existing ones will facilitate the distribution of the product to the targeted customers. Following the survey which was conducted, it was found out that about 21,300 kg of salt was and would be sold out through the existing distribution agents at Nchalo Trading Centre. In consideration of the financial base of the producers, use of the existing distribution channels need be strengthened and intensified as this will save transport costs since the hiring cost from project site to the trading centre is K50.00 per trip.

4.7 Promotion

Promotional measures will be required for the product for entering the market as it has shown that the product seem not to be known to the would be customers.

5.0 OPPORTUNITIES AND THREATS OF THE PROJECT

5.1 Raw Materials

The salt processing uses soil and water as its raw materials and these are locally found within the project area. In view of the location as well as the abundance of the said raw materials, the project faces no incremental costs in terms of transportation and procurement of raw materials. This therefore is seen to be a financial advantage to the production processes of the product as the production costs are kept at minimum. However, it is of worth noting that raw materials sustainability seem to be uncertain and this has been manifested by the non-establishment of the salt production capability. Nevertheless, the project has potential signs of continuity due to the reserves which have been identified in other localities such as Lake Chirwa in Zomba District, Phalombe in Mulanje District, Kazuni in Mzimba District, Kachulu and Kasungu.

5.2 Location

As highlighted in the introductory part of the report, the project is located in the outskirts of Nchalo Trading Centre within one km to the south of the sugar plantation. The project has the advantage of being close to the raw materials site which means that there are no transportation costs in the shipment of the raw materials. The project site is also easily accessible to the target market which is Nchalo Trading Centre and other neighbouring locations.

5.3 Environmental Impact

With the introduction of the new technological means of production, the use of firewood as the main source of energy has been substituted by the usage of biogas which is complimented by solar energy. The usage of biogas and solar energy has brought in environmental advantages to the site as this will reduce the deforestation. This calls for the strengthening of the usage of the newly introduced sources of energy through the dissemination of the information to other micro entrepreneurs who are also involved in salt production.

It is worth pointing that there are no organised waste handling methods. The spent soil is left out in unsightly soil heaps. This therefore calls for a mechanism where spent soil would be properly spread and levelled on the ground for salt regeneration and for land preservation.

The land in the project site has no vegetation. Therefore, there is a strong and urgent need to grow some vegetation to prevent soil erosion.

5.4 Business Threat

It is worth reporting that if the project gets on well off the ground, scrupulous dealers may force themselves into the manufacturing industry thereby depriving the community from enjoying the benefits of the investments.

6.0 RECOMMENDATIONS

6.1 The survey has shown that there is potential market for the product however the product seem not to be known to the would be customers and therefore this calls for a promotional campaign for the product so as to stimulate demand for the product.

6.2 As regards to the product packaging format, the survey has revealed that

44% of the visited distribution agents preferred the product to be distributed in 20 kg bags which in turn can be sold out in small quantities to meet the purchasing power of the community. 36% of the distribution agents preferred the product to be sold out in 20 kg bales of packets ranging from 100 grammes to 250 grammes. This therefore calls for the impartment of packaging skills onto the micro entrepreneurs involved in the salt manufacturing industry.

6.3 MIRTDC should establish through its research the source of the raw material underground and estimate its sustainability.

APPENDIX 2

MALAWI BUREAU OF STANDARDS

Our file code: BS/LAB/35/4 Our date: 1994-08-16

Your file code: Your date:

Address Correspondence to General Manager

MIITDC
P O Box 357
BLANTYRE

Note:
- Sample N° 1408 is S.M.
- Sample N° 1409 is Residue
- Sample N° 1410 is Salt
- Sample N° 1411 is Filtrate
- Sample N° 1412 is Residue liquor

REPORT NO. : 354/W 572

SAMPLE : Common Salt

MBS NO. : W 1408 to W 1412

IDENTIFICATION : NO 1P = W 1408; NO 1R = W 1409
NO 2P = W 1410. NO 3F = W 1411
NO 1RL = W 1412

CONDITIONS : See overleaf

✓1. TEST REQUIRED

According to MBS 188 : 1988

✓2. TEST METHOD

MBS 188 : 1988

✓3. RESULTS

	1P	1R	2P	3F	1RL
	W 1408	W 1409	W 1410	W 1411	W 1412
Sodium Chloride %m/m :	96,7	96,0	97,3	21,7	33,1
Alkalinity %m/m :	0,01	0,015	0,014	-	-
Impurities %m/m :	0,03	0,04	0,02	-	-
Moisture %m/m :	11,3	(18,4)	13,5	-	-
Iodine, mg/kg :	2,1	3,2	1,1	-	-

