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ASSISTANCE TO EELPA IN CERAMIC TECHNOLOGY

SI/ETH/85/801

ETHIOPIA

Technical report: Project proposal for the rehabilitation of the Ethio-Pottery Plant

Prepared for the Government of Ethiopia
by the United Nations Industrial Development Organization
acting as executing agency for the United Nations Development Programme

Based on the work of Tomas Hanzlicek,
expert in ceramic technology

United Nations Industrial Development Organization
Vienna

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Explanatory notes

The monetary unit in Ethiopia is the birr (Br).

References to tonnes (t) are to metric tonnes.

EELPA is the Ethiopian Electricity, Light and Power Association.

Mention of the names of firms and commercial products does not imply endorsement by the United Nations Development Programme (UNDP) or the United Nations Industrial Development Programme (UNIDO).

ABSTRACT

As part of the project "Assistance to EELPA in ceramic technology" (SI/ETH/85/801), for which the United Nations Industrial Development Organization (UNIDO) is the executing agency for the United Nations Development Programme (UNDP), an expert in ceramic technology was fielded for a total period of six weeks, starting on 12 September 1985.

One of the objectives of the expert's mission, i.e. to assist the Ethiopian Electricity, Light and Power Authority (EELPA) in the establishment of a pilot plant for the production of 10,000 units of electrically heated plates and 10,000 units of pots with ceramic body, was modified following the discovery of an existing ceramics factory, the Ethio-Potcery Plant, which could be rehabilitated in order to serve as a pilot plant. To this end the expert inspected and evaluated the existing facilities and equipment and prepared a comprehensive prefeasibilty study as well as a draft project document for the rehabilitation of that plant.

He furthermore carried out all other tasks listed in his job discription, i.e. he made an assessment of the workshop of EELPA and recommended the purchase of certain items of new equipment; proposed training programmes for local staff; investigated the availability and suitability of raw materials and took samples which were dispatched to the Czechoslovak Ceramic Research Institute at Pilsen, where they will be analyzed and tested in order to arrive at a suitable formula for the composition of ceramic raw material.

The expert concluded that the quality of the ceramic goods produced by EELPA could be substantially improved only if the entire ceramic technology were changed, that is from the choice of raw materials to product design. As an interim measure he proposed to reduce the manpower input in material preparation by using machinery, to increase the firing temperature and to improve the design of hot plates according to his suggestions, with a view to reduce the amount of imported materials used in their assembly.

With the rehabilitation of the Ethio-Pottery Plant the above-mentioned planned production capacity could be reached within a period of 18 months, according to the expert's calculations, and at a cost which is about one-third to one-fourth of that for a new pilot plant. The rehabilitation project would, furthermore, create about 180 new jobs, 71 per cent of which could be performed by women.

CONTENTS

INTRODUCTION

In 1980 the Ethiopian Electricity, Light and Power Authority (EELPA) began to study the possibility of manufacturing electrically heated hot plates with ceramic body. Local potteries situated at Lagedadi, Katcheny and Gaffarsa supply the market with ceramic goods such as cooking pots, coffee pots and a special type of plate (650 mm in diameter), which serves as a baking surface for the preparation of a national dish called "injera". All locally made ceramic products from the above-mentioned potteries located near Addis Ababa as well as those of other manufacturers have similar quality problems due to:

(a) The low quality of local raw materials and the lack of know-how in beneficiation and calculation of material mix;

(b) A lack of know-how in ceramic technology;

(c) A shortage of combustible for the firing of the ceramic body.

All locally made ceramic cooking pots or plates have to be heated by firewood or charcoal which aggravates the problem of deforestation in Ethiopia.

Previous steps undertaken by EELPA, in co-operation with the Italian Ceramic Research Institute of Faenza (reports from 1983 and 1985) were aimed at locating suitable raw materials and at establishing the most appropriate mixture of them.

During the expert's stay in Ethiopia an important part of his original job description (see annex I), namely the preparatory work for the establishment of a pilot plant, was revised, due to the fact that an existing factory, the Ethio-Pottery Plant could be used for that purpose.

All other duties listed in the job description were fulfilled. He made an assessment of EELPA's workshop and recommended the purchase of some new equipment (annex II).

Samples of sandstone with kaolinitic boulder were taken in the Mughar area, as well as kaolinized pegmatite from Bombawoha I deposit and washed kaolin from Kentery. Feldspars from the Harare and Kenticha deposits, as well as quartz, dolomite and talc were sampled. All raw materials will be dispatched to the Czechoslovak Ceramic Research Institute at Pilsen for testing.

Three Ethiopian technicians were selected and a training programme for them was elaborated.

Since the original project objective could be reached more easily by rehabilitating the Ethio-Pottery Plant, the expert elaborated a prefeasibility study (annex V) and prepared a draft project document for the rehabilitation of the Ethio-Pottery Plant (annex VI).

RECOMMENDATIONS

The expert's main recommendation is to proceed, as soon as possible, with the rehabilitation of the Ethio-Pottery Plant, instead of establishing a new pilot plant. Detailed proposals are contained in annexes V (prefeasibility study) and VI (draft project document).

Specific recommendations to EELPA

1. A survey of the available manpower at Gaffarasa Road (Addis Ababa) as well as at the pottery centres at Katchene and Lagedadi should be made.

2. Technicians having a background in ceramic technology should be selected as soon as possible, with a view to form the necessary technical staff for the ceramic plant.

3. The problem of water contamination of Lake Gaffarasa should be studied in co-operation with the responsible government authorities or oganizations.

4. The opening of the diatomite mine at Chefejile should be discussed with the Mining Authority.

5. The possibility of importing sufficient quantities of electrical resistances, switches and other accessories required for the plant's output of hot plates should be investigated.

6. The design of electrical appliances should be studied and the import of electrical resistance wire for each type of hot plate recalculated.

7. The fuel supply for the kilns should be ensured and the maintenance and repair of all transformers should be taken care of. The waste oil of the transformers should be used as kiln fuel.

Specific recommendations to UNDP/UNIDO

8. Due to the lack of staff skilled in ceramic technology and ceramic factory management, expertise in these areas should be provided.

9. The possibility of EELPA contributing to the projects as proposed in the prefeasibility study should be investigated.

I. ASSESSMENT OF THE EELPA WORKSHOP

The decision of EELPA to manufacture ceramic household appliances with incorporated heating element is based on the country's necessity to reduce deforestation which is causing erosion of soil and silting. The price of firewood and charcoal is increasing steadily and the importation of hot plates and other ceramic electrically heated appliances is not considered to be a suitable solution.

A. Previous studies and findings

In 1983 the Italian Ceramic Research Institute prepared a report on the raw materials from the Lagedadi area. A further study, elaborated two months later by the same Institute, covered the raw materials from Gaffarsa. The last report, prepared in 1985, dealt with the raw materials from the Katchene area in Addis Ababa. The Institute recommended to use the clay from Lagedadi, mixed with crushed sandstone. This composition has been used up to now in EELPA's workshop.

B. Production methods for hot plates

The raw material from Lagedadi is crushed by hammering and mixed in following proportions: 67 per cent sandstone and 33 per cent clay.

The plastic material is prepared in the simplest way - it is trampled by three to four workers in a small concrete basin and from time to time a small quantity of water is added. It is then shaped into large plates with a diameter of 650 mm (for "mitad", a traditional cooking utensil). The surface is smoothed by blades and sponges and then the manual screw press is used. The screw-driven metallic platform with the gypsum mould fixed to its bottom part, copies the grooves onto the plastic ceramic body. The base of "mitad" is dried in an electrically heated dryer with very low efficiency. After four to five days of drying, the electrical heating element is fixed to the grooves by plastic material of the same composition as above. The plate is then dried for a few more days - occasionally by exposure to the sun - after which the future baking surface is smoothed and subsequently covered with a thin layer of red clay ("engobe") to reduce as much as possible the apparent porosity of the ceramic body which is very high (23-25 per cent), due to the low firing temperature of the open fireplace. The firing technology employed in the EELPA workshop is one of the weak points. Cow-dung is used as combustible.

From 22 September 1985 on the electric kiln (carriage type, volume $2m^3$) has been operating up to 1,200°C. According to the recommendation by the Italian Ceramic Research Institute, the firing temperature used for "mitad" production is only 900°C.

The expert concluded that it was not possible to improve the quality of ceramic goods unless the whole ceramic technology was changed - from the choice of raw materials up to product design. What could be achieved for the time being is to reduce the manpower input in material preparation by using machines. The recommended machinery is included in annex II.

