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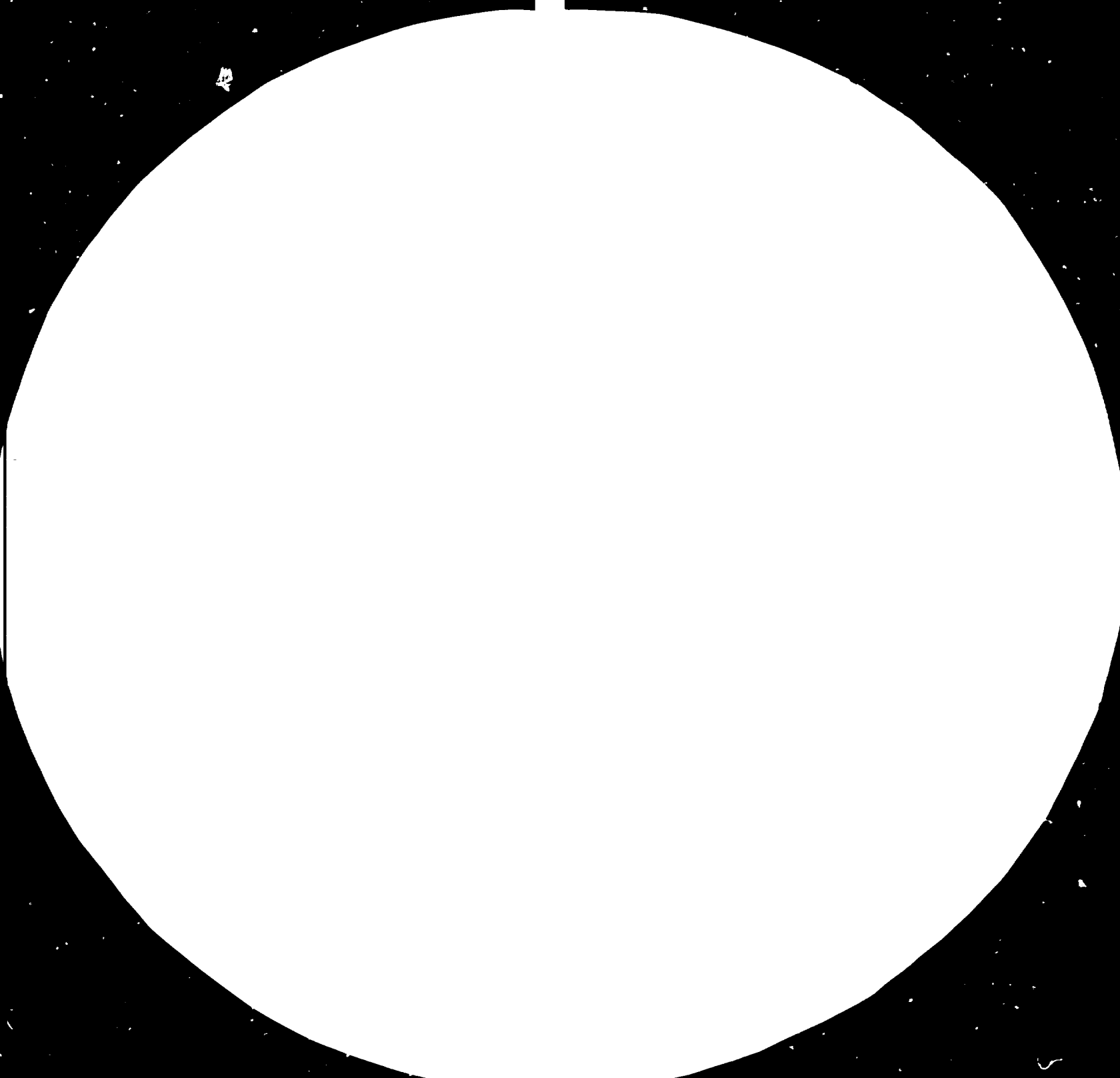