E G Chinangwa
Senior Assistant Laboratory Manager
for: GENERAL MANAGER

Annual salt production (kg.)	60000.00
Price of salt (Kwacha per kg.)	5.90
Fixed capital	894000.00
Fixed costs	90000.00
Gross sales	5.90
Cost of sales	1.50
Annual increase in production	0.10

YEAR		0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
Sales	Kg.		60000.00	66000.00	72600.00	79860.00	87846.00	96630.60	106293.66	116923.03	128615.33	141476.86
Gross sales	K'000		354.00	389.40	428.34	471.17	518.29	570.12	627.13	689.85	758.83	834.71
Gross sales	K/kg		5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90
Cost of sales	K/kg		1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Contribution	K/kg		4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40
Gross trading profit	K'000		264.00	290.40	319.44	351.38	386.52	425.17	467.69	514.46	565.91	622.50
Fixed costs	K'000		90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
Trading profit	K'000		174.00	200.40	229.44	261.38	296.52	335.17	377.69	424.46	475.91	532.50
Depreciation	K		44700.00	2235.00	111.75	5.59	0.28	0.01	0.00	0.00	0.00	0.00
Taxable income	K'000		174.00	200.40	229.44	261.38	296.52	335.17	377.69	424.46	475.91	532.50
Income tax	K'000		6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21
Profit after tax	K'000		167.79	194.19	223.23	255.17	290.31	328.96	371.48	418.25	469.70	526.29
Working capital	K'000	-92.10										
Fixed capital	K'000	-894.00										
Cash flow	K'000	-986.10	167.79	194.19	223.23	255.17	290.31	328.96	371.48	418.25	469.70	526.29
Acc. Cash flow	K'000	-986.10	-818.31	-624.12	-400.89	-145.72	144.60	473.56	845.04	1263.29	1732.99	2259.28

MALAWI BUREAU OF STANDARDS

Our file Code BS/LAB/35/4 Our date 1995/08/16

Your File Code: Your date:

Address Correspondence to General Manager

Malawi Industrial Research and
Technology Development Centre
P O Box 357
BLANTYRE

REPORT NO. : 354/X 588

SAMPLE : Salt

MBS NO. : X 1564

CONDITIONS : See overleaf

1. TEST REQUIRED

Acccrding to MBS 188

2. TEST METHOD

MBS 188

3. RESULTS (on Wet basis)

		Sample	MES 188 specification
Insoluble matter, % m/m	:	0,4	0,2 maximum
Alkalinity as CO_3 % m/m	:	0,01	0,1 maximum
Chloride as Nacl% m/m	:	98,8	97,0 Minimum
Iodine as KIO_3, mg/kg	:	Nil	50,0 Minimum
Moisture, % m/m	:	2,3	4,0 Maximum

4. REMARKS

4.1 The salt is not iodized. Insoluble matter is above maximum requirement.

E G Chinangwa
Scientific Officer
for: GENERAL MANAGER

MALAWI BUREAU OF STANDARDS

Our file code: BS/LAB/45/3 Our date: 1994-12-12

Your file code: Your date:

Address Correspondence to General Manager

The General Manager
MIRTDC
P O Box 357
BLANTYRE

REPORT NO. : 354/W 770

SAMPLE : Salt

MBS NO. : W 2035, W 2036, W 2243

IDENTIFICATION : Residue Salt, Product salt, Commercial Salt

CONDITIONS : See overleaf

1. TESTS REQUIRED

Appearance, Iodine, Iron

2. TEST METHOD

Appearance	-	Visual
Iodine	-	Titrimetric
Iron	-	AAS

3. TEST RESULTS

	W 2035	W 2036	2243
Appearance	Yellowish brown	Whitish brown	Crystalline White
Iodine as KIO_3, mg/kg	9,8	5,4	58,1
Iron, mg/kg	0,0297	0,0099	0,0099