To obtain ceramic goods of higher quality it will be necessary to increase the firing temperature up to 1,200 to 1,250°C and to select new raw materials. This would give a less apparent porosity of the ceramic body, higher strength and better thermal conductivity, i.e. the hot plate support would reach the cooking or baking temperature faster and thus reduce the consumption of electricity for heating or require fewer electric heating elements.

II. VISITS TO POTTERIES AND SAMPLING

A. Clay deposits at Katchene

No samples were taken from Katchene as the Italian Ceramic Research Institute had already analysed them: samples X and Y, report from 27 May 1985, lateritic clay with a high content of hematite (12% in both samples). The pottery makers get the clay from the river bottom, where there is no access for machinery.

The clay is not suitable for EELPA's purposes.

B. The Women's Pottery Co-operative

Local red (lateritic) clay is used without any beneficiation process. The products, which are shaped by hand and fired in an open fireplace using cow-dung as combustible, are of very low quality due to raw material choice, lack of technological know-how and shortage of firewood. Some years ago a ceramic kiln and simple but efficient washing basins were built, but neither is being used. The raw material which was evaluated in 1983 by the Italian Ceramic Institute (samples 1A, 2B, 3C and 4D) shows a high hematite content. The apparent porosity after firing is 12.2-18.1 per cent.

The clay is not suitable for EELPA's purposes.

C. The Ethio-Pottery Plant

The visit to that plant, which produces coffee cups, entirely changed the prospect of manufacturing electrically heated household appliances with ceramic body. Due to the fact that the existing machinery is in good condition, the building suitable and other benefits available, the EELPA manufacturing programme for ceramic supports for electrically heated appliances became viable.

The only problem that remained was to check the availability of raw materials. During the following days, after a visit to the Ethiopian Institute of Geological Surveys, samples were taken first from Mukarsa.

Mukarsa is situated about 55 km north of Addis Ababa, at approximately 9°28' latitude north and 39°33' longitude east. It belongs to the Menageshe district in the Shoa administrative region. It can be reached by an asphalted road which leads from Addis Ababa to Godjjam, passing through Mancho. Just before reaching Mancho (35 km from Addis Ababa) there is an all-weather road turning to the left which leads to Derba (15 km), a town situated at the edge of the plateau. This place is the terminal of the cable-way which transports limestone, gypsum and silica sand from the quarry at the bottom of the Mughar valley. The length of cable-way is 9 km and its bottom station is also accessible by road with trucks and vehicles with four-wheel drive, but only in the dry season.

The following data on the quarry were secured:

Area	12,800 m^2
Thickness	14 m
Volume	179,200 m^3
Average clay content	14.18%
Approximate reserve	60,000 t of kaolinitic clay

The maximum and minimum kaolin content in the sandstone is 18.15 per cent and 6.95 per cent respectively. The thickness of overburden is high, but the material could be excavated and moved to a barren slope.

Sample No. 1, sandstone with kaolinitic boulder ± 50 kg, was taken there. Preliminary checking showed a clay content of 17.5 per cent.

Washed kaolinitic clay is suitable for EELPA's purposes.

D. The Ethiopian Glass Factory

The Ethiopian Glass Factory produces different types of bottles and glasses from local raw material. The sandstone comes from the Mughar area and after beneficiation contains 0.5 per cent of iron oxides. The dolomite is brought in bulk from Harare and after processing (crushing and washing) is used in glass composition.

Sample No. 2, dolomite in bulk, was taken from the stock of the Glass Factory as well as a sample of sand.

Both raw materials, after beneficiation, are suitable for EELPA's planned production.

E. Bombawoha I and Kenticha deposits

The Bombawoha I deposit is located on the road from Addis Ababa to Kebre Mengist, in the Sidamo administrative region, at a distance of 426.7 km from the capital. There is an all-weather gravel road passing right through the deposit and connecting Addis Ababa with Negele town.

The highly kaolinized pegmatite has an estimated kaolin content of 30 per cent and unfortunately contains a high quantity of mica. The Bombawoha I deposit has been studied by the Ministry of Mines and Energy from 1983-1985. The estimated reserves of kaolinitic clay are approximately 100,000 t.

Since the geological prospection of that deposit has not been completed and because the Ethiopian Mining Corporation only recently received the preliminary results of the geological observation and estimation and should complete the geological work by a feasibility study including selective mining and an economical evaluation, it seems advisable to utilize the Mughar deposit and to build an independent washing plant at Kentery.

According to the published figures on kaolin analyses and tests, the kaolinitic clay from the Bombawoha I deposit is suitable for EELPA's ceramic production.

Samples No. 5 and 6 were collected at the Kenticha quartz and feldspar deposit, but it is very difficult to reach the veins of minerals from Shakisso town (48 km from Addis Ababa). The whole deposit should be studied carefully to identify an industrial way of mining and an economic evaluation should be made.

The deposit is suitable for the ceramic industry from a quality point of view.

F. Diatomite deposit at Chefejile

That deposit is located 18 km east of the main road Addis Ababa-Awassa, approximately 150 km from Addis Ababa. The access is on 150 km of asphalted road and 18 km of gravel road, which is suitable for trucks and four-wheel drive vehicles. The deposit contains about 55,000 t of diatomite with easy mining conditions.

The diatomite is fully suitable as a thermal-insulator material.

III. ANALYSES AND TESTS TO BE CARRIED OUT IN CZECHOSLOVAKIA

Kaolines (kaolinitic boulder of Mughar sandstone, kaolinitic content of Bombawoha I, kaolinitized pegmatite, processed kaolin from Kentery)

(a) Kaolin content in sandstone
(b) Kaolin content in kaolinitized pegmatite
(c) Chemical analysis
(d) DTA
(e) Grain size distribution
(f) Deflocculation tests
(g) Mixing water, plasticity, drying, firing, total shrinkage
(h) Absorptivity, apparent porosity and bulk density of fired material
(i) Refractoriness
(m) Modulus of rupture

Sand from sandstone and sand from the Glass Factory

(a) Grain distribution test
(b) Chemical analysis
(c) Impurities identification

Feldspars from Harare (rose-coloured sample) and Kenticha (white colour)

(a) Chemical analysis
(b) Fusion - flow test

Dolomite from Harare

(a) Chemical analysis
(b) Impurities identification

Development of new prototypes of "mitad" and "dist" at Keramo Co-operation.

IV. GOVERNMENT ACTIVITIES TO DEVELOP THE CERAMIC INDUSTRY

According to information obtained from the Building Materials Corporation and Industrial Project Services (IPS) of the Ministry of Industry, a first study of new activities in the ceramic industry is planned. An important government project for the development of technology, mining and treatment of raw materials for the ceramic industry is at present being prepared by IPS, aiming at a production of 2,000 t of tableware, 3,000 t of wall tiles and 1,000 t of sanitary ware per year.

Obviously EELPA will benefit from any such government activity in ceramic raw material mining, beneficiation or treatment.

V. TRAINING OF LOCAL STAFF

EELPA selected the following three Ethiopian technicians to receive training in Czechoslovakia through the UNIDO/CSSR Joint Programme:

Ato Solomon Assefa
Ato Shiberu Dubala
Ato Zewide Bayene

The duration of the training programme is two months, broken down as follows:

	Duration
Six weeks UNIDO/CSSR Joint Programme	
(a) Main ceramic raw material inventory of basic parameters	1 week
(b) Laboratory tests of: Clays and kaolins Feldspars Sands	3 weeks
(c) Visits to porcelain factories, a kaolin dressing plant and an electro-porcelain factory	1 week
(d) Possibilities for upgrading selected non-metallics	2 days
Two weeks in Keramo Co-operative	
(a) Manufacture of artistic ceramics and pottery Shaping by jiggers Hand-moulding Casting Gypsum mould preparation	10 days
(b) Visit to electro-porcelain factories Desná I and Desná II	1 day
(c) Calculation of electrical heating elements, including basic safety regulations for hot plates and any other household appliances	2 days
UNIDO/CSSR Joint Programme, Pilsen, Final report and evaluation	3 days

VI. ASSEMBLY AND COST OF HOT PLATES

At present the ceramic body for hot plates is assembled with the following components:

Metal supports (legs)
Sheet metal lagging with thermal insulation (asbestos covered by a thin layer of gypsum)
Switch, cable and plugs
Metal lid with wooden handle

The sales price of the electrically heated "mitad" (3.5 kW, 650 mm diameter hot plate with metal lid) is birr 200. This could be lowered considerably if the heat dissipation from the bottom of the hot plate could be reduced in which case the metal body and legs would no longer be needed. If the aluminium lid for the "mitad" would be replaced by one made of local material, such as bamboo, the cost could be further reduced by about birr 20.