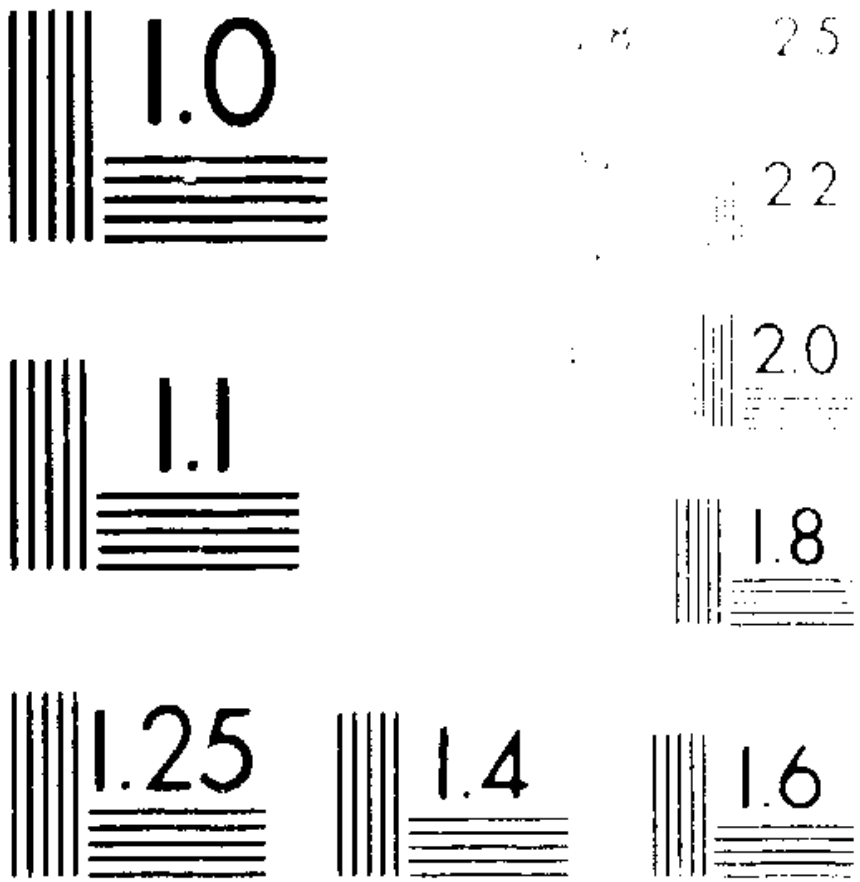
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INTEGRATED UTILIZATION OF BENTONITE AND ENERGY CONSERVATION IN THE EGYPTIAN GLASS INDUSTRY

Egypt.

Technical Report: Assessment of the Scope for future co-operation in the fields of Bentonite, Glass and Brick manufacture*

Prepared for the Government of
The Arab Republic of Egypt
by the United Nations Industrial Development Organization,

Based on the work of Zdeněk A. Engelthaler,
Chief Executive of the
UNIDO-Czechoslovakia Joint Programme

United Nations Industrial Development Organization
Vienna

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ABSTRACT

The mission, realized by the UNIDO Vienna according to the request from UNDP Cairo and Egyptian Authorities, was related to two main projects, i.e. Integrated Utilization of Bentonites in Egypt and Energy Conservation in the Egyptian Glass Industry. The Draft Project Proposal for the integrated utilization of bentonites in Egypt was revised by the Egyptian Authorities, completed during the mission and negotiated with UNDP Cairo. The Project Concept on Energy Conservation in the Egyptian Glass Industry was negotiated with the Egyptian Authorities and with the glass company concerned. The revised and agreed version was negotiated with UNDP Cairo and it will serve for the elaboration of the UNIDO Project Document.

Aside the foregoing two projects, the Egyptian Authorities with the UNDP Cairo support expressed their interest in a high level UNIDO mission to the Egyptian red brick industry.

In order to formulate the revised version of the Draft Project Proposal and the Project Concept, negotiations with the Governmental Authorities as well as with the industrial and agricultural sectors were conducted and the related farms, factories and institutions were visited.

I. INTRODUCTION

UNIDO Headquarters in Vienna, upon the request of the Egyptian Authorities and UNDP Cairo, arranged a high level consulting and formulating mission to Egypt in order to negotiate problems associated with the integrated exploitation of Egyptian bentonites and with energy management problems in the glass industry as the possibility to assist the Egyptian Authorities in lowering the energy consumption in a selected glass plant as the basis for further UNIDO assistance in the energy management in the Egyptian industry within the frame of the revolving fund which might enable the continuous activities in energy conservation in other industries. Ceramics and refractories are the next suggested sector.