4. REMARKS

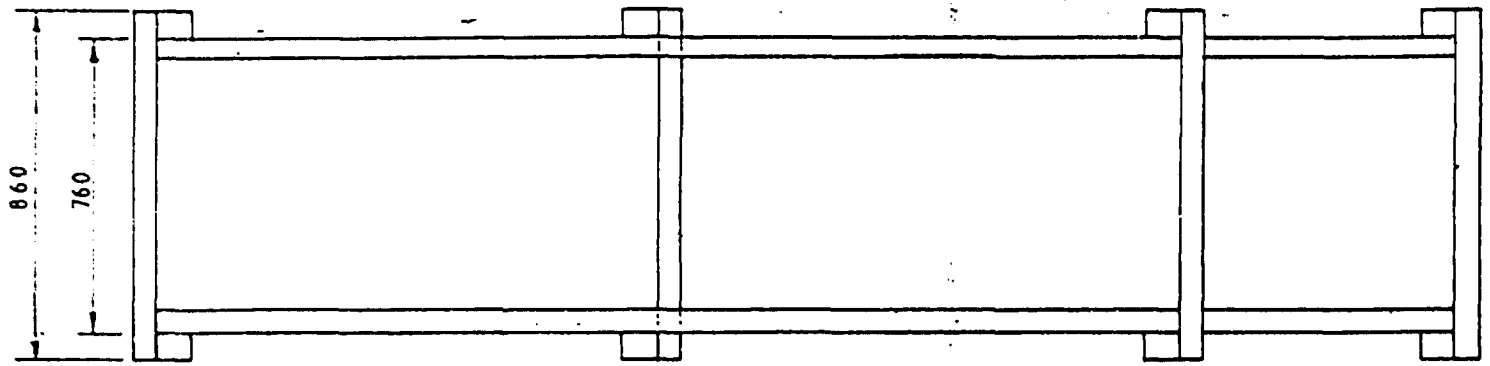
The degree of browning of salt from saline salts seems to correlate with levels of iron and not iodine.