Considering all the above-mentioned reductions, the following items still need to be imported:

	Birr
Thermally resistant electrical wire	15
Electrical switch	15
Plugs and cable	10
Total	40

For hot plates with a diameter of 250, 300 and 350 mm the required importation will amount to about birr 33 each. At present EELPA has a stock of resistance wire (Ni-Cr alloy, 1.2 mm diameter) worth about birr 50,000.

The cost for importing EELPA's annual requirement of resistances, switches, cables and plugs would be the following:

Estimated "mitad" production, initial output 3,465 pieces/year
Estimated production of hot plates, initial output 6,930 pieces/year

3,465 x 40 = birr 138,600
6,930 x 33 = birr 228,690
Total birr 367,290

At an exchange rate of 2.07 this amounts to $US 177,435.

EELPA should concentrate its efforts on improving the assembly. Instead of sheet metal lagging a ceramic support could be designed. With the use of diatomite insulation the iron legs could also be dispensed with. The manufacture of lids from bamboo or locally available leaves should be arranged with the Handicrafts and Small-scale Industries Development Agency (HASIDA).

The requirement of electrical heating elements should be recalculated. With a higher-quality ceramic body the input could be lowered (from at present 3.5 kW to 1.5-1.8 kW), which will reduce the above-mentioned importation costs.

The electrically heated furnace should be moved from EELPA's workshop to the Ethio-Pottery Plant and the existing transformer for 100 kVA should be exchanged by one for 250 kVA. EELPA agreed to supply the necessary transformer.

Annex I

JOB DESCRIPTION

Post title: Ceramic technologist

Duration: One month

Date required: As soon as possible

Duty station: Addis Ababa, with travel in the country

Purpose of project: To assist the Ethiopian Electricity, Light and Power Authority (EELPA) in the manufacture of electrical household appliances with ceramic body.

Duties: The expert will be attached to EELPA and will specifically be expected to carry out the following duties:

- Review the technological and manpower requirements of the EELPA ceramic workshop which is expected to establish a pilot plant manufacturing 10,000 pieces of electrically heated plates and 10,000 pieces of pots with ceramic body;

- Investigate the availability and suitability of raw materials for the manufacture of the above products;

- Supervise the sampling and dispatching of raw material samples to the Czechoslovak Ceramic Research Institute at Pilsen, Czechoslovakia, for testing purposes. Identify the types of laboratory tests to be carried out at that Institute;

- Select two Ethiopian technicians who are expected to receive training in Czechoslovakia through the UNIDO/CSSR Joint Programme, and prepare the training programme.

The expert will also be expected to prepare a technical report reflecting his finding and recommendations to the Government.

Annex II

RECOMMENDED EQUIPMENT FOR EELPA'S WORKSHOP

Machinery

1 double-shaft mixer, minimum capacity 300 kg

1 industrial scale for 500 kg

1 rotary screen

Laboratory equipment

1 radiation pyrometer

1 laboratory balance for up to 2,000 g

1 laboratory dryer, 0.25 m^3

1 set of laboratory sieves with shaker

1 set of procelain and glass vessel

1 electrical hot plate

Set of Seger cones, for a temperature range from 900 to 1,350°C

Tools

20 pottery ribs

20 scraper blades

20 sponges

20 pottery knives

Annex III

PERSONS MET DURING THE MISSION

Ethiopian Electricity, Light and Power Authority	Ato Tamena, General Manager Ato Haile Woldehana, department chief Ato Solomon Assefa Ato Shiberu Dubala Ato Zewede Bayene
Ethiopian Institute of Geological Surveys	Ato Befekadu Balcha, Head, Mineral Exploration Department Ato Aklilu, geologist
Building Materials Corporation	Ato Gragu Kumula, department chief Mrs Shwash Ahay, assistant
Industrial Project Service	Ato Atnatu Membrate, senior project engineer
Ethiopian Mineral Resources Development Corporation	Ato Shiferaw Demissie, Head, Exploration Department

Annex IV

REFERENCES

Report on the Ethio-Pottery Plant, Ministry of Mines and Energy (issued in 1983 in Amharic only)

Report on the kaolinitic sandstone quarry at Mukarsa, Ethiopian Geological Survey of the Ministry of Mines and Energy (handwritten, April 1984)

Bombawoha I and II kaolin deposit and Kenticha feldspar/quartz deposit, Ethiopian Geological Survey of the Ministry of Mines and Energy (issued in May 1985)

Mineral occurrences of Ethiopia, Ministry of Mines and Energy (issued in 1966)

Annex V

PREFEASIBILITY STUDY

A. Present situation

The Ethio-Pottery Plant was erected in 1974 by a private owner with the aim of manufacturing household items like coffee sets, cups, plates, dishes, tea-pots and pots. The plant area is 13,600 m^2, with 6,000 m^2 in reserve. The raw material deposit is near Mughar river at Kentery.

So far the only production has been coffee cups, and due to the shortage of fuel oil and a lack of know-how in ceramic technology, only 26 workers are engaged.

B. Existing equipment

The most important findings concerned the existing machinery and equipment and its condition.

Type of equipment	Quantity	Condition
Roll crusher	2	good
Manual press	1	good
Jigger (530 ø)	1	good
Propeller mixer	2	good
Stirring device	1	good
Ball mill (600-800 kg)	2	requires maintenance
Swing sieve	2	requires maintenance
Diaphragm pump	1	good
Filter press	1	good
Extruder	1	good

C. Erection of a washing unit

The kaolinitic clay deposit has a calculated reserve of about 60,000 tonnes. It would suit EELPA's purposes to erect the washing unit at Kentery, for the following reasons:

(a) The distance to the deposit is only 7 km;

(b) The necessary washing water could be taken from the Mughar river for eight months a year (only during the rainy season the water is contaminated and cannot be used for washing);

(c) The altitude of Kentery is about 700-800 m lower than that of Addis Ababa and therefore the average daily temperatures are higher, which permits the use of solar dryers;

(d) The required manpower is available.

Calculation of capacity

The sandstone from Kentery has a kaolin content of 6.5-18 per cent. For the following calculation the lower figure has been considered. The ceramic

plant requirement is 700 kg of kaolin and 400 kg of sand per day. Since the washing unit can be operated only eight months per year, 15 tonnes of sandstone will have to be washed daily.

Transportation

One five-tonne-truck, making three trips per day, would bring 15 tonnes of sandstone from the quarry to the dressing plant. The washed kaolinitic clay and sand will then be transported by the cable-way to the upper station, from where one truck per week is required to take it to the ceramic factory.

Proposed technology

To decrease importations as much as possible, and to utilize existing natural resources, the following technological proposal is made:

(a) Crushing and first washing in turbo-wash mill;

(b) Separation of the kaolinitic clay in a Schultz device;

(c) Sedimentation in concrete basins;

(d) Thickening on tables with thick cotton-cloth lining;

(e) Drying in solar dryers.

An example of plant layout and the design of the Schultz separator, the tables with water drainage and the solar dryer are shown in figures I-III.

D. Technological proposals for the manufacture of ceramic goods

Hot plates and small electrical resistors

For these items the cordieritic material should be calculated on the basis of chemical analyses and ceramic tests. The base of the ceramic hot plate would be moulded by jiggers, while the small electrical resistors would be cast in gypsum moulds.

Low-tension insulators

The LT 220 V and telecommunication insulators (rotative type 8-10 cm high and 6-8 cm diameter) should be manufactured by toggle presses and the same cordieritic material used. The surface of the insulators must be covered by glaze.

Kitchen ware

For the kitchen-ware production the composition of semi-vitreous body should be calculated. The ceramic body surface could be covered by glaze or engobe.

All coffee-pots, teapots, dishes, vases, ashtrays, jars, mugs etc., should be cast in gypsum moulds. For the production of pots the jigger could be used; for the inside glazing only lead-free glaze must be utilized.