During the period from 19 through 24 November 1984, Mr. N. G. Biering, Industrial Development Officer from UNIDO Headquarters, participated in all negotiations conducted with the Egyptian Authorities and with UNDP Cairo.

Following the request from the Egyptian Authorities and UNDP Cairo, the mission was extended by visiting a modern red brick making plant and negotiations resulted into the request for high level consultations and formulating UNIDO mission for the brick industry in Egypt. This governmental request is expected to be submitted in the near future.

All objectives of the high level consulting and formulating mission were fulfilled.

The tests made with Egyptian bentonites from the Fayoum locality as well as from the Cairo-Alexandria deposits were introduced and negotiated with the Egyptian experts. Two bentonite deposits were visited and their situation negotiated.

The bigger samples taken (more than 50 kgs each) are at the Egyptian custom clearance at present to be shipped to the UNIDO-Czechoslovakia Joint Programme in Pilsen for conducting semi-industrial tests on their integrated exploitation possibilities. Several round table discussions were conducted not only on experts' level but also on the level of Governmental Authorities. The Project Proposal for the Integrated Utilization of Bentonites in Egypt was negotiated and completed during the mission. Its version is attached. The same version of the Project Proposal is being submitted by the Egyptian Authorities through the Ministry of Foreign Affairs to UNDP Cairo and UNIDO Vienna.

The application of Egyptian bentonites in different fields is being followed in Egypt under the sponsorship of the National Research Centre in Cairo. Both General Directors of CMRDI and the Sinai Manganese Company are very much interested in visiting the UNIDO-Czechoslovakia Joint Programme in Pilsen and Czechoslovak Ceramic Works in Prague in order to exchange their points of view concerning the commercial exploitation of bentonites. Furthermore, the National Research Centre is deeply interested in its active participation in the World Congress in Belgrade and its technical follow-up in Czechoslovakia in order to share experience in the integrated exploitation of bentonites with Czechoslovakia and with other countries.

UNDP Cairo kindly arranged a round table discussion on the integrated utilization of bentonites with its senior officials. The discussion showed that Egyptian bentonites could also be exploited jointly in other UNDP projects implemented in Egypt.

The project activities on energy conservation in the Egyptian glass industry were analyzed and negotiated with the Governmental Authorities, with the El-Tebbin Institute which will be a co-operating body with the El-Nassr Glass and Crystal Company in Mostorod selected for the project implementation. The Company itself is interested in the UNIDO assistance. The Project Management Committee will be formed from the Governmental Authorities, El-Tebbin Institute, the Glass Company, UNDP Cairo and UNIDO Vienna in order to sponsor the project activities and to evaluate the project achievements. The El Nassr Glass and Crystal Company agreed to cover the necessary local costs in local currency and to reimburse the convertible currency to the Revolving Fund. The Project Concept was reelaborated and negotiated with UNDP Cairo. It will serve as the background paper for the preparation of the Project Document by UNIDO Vienna. Its version is attached.

Aside the projected duties, upon the request of the Egyptian Authorities, the writer visited a number of places outside Cairo in order to negotiate test results of the application of bentonites for soil reclaiming and cattle feeding, to inspect bentonite deposits and bentonite application in the new modern plant Missr El-Fayoum Building Materials Company in El-Fayoum. The Egyptian Authorities, with the support of UNDP Cairo, are also interested in high level consultations with Egyptian brick making companies. UNDP Cairo will raise such a request to UNIDO Vienna in order to create a new project.

II. FINDINGS AND RECOMMENDATIONS

1. The Egyptian Authorities with the support of UNDP Cairo are interested in the implementation of three UNIDO projects:

   a/ Integrated Utilization of Bentonite in Egypt

   b/ Energy Conservation in the Egyptian Glass Industry

   c/ High level consulting mission to the Egyptian brick companies

2. Integrated Utilization of Bentonite in Egypt

   The draft project proposal, elaborated by UNIDO and the UNIDO-Czechoslovakia Joint Programme, was reviewed by the Egyptian Authorities and completed during the mission. (Its version is attached). It is now being submitted by the Egyptian Authorities to UNDP Cairo and UNIDO Vienna through proper channels.