W H Muyila
Scientific Officer
for: GENERAL MANAGER

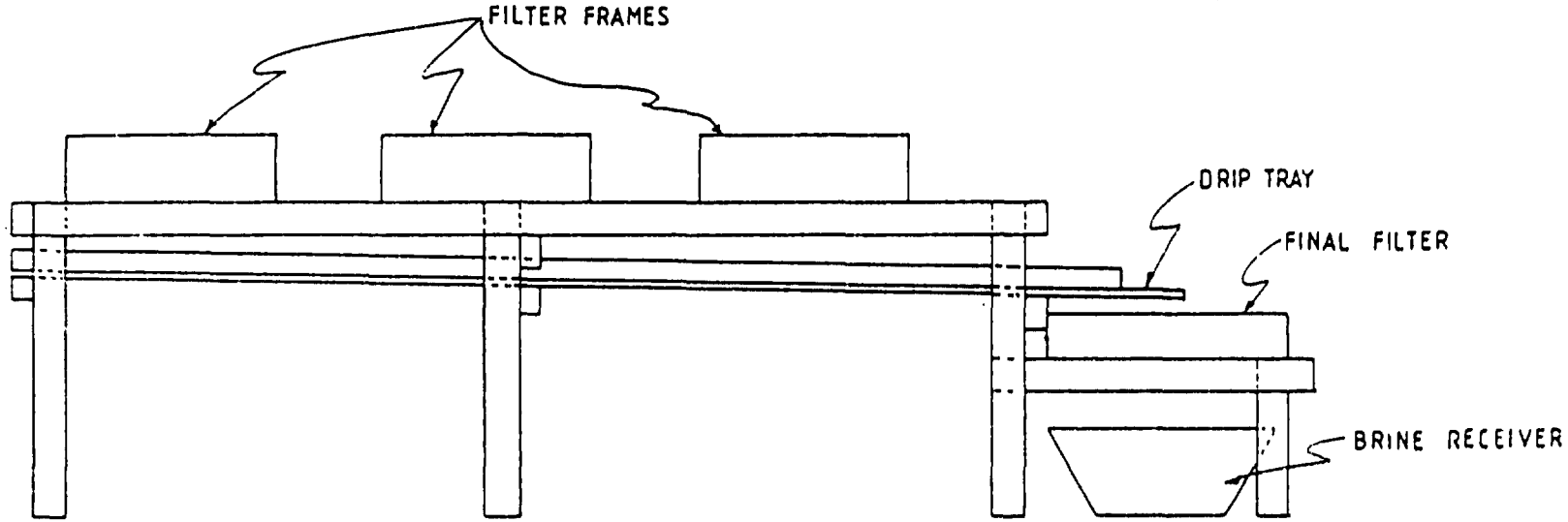
DRAWING N° 1

FILTER TABLE

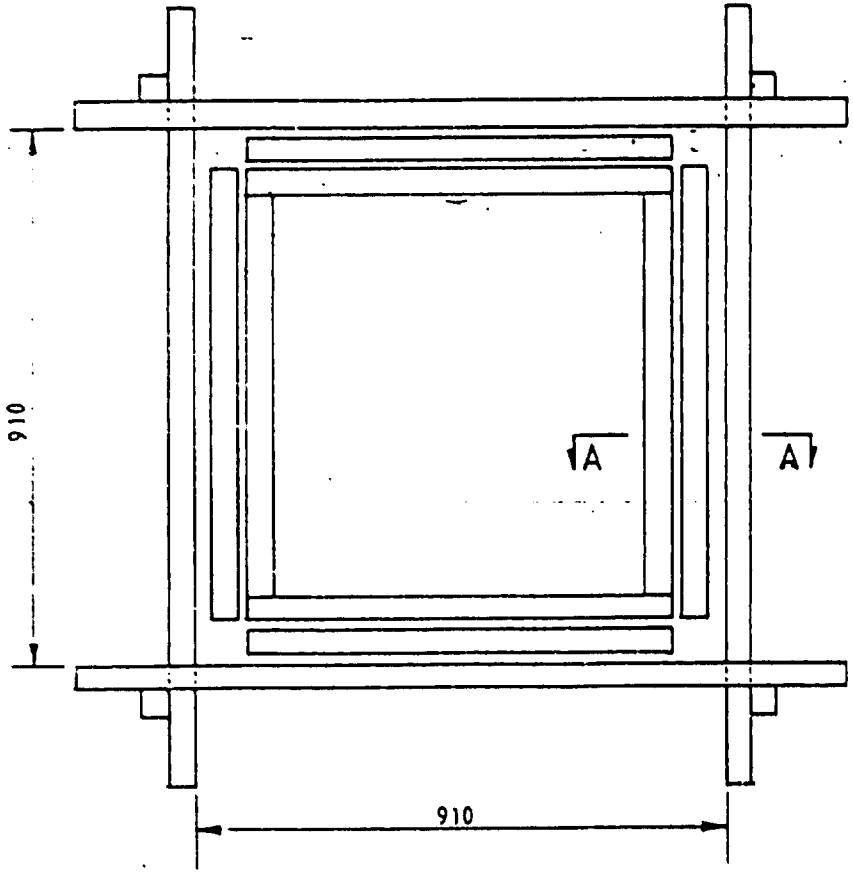
NOTE: CROSS BRACE AS NEEDED FOR STABILITY.
LEGS 100 × 100.
DIMENSIONS IN MILLIMETRES.