Figure I. Proposed arrangement of equipment for the kaolin dressing plant

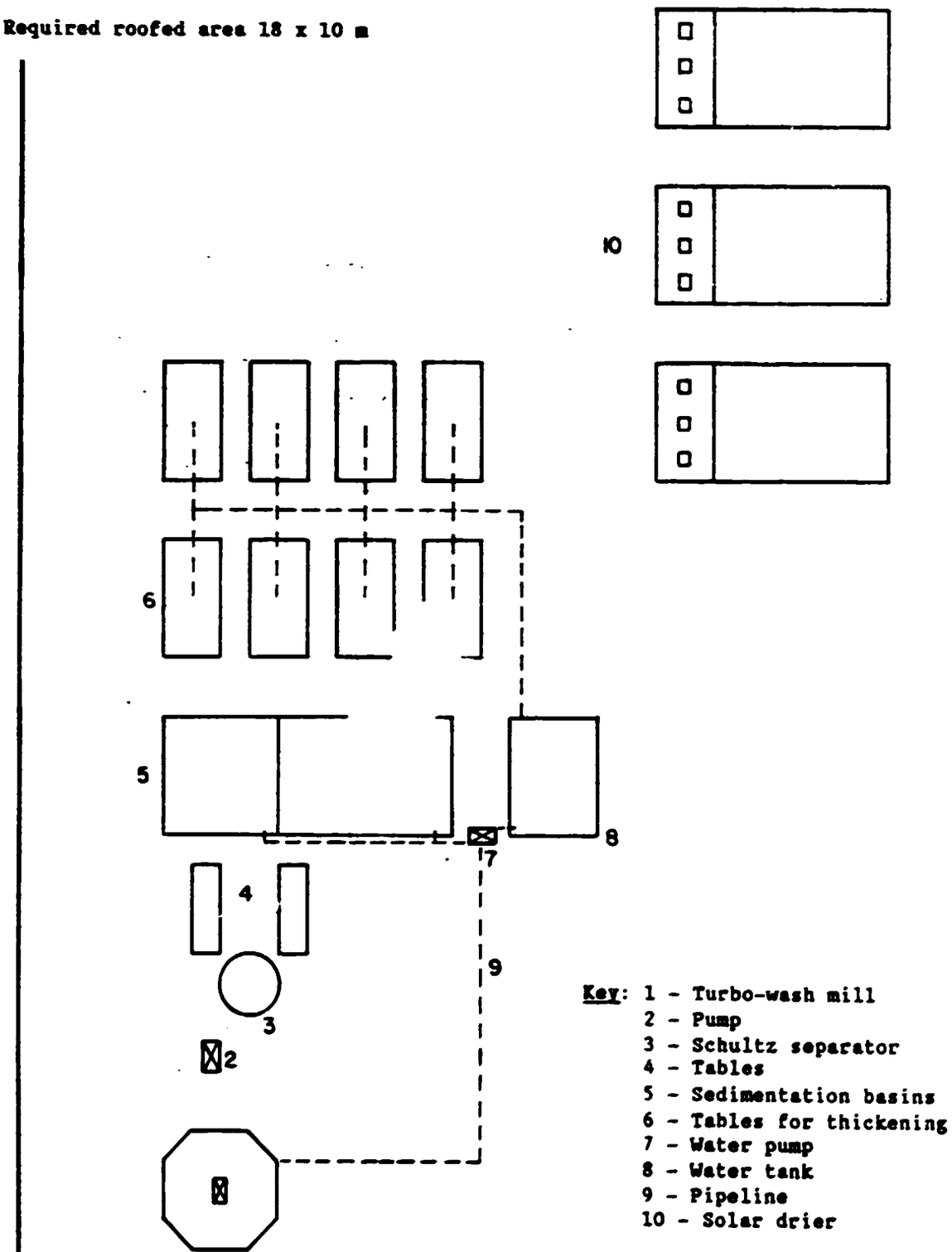
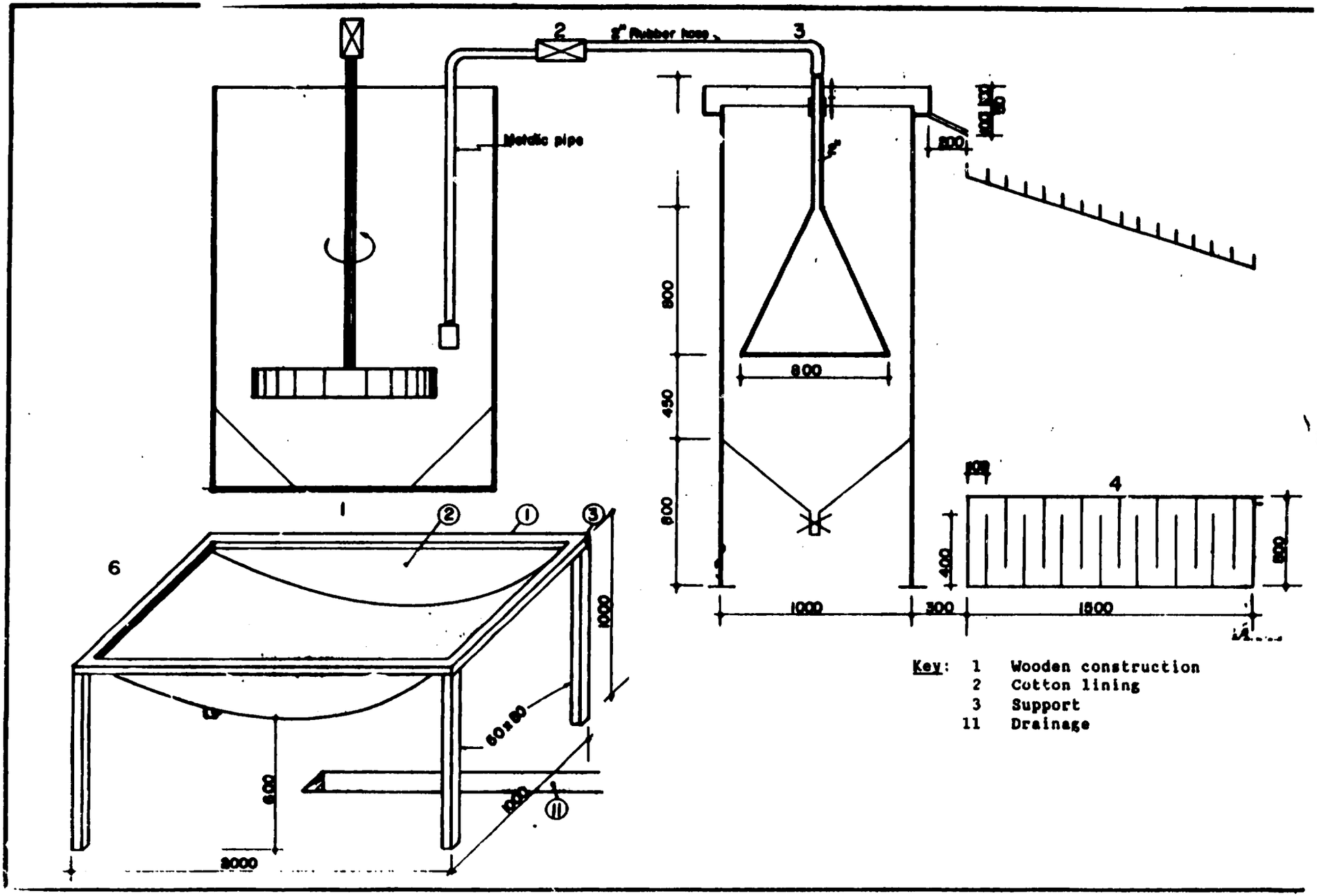
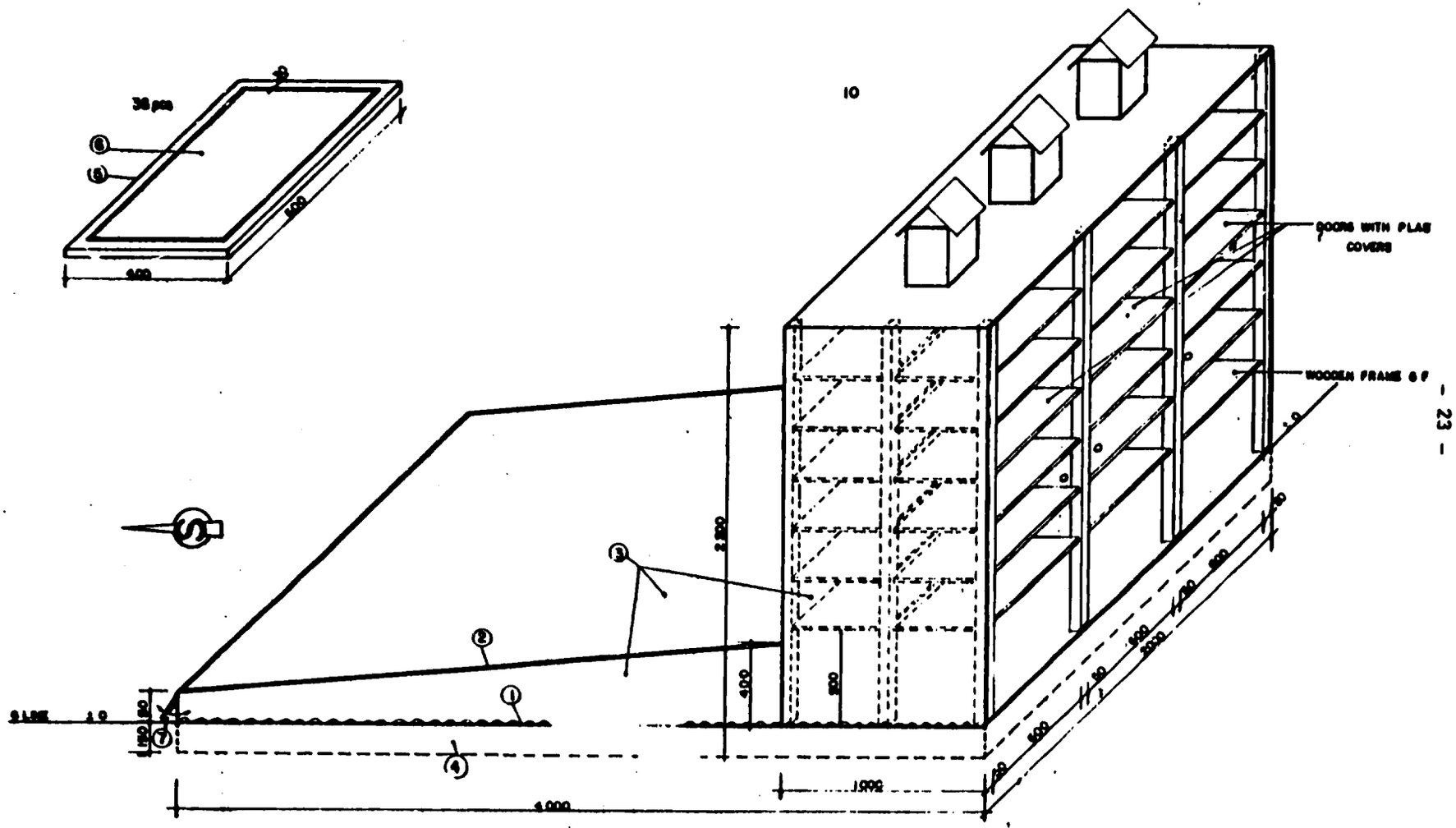