PLAN



ELEVATION



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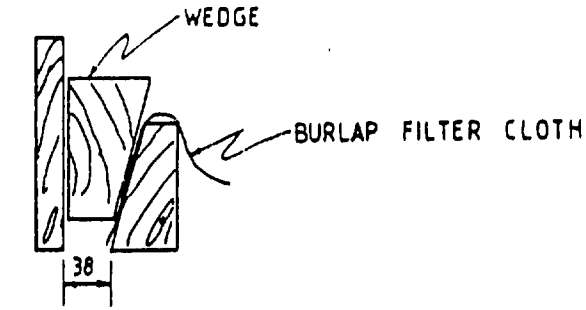
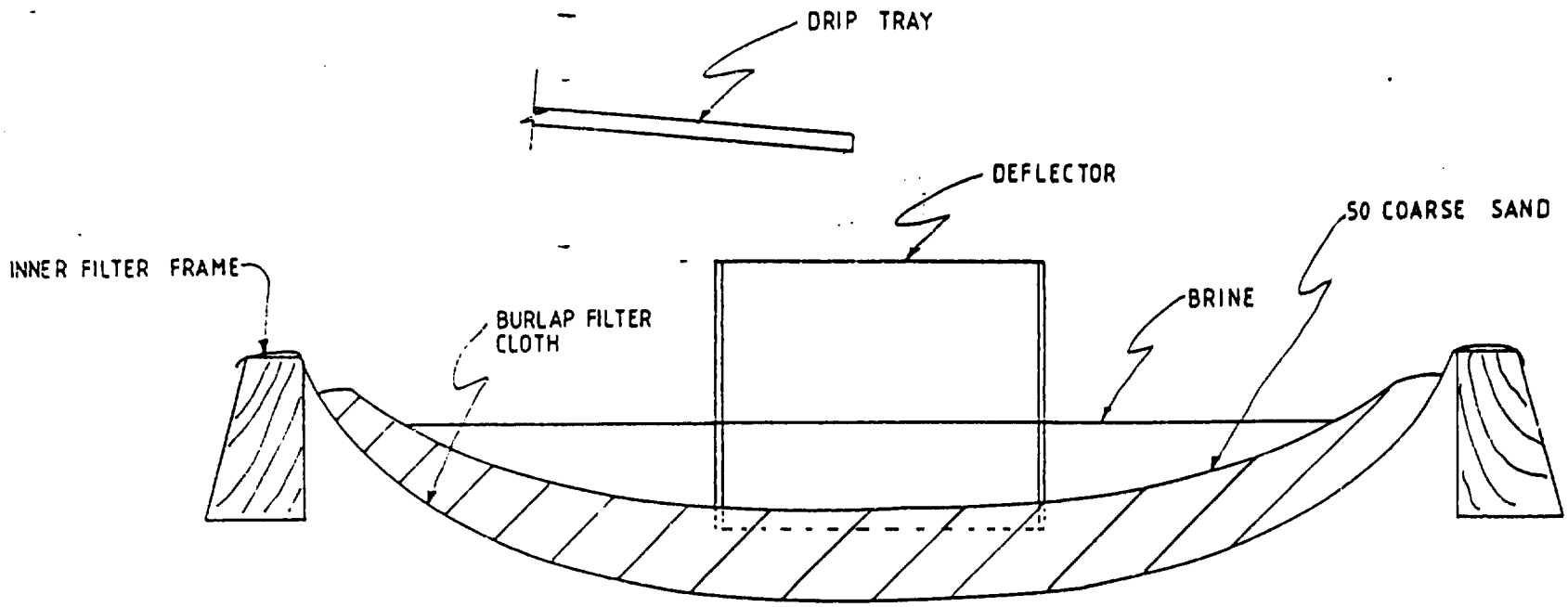


SECTION A-A

DRAWING N° 2

FILTER FRAME

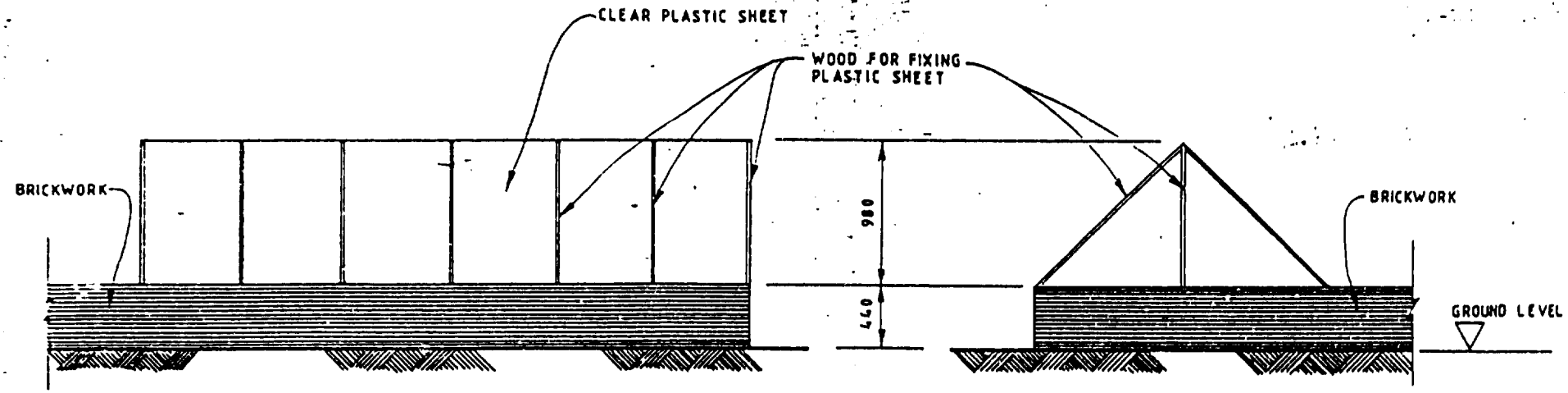
NOTE:
FILTER FRAME APPROX 910×910, 150×25.
INNER FRAME AND WEDGES 50×100 BEVELED AS INDICATED.
DIMENSIONS IN MILLIMETRES