Figure II. Design of the Schultz separator and the tables with water drainage



Key: 1 Wooden construction
2 Cotton lining
3 Support
11 Drainage

Figure III. Design of solar drier



Key:
1 Black painted metal
2 Wooden construction
3 Transparent plastic
4 Basement (with diatomite insulation)
5 Wooden frame
6 Cotton cloth lining

E. Calculation of capacities

Initial production capacity

Work station	Production: Units/day	Production: Green weight	Production: Kg/day	Sales price (birr)
Jigger ("mitad")	20 a/	8.0	160	30
Jigger (three types of hot plates)	40 a/	1.2	48	15
Jigger with excentric knife (three types of pots and lids)	20 20	1.5 0.6	30 12	7
Jigger (LT insulator)	30	0.8	24	4
Pottery wheel b/	-	-	-	
Toggle press (LT insulator)	250	0.6	150	3
Toggle press (LT insulator)	250	0.6	150	3
40 work stations for casting, each	25	0.6 c/	600	6

a/ One unit consisting of one grooved plate, one thin and plane one, and the support.

b/ For the first six months only training programme.

c/ Weight varies according to product design.

Material preparation

Plastic material: 574 x 1.4 = 803 kg, i.e. 850 kg/day

Casting slip: 600 x 1.8 = 1,080 kg, i.e. 1,000 kg/day

The coefficients of 1.4 and 1.8 were determined empirically, based on material humidity, losses during manufacturing etc.

Daily raw material consumption

Plastic material for jiggering	850 kg - 22% humidity	$\simeq$ 680 kg
Casting slip	1,000 kg - 33% humidity	$\simeq$ 700 kg
Total		1,380 kg $\sim$ 1,400 kg

Capacity of ball mills

The capacity of each ball mill is 600-800 kg of the raw-materials mixture. The required milling time is 6-12 hours. With 21 working days/month of 16 hours each, the total working hours is 366.

$$\frac{336}{12} = 28$$

Therefore each mill could be fed 28 times, and the monthly output of the two ball mills would be 28 x 2 x 700 = 39,200 kg.

Since the requirement for the initial capacity is only 1,400 x 21 = 29,400 kg/month, this means that only 75 per cent of the two-shift capacity will be utilized.

Capacity of storage basins

1 storage basin for plastic material	1.5-2 m^3
1 storage basin for casting material	2 m^3

Daily glaze consumption

	Body weight	Percent of glaze
LT insulators shaped by jigger	24 kg/day	10
LT pressed insulators	300 kg/day	10
Cast production	600 kg/day	15

The total daily glaze consumption is therefore about 150 kg.

Daily water consumption

Applying a coefficient of 6.5, the daily water consumption is estimated to be (6.5 x 1.4 t), i.e about 9.1 m^3.

Required staff (including dressing plant)

Production staff	123
Service staff	48
Technical and administration staff	10
Total	181

Seventy-one per cent of the total staff should be females. For details see table 1.

Electricity consumption

	kWh
Ethio-Pottery Plant: total input of machinery, lighting and kitchen, excluding electrical kiln	3,590.7
Dressing plant: total input of machinery and lighting	712
Total	4,302.7

For details on electricity consumption see table 2.

Table 1. Required Staff

	Number of shifts	Total number of staff		Average monthly salary (birr)	
		Male	Female	Per staff	Total
Production staff					
(a) Ethio-Pottery Plant					
Material preparation	2	8		250	2 000
"Mitad" production	1	2		150	300
Hot plate production	1	2	1	150	450
Toggle press No. 1	1		2	150	300
Toggle press No. 2	1		2	150	300
Pots	1	3	2	150	750
Pottery wheel	1	2	1	150	450
Casting	1		40	150	6 000
Smoothing	1		10	150	1 500
Glazing	1		10	200	2 000
Decoration	1		20	200	4 000
Kiln operation	3	8		350	2 800
(b) Dressing plant					
Operation		10		200	2 000
Subtotal		35	88		
Service staff					
Truck and bus drivers	1	4		300	1 200
Transport of material	1	2		100	200
Quality control and packing	1		6	150	900
Gypsum department	1	1	4	200	1 000
Laboratory	1		3	300	900
Stock keeper	1		1	350	350
Cook	1		5	150	750
Assistant cook	2		5	100	500
Kitchen staff	1		5	80	400
Mechanic	1	1		200	200
Assistant mechanic	1	1		150	150
Bricklayer	1	1		200	200
Cleaning	1		5	80	400
Guard	3	4		100	400
Subtotal		14	34		

continued

Table 1 (continued)

	Number of shifts	Total number of staff		Average monthly salary (birr)	
		Male	Female	Per staff	Total
Technical and Administration staff					
Technologist	1		1	350	350
Master of material preparation	1	1		500	500
Master of shaping	1		1	500	500
Master of kiln department	1	1		500	500
Master of decoration	1		1	500	500
Material accountant	1		1	400	400
Salary accountant	1		1	400	400
Chief of administration	1		1	500	500
Secretary	1		1	200	200
Director	1	1		900	900
Subtotal		3	7		
Total		52	129		

Recapitulation

Production staff	123
Service staff	48
Technical and administration staff	10
Total	181

Table 2. Consumption of electricity

Number	Type of equipment	kW Input	kW Total	Working hours	kWh
A.	Ethio-Pottery Plant				
2	Roll crushers	10	20	3	60
1	Jigger	3	3	8	24
2	Propellers	5	10	8	80
1	Stirring device	7	7	16	112
2	Ball-mills	7	14	16	224
2	Swing sieves	1.5	3	6	18
1	Diaphragm pump	5	5	16	80
1	Extruder	7	7	10	70
2	Toggle presses	3	6	8	48
4	Jiggers	2	8	8	64
1	Electrical kiln (laboratory)	25	25	Occasionally	100
1	Compressor	4	4	8	32
1	Mixer	4	4	8	32
2	Spray cabins	0.5	1	8	8
2	Glaze cleaners	1.5	3	8	24
12	Burners	0.5	6	36:3	72
4	Ventilators	0.8	3.2	36	115.2
1	Vacuum chamber mixer	1.5	1.5	5	7.5
	Total imput of machinery				1 170.7
	Lighting				2 100
	Kitchen				320
	Electrical kiln				470
	Total				4 060.7
B.	Dressing plant				
1	Turbo-wash mill	20	20	16	320
1	Mud pump	5	5	16	90
1	Water pump	2	2	32	64
	Lighting				238
	Total				712

Kiln capacity

The ceramic production should be divided according to the technological process involved into:

Monofiring (non-glazed body)	208 kg/day
Bisquit firing	966 kg/day
Glaze firing	900 kg/day

The losses would be:

	Per cent
Green body	5
Drying	6
Bisquit firing	7
Glaze firing	7

The firing cycle is 119 hours (36 hours of firing + 72 hours of cooling + 11 hours of charging and discharging).

With each kiln operating 720 hours per month (30 days x 24 hours), each can be charged 6 times per month (720 : 119 hours of firing cycle). The maximum existing firing capacity is therefore 6 x 6 = 36 kiln loads.

Requirement for initial production

(a) Monofiring of non-glazed body: 208 kg - 11% loss = 185 kg/day
185 x 21 = 3,885 kg/month
Each kiln of 5.5 m^3 (220 kg/m^3) = 1,100 kg/kiln
3,885 : 1,100 = 3.5 times, i.e. 4 kiln loads

(b) Bisquit firing: 966 kg - 11% loss = 859 kg/day
859 x 21 = 18,039 kg/month
Each kiln of 5.5 m^3 (300 kg/m^3) = 1,500 kg/kiln
18,039 : 1,500 = 12 times, i.e. 12 kiln loads

(c) Glaze firing: 859 kg - 7% of loss = 798.9 kg/day
800 kg x 21 = 16,800 kg/month
Each kiln of 5.5 m^3 (180 kg/m^3) = 900 kg/kiln
16,800 : 900 = 18.6 times, i.e. 19 kiln loads

The total kiln capacity required is therefore 35 loads.

Oil consumption

The calculation of the fuel oil consumption is based on estimates (verbal information of a representative of the present owner).

5 barrels of 200 litres for kiln and firing = 1,000 l/kiln
1,000 x 35 x 12 = 420,000 l/year

At a price of birr 0.5/l, the total yearly consumption would cost birr 210,000.

F. Cost estimates

Compensation cost

According to the figures indicated in the study which the Ministry of Mines and Energy made in 1983, the actual cost for compensation is birr 735,559, and is composed as follows:

	Birr
Construction	410,647
Equipment	237,864
Electrical installation	36,173
Office installation	8,475
Vehicles (1 VW combi, 1 truck)	42,400
Total	735,559

New investments

	Birr
Civil work (erection of washing plant)	24,000
Kiln repair	10,000
Electrical installation	6,000
Water supply	4,000
Total	44,000

Spare parts requirement

	$US
2 mixing propellers	6,000
100 pieces of filter cloth	1,000
Pump parts	500
Balls for mill	3,000
Ball-mill lining (set)	5,000
Screen for swing sieve (5 m^2)	300
Steel moulds (toggle presses)	2,000
Jigger rotary plate ø 650 mm	500
12 belts for ball-mill	1,000
2 sponge belts	200
Total	19,500

New equipment

(a) Ethio-Pottery Plant

	$US
Ball-mill (250 kg)	5,000
Casting system with 40 working places	15,000
6 ventilators	3,000
Total	23,000

(b) Dressing plant

	$US
Turbo-wash mill	15,000
Mud pump	3,000
Water pump	2,000
Total	20,000

(c) Vehicles (1 bus, 1 truck) birr 100,000

Total fixed assets

	Birr	$US
Compensation	735,559	
New investment	44,000	
Vehicles	100,000	
Spare parts		19,500
New equipment		43,000
Total	879,559	62,500

Manufacturing costs

		Birr	$US
(a)	Raw materials		
(i)	Clays, 50% of 1,400 kg/day, i.e. 160 t/year, at about birr 100/t	16,000	
(ii)	Feldspar, sand, talc, dolomite, 50% of 1,400 kg/day i.e. 160 t/year, at about birr 80/t	12,800	
(iii)	Other materials such as gypsum, colouring oxides etc.	10,000	
(iv)	Utilities:		
	Fuel oil	210,000	
	Diesel oil for truck and bus	80,000	
	Electricity for factory	121,200	
	Electricity for dressing plant	26,315	
(v)	Glaze (imported)		
	150 kg/day, i.e. 35 t/year		70,000
(vi)	Water, 9.1 x 21 x 11 = 2,102.1 m^3, at birr 0.5/m^3	1,051.05	
(b)	Supplies	15,000	
(c)	Labour	421.800	
(d)	Depreciation		
	10% for machinery and vehicles	45,892.40	
	4% for building	30,803.70	
(e)	Contingencies		
	10% of (iii) and (v)	1,000	7,000
	Total	991,862.15	77,000

Recapitulation of costs, sales and profits

(a) Sales

	Birr
"Mitad", 75% of production	103,950
Hot plates, 75% of production	103,950
Pots (50% of 1st quality at birr 7)	32,340
(25% of 2nd quality at birr 5)	11,550
LT insulators, 75%	20,788
LT insulators, 75%	259,875
Cast goods	
(50% of 1st quality at birr 6)	693,000
(25% of 2nd quality at birr 4)	231,000
Total	1,456,453

(b) Working capital

For new plants, the working capital is normally considered to be an amount equal to 10-15 per cent of the fixed investment. For the purpose of this study, it is to be calculated according to the following formula:

$$\text{Working capital} = \frac{\text{manufacturing costs x 6}}{12}$$

The working capital is therefore birr 575,626.05.

(c) Total investment costs

	Birr
Total fixed assets	879,559
Working capital	575,626.05
Total	1,455,185.05

(d) Sales and profits

	Birr
Sales	1,456,453
Manufacturing costs	1,151,252.10
Profit before taxes	305,200.90

G. Return on investment

The return on investment is generally calculated according to this formula:

$$Prb = \frac{Pb \times Ra}{If} \times 100$$

Prb = percentage return on investment before taxes
Ra = annual production rate
Pb = profit before taxes per unit of production
If = fixed capital investment

$$Prb = \frac{305,200/200 \times 200}{1,455,185} \times 100 = 20.97$$

H. Pay-off time

The pay-off time (D) is the number of years in which the capital investment will be returned by the profits, calculated before deduction of depreciation, and thus is the period of time that will elapse before any earnings over the inital investment will be realized.

$$D = \frac{If}{Pb \times Ra + \text{depreciation}}$$

$$D = \frac{1,455,185}{305,200/200 \times 200 + 76,696.1} = 3.8$$

Annex VI

DRAFT PROJECT DOCUMENT

Title: Rehabilitation of the Ethio-Pottery Plant

Number: Duration: 24 months

Primary function: Reactivation of the ceramic plant production

Secondary function: Creation of the new working places
(UNDP class. and code)

Sector: (Govt. class.) Industry (UNDP class. and code)

Subsector: (Govt. class.)

Government implementing agency: Ethiopian Electricity Light and Power Authority (EELPA)

Executing agency: United Nations Industrial Development Organization (UNIDO)

Estimated starting date: June 1986

Government inputs: Birr 1,462,685 UNIDO inputs: $US 472,300

Signed:

On behalf of the Government	Date
On behalf of the executing agency (UNIDO)	Date
On behalf of the United Nations Development Programme	Date

PART I. LEGAL CONTEXT

This project document shall be the instrument referred to as such in article I, paragraph 1, of the Assistance Agreement between the Government of Ethiopia and the United Nations Development Programme, signed by the parties on 26 February 1981.

The Government Implementing Agency shall, for the purpose of the Standard Basic Agreement, refer to the Government Co-operating Agency described in that Agreement.