DRAWING N° 3

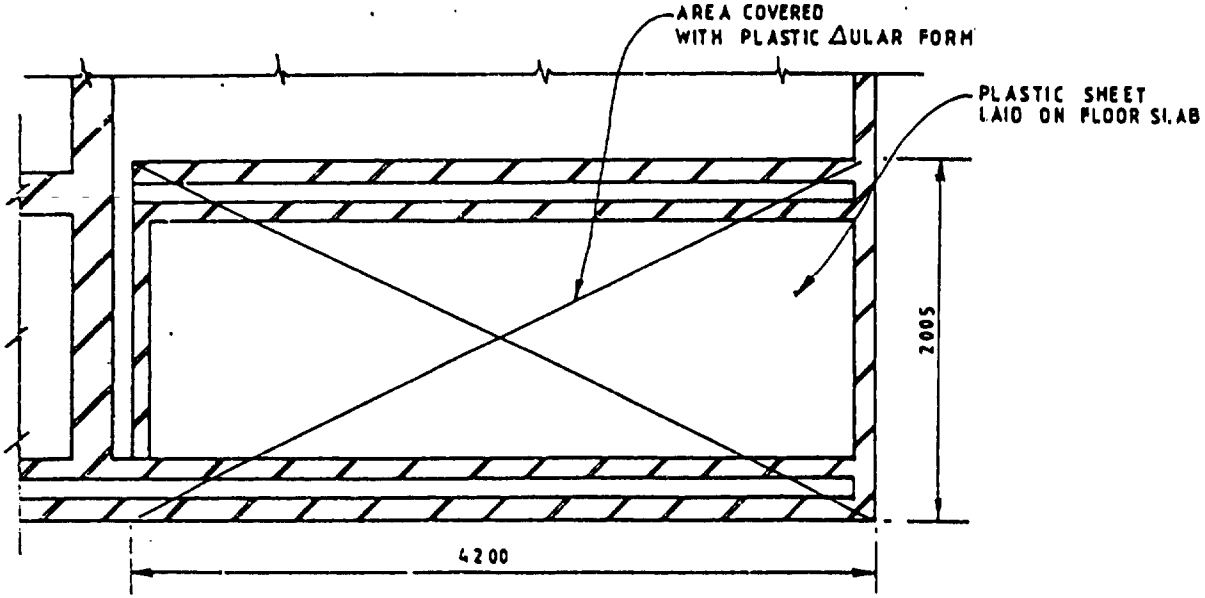
FINAL FILTER (SCHEMATIC)

NOTE: DIMENSIONS IN MILLIMETRES



ELEVATION SCALE 1:40

ELEVATION SCALE 1:40



PLAN SCALE 1:40

MALAWI INDUSTRIAL RESEARCH AND TECHNOLOGY DEVELOPMENT CENTRE
P. O. Box 357
BLANTYRE Tel. 623805 Fax 623831

SOLAR STILL

DRAWN: M J MFUNE

DATE: OCT 1995

SCALE: AS SHOWN

DRAWING N° 4

TABLE 1 SOLAR STILL OPTIMIZATION — FILTRATE LEVEL AND TEMPERATURE DETAILS

STILL DIMENSIONS 4050 mm × 3600 mm

DATE	FILT RATE (lts.)	FILTRATE LEVEL IN THE STILL (MM)					SALT REMOVED (kg)	RESIDUE (kg)	DAILY TEMPERATURES (°C)									
		TIME							TIME									
		8.00	10.00	12.00	14.00	16.00			8.00		10.00		12.00		14.00		16.00	
									IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
9.8.95	-	-	-	-	-	-	-	-	30	25	36	26	40	29	50	30	40	29
10.8.95	-	-	-	-	-	-	-	-	29	23	40	27	45	29	57	31.5	49	30
11.8.95	128	17	17	16.9	16.5	16.2	-	-	27	22.5	35	27	42	29.5	48.5	30	40	29.5
15.8.95	-	6	6	5.8	5.2	5	10	-	27	22	45	26	50	30	57	30	44	30
16.8.95	-	4	4	3.9	3.4	3.3	-	-	25	21	36	27	55	31	40	25	35	24
17.8.95	-	3	3	2.5	2	1.7	7	-	27	23	40	26.5	55	30	51	29.5	49	30
18.8.95	-	1	1	-	-	-	-	-	27	22	40	27	57	31	45	30	45	30
23.8.95	-	-	-	-	-	-	5	-										
25.8.95	-	-	-	-	-	-	-	5										