PART II. THE PROJECT

1. Objectives

(a) Development objectives

The development of local production facilities for the manufacture of ceramic bodies for electrically heated hot plates, including plates of 650 mm diameter for national food preparation, as well as for about 80,000

low-tension (LT) insulators and other ceramic household goods such as teapots, coffee-pots, cups, pots and dishes, which will be made from local raw materials, will help to decrease importations. By establishing a national ceramic production - the initial capacity of the plant will be about 200 tonnes per year - also new jobs will be created. Furthermore, the increased use of electrically heated household appliances will reduce the utilization of other fuels, such as charcoal and firewood, thus alleviating the existing problems of deforestation and consequent erosion of the soil. The proposed rehabilitation plan will also generate new industrial activities.

(b) Immediate objectives

(i) To rehabilitate the ceramic plant, using existing machinery and kilns;

(ii) To create 180 working places, 71 per cent of which shall be occupied by women;

(iii) To start a new ceramic technology programme in Ethiopia, including the beneficiation of the raw materials;

(iv) To develop a system of ceramic raw materials testing and upgrading of selected non-metalics;

(v) To train national staff in all aspects of ceramic technology;

(vi) To establish the necessary linkages with domestic pottery makers and other manufacturers to improve the quality of ceramic products.

2. Special considerations

No special considerations apply in respect of this project.

3. Background and justification

Firewood and charcoal are generally used for baking and cooking the traditional Ethiopian food (injera and watt). The use of these fuels is inefficient and costly and causes great economic losses to the country. Recently it was estimated that annually 180,000 tonnes of charcoal are used for various domestic and agricultural purposes in the urban and rural areas. The increased use of firewood also resulted in the deforestation of some regions, erosion of land and silting. In addition, the prices for firewood and charcoal are increasing steadily, and today the use of electricity for baking and cooking purposes is considered more economical and convenient. In this connection, the Ethiopian Electric, Light and Power Authority (EELPA) with a view to increasing the utilization of electrical energy, has investigated the possibility of manufacturing electrical appliances which can be used safely and economically for baking and cooking.

(a) Recapitulation of main results of the prefeasibility study

(i) The buildings of and the equipment at the Ethio-Pottery Plant are in very good condition;

(ii) Raw materials are available and suitable for EELPA's purposes;

(iii) A washing unit with the new working places has to be built;

(iv) For kiln fuel the waste oil of the transformers of EELPA could be used;

(v) The capacity of the existing machinery and kilns is suitable for the production of about 200 tonnes of ceramics per year;

(vi) The costs of investment, vehicles and other components of the total fixed assets as well as the required working capital are relatively low due to the low cost of compensation after 11 years of depreciation;

(vii) The calculation of sales and profits is based on the envisaged initial capacity of the plant, considering a waste of 25 per cent during production and 25 per cent of second-quality choice;

(viii) The recommended UNDP/UNIDO contribution for spare parts and additional equipment totals $US 70,000;

(ix) The return on investment is 20.97 per cent when the calculation is based on the cost of the rehabilitation of the Ethio-Pottery Plant, including the erection of a new washing unit.

(b) Production cost and sales prices for "mitad" and hot plates

The present sales price of EELPA's "mitad" is birr 200 and the sales price of private manufacturers is birr 250.

The estimated cost of "mitad" with a diameter of 650 mm would be:

	Birr
Ceramic body with support	30
Electrical part	40
Lid (bamboo or leaves) 1/	5
Assembling (labour)	10
Diatomite insulation and cement	4
Total	89

The cost for hot plates (150, 250 and 350 mm diameter) would be:

	Birr
Ceramic body with support	15
Electrical part	23 or 33
Assembling (labour)	10
Diatomite insulation and cement	2
Total	50 or 60

The present market price for hot plates is birr 80.

1/ To be produced by HASIDA, as discussed with Gezachew Tsegaye, Head of Technical Department.

(c) Savings in foreign exchange

The necessary importations of EELPA amount to about $US 175,000 per year. The attached table shows the volume and the value of importations for the years 1980 to 1984, while the following calculations indicate that these expenses could be saved once the Ethio-Pottery Plant would be operating at full capacity.

In 1983, 202,024 insulators for industrial use were imported. If 65 per cent of these are LT insulators and insulators for telecommunication, then the consumption was 130,000 pieces. The local market price is estimated at birr 3/piece, which gives a value of birr 390,000 or $US 188,000.

With an initial capacity of the pottery plant of 85,000 pieces, the importation will decrease by $US 65,200 and the profit will be $US 122,800. This amount covers 69.2 per cent of EELPA's necessary importation.

With the full capacity of the pottery plant which is estimated to be 120,000 pieces/year, the profit will be $US 175,000 and EELPA's requirement of electrical insulators will be covered completely.

4. Project outputs

(a) The initial production of the plant will be as follows:

3,450 units of "mitad"
6,900 units of hot plates
7,000 pots with covers
5,100 LT insulators
86,600 small LT insulators
163,700 pieces of cast ceramic goods;

(b) The production of the dressing unit will be 700 kg/day and the first Ethiopian kaolin washing/beneficiation plant will be erected;

(c) Local workers and technical staff will be trained in the new industrial technology branch;

(d) New working places (181) and mining opportunities will be created;

(e) The importation of ceramic products such as LT insulators and all kinds of tableware will be substantially reduced;

(f) The co-operation with other manufacturers of ceramic goods will be enhanced. The bamboo lid for the "mitad" will be produced in co-operation with HASIDA.

The CTA will produce a first progress report one month after his assignment to the project. Subsequently progress reports will be prepared every three months. The terminal report of the project will be prepared in accordance with the policies and procedures established by UNDP/UNIDO.

Importation of electrical appliances and LT insulators, 1980-1984

	1980		1981		1982		1983		1984	
	Units	Birr	Units	Birr	Units	Birr	Units	Birr	Units	Birr
Electrical irons	5 947	427 578	2 433	34 318	2 034	47 582	406	22 766	1 342	47 900
Coffee makers	79	136 908	178	158 950	358	459 374	318	536 390	41	20 672
Electrical hot plates and ovens	7 616	533 538	5 105	516 571	1 277	605 239	7 439	159 704	712	640 934
Insulators	386	89 658	106 320	57 803	66	23 513	250	39 453	350 087	106 818
Insulators for industrial use	204	142 076	90 771	499 850	30 800	495 182	202 024	1 568 381	1 179	218 079
Sockets etc. (plastic and ceramic body) Unit in kg	468 954	9 153 906	289 826	5 489 954	1 375 690	12 238 485	4 931 878	34 974 477	692 968	11 905 695

5. Project activities and modalities of implementation

To achieve the objectives of the project, emphasis will be given to the on-the-job training of the national staff, and the team assigned to the project shall work according to the following plan:

		Proposed starting date	Planned completion date
(a)	Construction of the washing plant at Kentery. National staff: civil engineer, electrical engineer and 30 workers. International staff: occasional visits by the CTA and the mechanical engineer. (The necessary wooden constructions should be made before at Addis Ababa.)	July 1986	December 1986
(b)	Checking and maintenance of machinery with the participation of an international expert and a national mechanic and his assistant.	July 1986	September 1986
(c)	Kiln repair with the participation of an international expert and four to five national workers (bricklayers). During that period the future master of the kiln department will receive the necessary on-the-job training.	July 1986	December 1986
(d)	Establishment of plant laboratory, including on-the-job training of three national laboratory staff in ceramic material testing, quality control tests and laboratory checking of recommended material compositions. International staff: CTA.	July 1986	December 1986
(e)	Start operation of dressing plant. International staff: CTA and expert in ceramic machinery. On-the-job training of the national staff of the washing plant in machinery operation and maintenance as well as background information in technology.	January 1987	January 1987
(f)	Gypsum department International staff: expert in gypsum mould making. On-the-job training of five national workers in model preparation, master mould preparation and casting moulds.	July 1986	March 1987

			Proposed starting date	Planned completion date
(g)	Start operation of the Ethio-Pottery Plant with the participation of the following international staff:		February 1987	December 1987
	CTA		On board	December 1987
	Expert in gypsum mould-making		On board	March 1987
	Expert in shaping and casting		January 1987	June 1987
	Expert in kiln operation		January 1987	June 1987
	On-the-job training of all workers, and for all technical staff basic courses in ceramic technology as well as special courses for the following departments: kiln, glaze and decoration, casting, jigger and hand shaping, and material preparation.			
		Duration (man-months)		
(h)	Training schedule for national staff under individual fellowships:			
	Specialist in gypsum mould preparation and model design	3	October 1986	December 1986
	Technologist - upgrading of ceramic raw material and calculation of ceramic material compositions, including laboratory tests	3	October 1986	December 1986
	Director - work organization in ceramic plants, basic technology and special course on fire, health and safety regulations	3	October 1986	December 1986

	Duration (man-months)	Proposed starting date	Planned completion date
Specialist in decoration and glaze application - upper and underglaze decorating techniques, hand-painting and gold application, with special focus on firing temperatures	3	January 1987	March 1987
Mechanic - maintenance of machinery, including electrical parts of equipment and pertinent safety regulations	3	October 1986	December 1986
Total	15		

6. Project inputs

(a) Government inputs

The Government will assign a national professional officer as national project co-ordinator. In addition, the Government will assign a minimum of 10 national professional staff and 170 workers to the project.

The Government will also provide technical personnel in the specializations and number indicated in the Government contribution budget or as may be required by the workplan of the project.

The Government will be responsible for providing the administrative support personnel needed to service the project and all the international and national staff assigned to it, with the exception of the administrative support personnel for which provision has specifically been included in the UNDP/UNIDO contribution budget.

The Government will be responsible for the identification, release and reinstatement of national personnel sent for training abroad and for the payment of their local entitlements during their training.

Furthermore, the Government will be responsible for providing adequate office accommodation and facilities; for the operation and maintenance costs of all project equipment, including vehicles; for any transport requirements in addition to those covered under the UNDP/UNIDO contribution; for reproduction and other locally obtainable subcontracted services required in connection with the production of reports, maps etc. and for any miscellaneous and other local costs not specifically provided for under, or in excess of, the UNDP/UNIDO contribution.

Assignment of national staff

Director: He/she should have a degree in engineering or science, with experience in management at the executive level.

Technologist: He/she should have a secondary technical school baccalaureate in chemistry, mathematics and physics.

Masters: They should have secondary technical school baccalaureates and experience in organization and team leading.

Head of gypsum department: He/she should have a baccalaureate from a secondary artistic school and experience in organization.

(b) UNDP/UNIDO inputs

Personnel

UNDP will provide, through UNIDO as the executing agency, the following experts:

	Man-months
Chief technical adviser for the management of (a) the dressing plant, including supervision of its erection, and (b) the Ethio-Pottery Plant, including participation in the on-the-job training of national staff.	18
Expert in kiln maintenance and repair	6
Expert in machinery maintenance and repair	4
Expert in gypsum mould making	9
Expert in production organization	6
Expert in kiln operation	6

UNIDO will make every effort to recruit those experts, subject to the availability of suitable candidates and donor financing. The terms of references for the consultant and expert posts are outlined below.

Chief technical adviser (CTA)

The CTA should have a degree in engineering or science, and long practical experience in the ceramic industry, including experience in the management of a national ceramic plant and the conducting of technical courses as well as on-the-job training of staff. He/she will have full responsibility for the preparation of suitable training programmes for the director, the technologist and the master in decoration.

The project will be conducted under the CTA's general supervision. He/she will be responsible to the General Manager of EELPA for the overall performance of the project and for the direction and co-ordination of the work of experts under him/her, in accordance with the timing and other details specified in the work plan. The period of assignment will be 18 (3 + 15) months, starting in July 1986. The duty station will be Addis Ababa (Ethio-Pottery Plant).

Subcontract

The following consultancy services, totalling 31 man-months, will be provided under a subcontract:

(i) Expert in kiln maintenance and repair

The expert should have a baccalaureate from a secondary school and 10 years experience in the field of specialization. Experience in team leading is required and he/she is expected to conduct a training course as a part of the on-the-job training for the national kiln staff. The expert will work under the general supervision of the CTA and in close co-operation with national technical staff.

The duration of the assignment is six months, starting in July 1986. The duty station is Addis Ababa (Ethio-Pottery Plant).

(ii) Expert in machinery maintenance and repair

The expert should have a baccalaureate from a secondary technical school and 10 years experience in the repair of ceramic machinery, including selection of spare parts. He/she will be expected to carry out the on-the-job training of the local mechanic and his assistant and to prepare the abroad training programme for the mechanic.

The expert will work under the general supervision of the CTA and in close co-operation with the national technical staff.

The duration of the initial assignment is three months, starting in July 1986. A second mission, of one month, should start in January 1987. The duty stations are Addis Ababa (Ethio-Pottery Plant) and Kentery (dressing plant).

(iii) Expert in gypsum mould making

The expert should have a secondary technical school education and seven years of experience in gypsum moulding. He/she will be expected to carry out the on-the-job training of the national staff of the gypsum department and to prepare the relevant abroad training programmes.

The duration of the assignment is nine months, starting in July 1986. The duty station is Addis Ababa (Ethio-Pottery Plant).

(iv) Expert in shaping and casting and expert in kiln operation

The experts should have a baccalaureate from a secondary technical school, a minimum experience of 10 years in their field of specialization as well as experience in team leading. Under the general supervision of the CTA, and in close co-operation with national technical staff, they will be responsible for establishing working teams in the different departments, and for designing and executing a systematic on-the-job training of local workers at different co-operating departments of the plant.

Their period of assignment is six months, starting in January 1987, and their duty station is Addis Ababa (Ethio-Pottery Plant).

Training

UNDP/UNIDO will provide $US 30,000 for the cost of training as outlined in the project budget and the training schedule.

Equipment

$US 1,500 will be provided for the purchase of expendable equipment, and $US 68,500 for non-expendable equipment, including two vehicles (one small and one four-wheel drive car) at an estimated cost of $US 15,000.

Miscellaneous

UNDP/UNIDO will provide the following miscellaneous expenditures:

Spare parts for equipment	$US 500
Reporting costs	$US 1,000
Sundry	

PROJECT BUDGET COVERING UNDP CONTRIBUTION
(In US Dollars)

Country: Ethiopia
Project number:
Project title: Rehabilitation of the Ethio-Pottery Plant

		Total		1986		1987	
		m/m	$	m/m	$	m/m	$
10:00	PROJECT PERSONNEL	18	137 400	6	44 400	12	93 000
11:01	CTA						
11:02							
11:03							
11:04							
11:05							
11:06							
11:99	Sub-total	18	137 400	6	44 400	12	93 000
13:00	Support personnel						
14:00	UN volunteers						
15:00	Experts travel		2 000		1 000		1 000
16:00	Mission costs		2 000				2 000
17:01	Locally hired experts						
19:00	Total personnel component	18	141 400	6	45 400	12	96 000
20:00	SUB-CONTRACTS						
29:00	Total subcontracts component	31	229 400	15	111 000	16	118 400

PROJECT BUDGET COVERING UNDP CONTRIBUTION
(In US Dollars)

Country: Ethiopia
Project number:
Project title: Rehabilitation of the Ethio-Pottery Plant

		Total		1986		1987	
		m/m	$	m/m	$	m/m	$
30:00	TRAINING						
31:00	Fellowships	15	30 000	12	24 000	3	6 000
32:00	Study tours						
33:00	In-service training						
39:00	Total training component	15	30 000	12	24 000	3	6 000
40:00	EQUIPMENT						
41:00	Expendable equipment		1 500		500		1 000
42:00	Non-expendable equipment		68 500		68 500		
49:00	Total equipment component		70 000		69 000		1 000
50:00	MISCELLANEOUS						
51:00	Operations/maintenance		500		250		250
52:00	Reporting costs		1 000		250		750
53:00	Sundry						
59:00	Total miscellaneous component		1 500		500		1 000
99:00	TOTAL UNDP CONTRIBUTION		472 300		249 900		222 400

Project budget covering Government contribution in kind

Country: Ethiopia
Project number:
Project title: Rehabilitation of the Ethio-Pottery Plant

		Total		1986		1987	
		m/m	$	m/m	$	m/m	$
10:00	PROJECT PERSONNEL						
	Construction of dressing plant	198	24 000	198	24 000		
	Machinery checking	12	2 100	12	2 100		
	Kiln repair	30	10 000	30	10 000		
	Laboratory erection	18	5 400	18	5 400		
	Erection of gypsum department	30	10 000	30	10 000		
	Plant operation and support personnel	2 148				2 148	
19.00	Component total	2 436	51 500	288	51 500	2 148	
40.00	EQUIPMENT						
41.00	Working capital		575 626				575 626
42.00	Compensation cost		735 559		735 559		
49.00	Component total		1 311 185		735 559		575 626
50.00	MISCELLANEOUS						
	Vehicle		100 000				100 000
59.00	Component total		100 000				100 000
99.00	Grand total		1 462 685		735 559		675 626