NOTE: IN : INSIDE STILL (VAPOUR TEMPERATURE)
OUT : OUTSIDE STILL

TABLE 2 SOLAR STILL OPTIMIZATION — FILTRATE LEVEL AND TEMPERATURE DETAILS

STILL DIMENSIONS 4050mm×1800mm

DATE	FILT RATE (ltrs)	FILTRATE LEVEL IN THE STILL (cm)					SALT REMOVED (kg)	RESIDUE (kg)	DAILY TEMPERATURES (°C)									
		TIME							TIME									
		8.00	10.00	12.00	14.00	16.00			8.00		10.00		12.00		14.00		16.00	
									IN	OUT	IN	OUT	IN	OUT	IN	OUT	IN	OUT
12.9.95	64	-	-	-	10	10	-	-	-	-	-	-	-	-	60	35	40	33
13.9.95	-	10	9.5	9	8	8	-	-	30	25	40	32	50	38	35	29	33	30
14.9.95	120	30	29	27	25	24	-	-	35	25	45	31	55	32	50	32	45	32
15.9.95	-	23	23	22	20	20	-	-	35	25	45	29	52	31	52	32	45	32
18.9.95	-						-	-	35	24	40	30	50	35	40	30	30	25
19.9.95	-	13	12	10	9	9	-	-	30	24	45	30	52	35	50	30	47	35
20.9.95	-	9	8.5	8	7	7	-	-	32	25	48	30	50	33	55	34	46	31
21.9.95	-	6.5	6	5	3	3	17	-	35	25	50	30	55	33	60	36	45	33
22.9.95	-	3	3	2			-	-	30	25	47	29	56	33				

INITIAL BRINE TEMPERATURE = 65° C

NOTE IN : INSIDE STILL (VAPOUR TEMPERATURES)
OUT : OUTSIDE STILL

TABLE 3

SALT HARVESTING

BOILING TO CRYSTALIZATION . SALT RECOVERY PROCESS

Date	Operator	Batch No.	Area (m^2)	Soil (kg)	Water (litres)	Filtrate (litres)	Salt (kg)	Residue (kg)	Salt (kg/m^2)
09-08-95	Mr Chatata	1	20.15	403	201	80	16	-	0.79
10-08-95	"	1	33.3	666	333	80	24	-	0.72
10-08-95	"	2	33.3	666	333	80	22	-	0.666
11-10-95	"	1	20.15	403	201	80	18	-	0.89
12-08-95	"	1	33.3	666	333	80	28	-	0.84

TABLE 4

SALT HARVESTING

SOLAR SALT CRYSTALIZATION PROCESS

Date	Operator	Batch No.	Area (m^2)	Soil (kg)	Water (litres)	Filtrate (litres)	Salt (kg)	Residue (kg)	Salt (kg/m^2)
10-08-95	Mr Chatata	1	14.92	403	208	80	11	2.5	0.74
10-08-95	"	2	15.44	417	208	80	11	2.5	0.71
12-09-95	Mrs Chatata	1	20.83	417	208	80	12.46	2.83	0.59
12-09-95	Mrs Banda	2	15.44	417	208	80	12.46	2.83	0.81
12-09-95	Mrs Bramu	3	16.14	444	224	80	12.46	2.83	0.76

NOTE: Data for the salt and residue amounts for the month of September obtained through simple proportion.

Table 5 Cash Flow

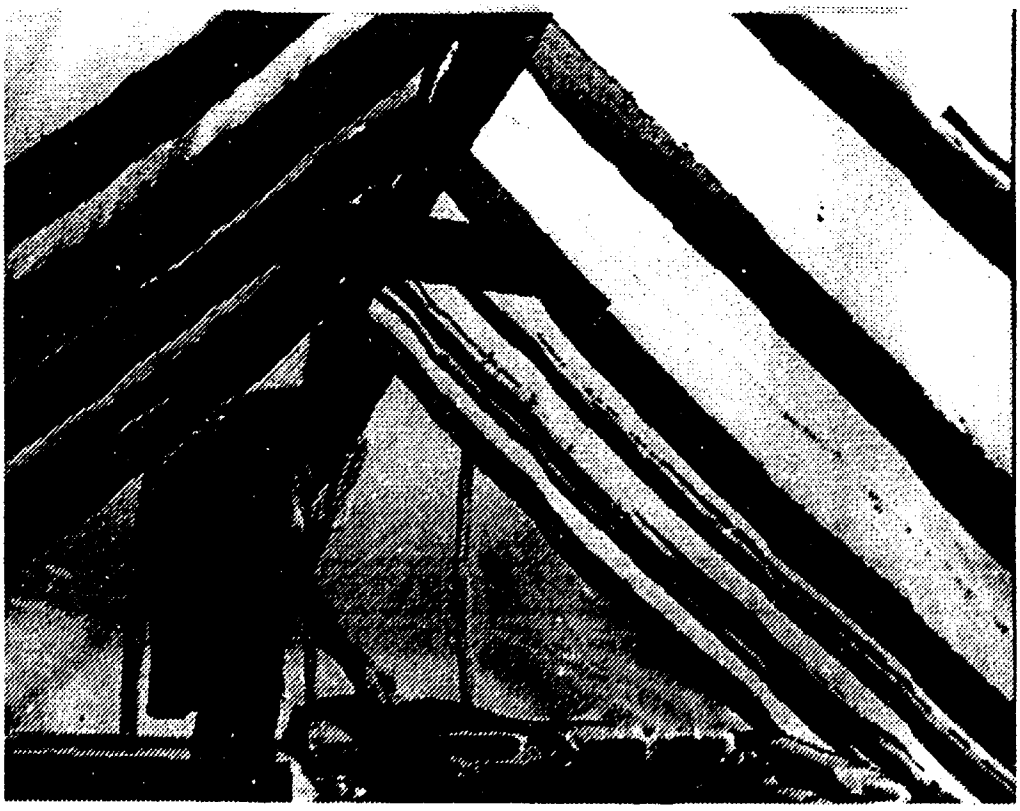
CASH FLOW

Annual salt production (kg.)	60000.00
Price of salt (Kwacha per kg.)	5.90
Fixed capital	894000.00
Fixed costs	90000.00
Gross sales	5.90
Cost of sales	1.50
Fixed production for 10 years	

YEAR		0.00	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
Sales	Kg.		60000.00	60000.00	60000.00	60000.00	60000.00	60000.00	60000.00	60000.00	60000.00	60000.00
Gross sales	K'000		354.00	354.00	354.00	354.00	354.00	354.00	354.00	354.00	354.00	354.00
Gross sales	K/kg		5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90	5.90
Cost of sales	K/kg		1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50	1.50
Contribution	K/kg		4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40	4.40
Gross trading profit	K'000		264.00	264.00	264.00	264.00	264.00	264.00	264.00	264.00	264.00	264.00
Fixed costs	K'000		90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00	90.00
Trading profit	K'000		174.00	174.00	174.00	174.00	174.00	174.00	174.00	174.00	174.00	174.00
Depreciation	K		44700.00	2235.00	111.75	5.59	0.28	0.01	0.00	0.00	0.00	0.00
Taxable income	K'000		174.00	174.00	174.00	174.00	174.00	174.00	174.00	174.00	174.00	174.00
Income tax	K'000		6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21	6.21
Profit after tax	K'000		167.79	167.79	167.79	167.79	167.79	167.79	167.79	167.79	167.79	167.79
Working capital	K'000	-92.10										
Fixed capital	K'000	-894.00										
Cash flow	K'000	-986.10	167.79	167.79	167.79	167.79	167.79	167.79	167.79	167.79	167.79	167.79
Acc. Cash flow	K'000	-986.10	-818.31	-650.52	-482.73	-314.94	-147.15	20.64	188.43	356.22	524.01	691.80

PHOTOGRAPH 7: INSIDE TEMPORARY SOLAR STILL

THE MAN IS SHOWING SOME OF THE CRYSTAL SALT



PHOTOGRAPH 8: INSIDE TEMPORARY SOLAR STILL