3. Energy Conservation in the Egyptian Glass Industry

   The project concept, elaborated by UNIDO, was negotiated in full detail with the Egyptian Authorities, with the El Tebbin Institute, El Nassr Glass and Crystal Company and with UNDP Cairo. Its revised version is attached and it will be a background paper for the preparation of the Project Document by the UNIDO Headquarters.

4. The Egyptian Authorities with the support of UNDP Cairo are also interested in high level consultations with the Egyptian brick companies. UNDP Cairo will ask UNIDO to elaborate a draft project proposal on such activities.

5. Detailed Findings and Recommendations, related to each institution visited, are presented separately in the following chapters.

III. CENTRAL METALLURGICAL RESEARCH AND DEVELOPMENT INSTITUTE, NATIONAL RESEARCH CENTRE, Dokki-Cairo, Egypt

The Central Metallurgical Research and Development Institute has moved from Cairo to Dokki, an industrial estate area about 30 km southern from Cairo. Meanwhile the laboratories are being furnished, the pilot plant is more or less ready. All the Institute was established with the assistance of UNDP Cairo about 3 years ago.

The main scope and functions of the Central Metallurgical Research and Development Institute (CMRDI) are to undertake industrial research in the different branches of metallurgy including

1. Evaluation and beneficiation of ores
2. Extraction and refining of metals (ferrous and non-ferrous)
3. Development of alloys, their heat treatment and formulation into shapes by casting and fabrication
4. Study on the physical, mechanical and chemical properties of metals and alloys
5. Corrosion and its prevention and examination of failure
6. Environmental protection and pollution control
7. Utilization of waste materials.

Processes and developments reached on the laboratory scale are verified in the pilot plant which is well equipped also for dressing and up-grading of non-metallics.

One of the basic programmes of CMRDI is the complex exploitation of Egyptian bentonites which, in the deposits, are contaminated by gypsum. To get purer bentonites, the first hand sorting is realized during the extraction in the mine. When bentonite crushes into the fractions with the particles bigger and smaller than 20 mm, the finer fraction is enriched with gypsum while the fraction with the particles bigger than 20 mm shows its gypsum content to be only 25% of the original material. This fraction is then used for alkaline or acid

activation while the finer fraction is considered to be applied in farming. The Egyptian bentonites, being naturally solidified, do not disintegrate by themselves, they must be ground.

The alkaline activation is made in a semi-dry way by adding soda-ash and necessary water to a dry edge runner mixing machine, bentonites are kneaded during about 20 minutes.

The wet alkaline activation of bentonites is prepared but not yet started. It will be realized in an extruding machine with steam.

The acid activation, made on a pilot-plant scale, is based on mixing finely ground bentonite with diluted hydrochloric acid, heated up to 95°C for about 2 hours. The activated bentonite is then filterpressed and washed twice with water. Drying is made in sunshine. The Institute plans to establish a continuous technology by replacing the filterpressing operation by the thickening of the slurry with electrolytes.

Conclusions and Recommendations

1. CMRDI is deeply interested in the development of a linkage arrangement with the UNIDO-Czechoslovakia Joint Programme in Pilsen and with the Czechoslovak institutions dealing with bentonites.
2. The General Director of CMRDI has requested a trip to the Joint Programme in Pilsen in order to be acquainted with its activities and achievements.
3. The Joint Programme Chief Executive will arrange for providing the General Director with the Information on the Joint Programme activites and with the list of the Joint Programme publications to be requested through INTIB, UNIDO Vienna.
4. The Joint Programme will request a company in Bratislava (the Dimitrov's Plants) for the in-plant training of Egyptian experts in the acid activation.

5. The Egyptian side reviewed the Draft Project Proposal "Integrated Utilization of Bentonites in Egypt" which will be submitted to UNDP Cairo and UNIDO Vienna through proper channels.

6. JNDP Cairo and the Egyptian Authorities support the participation of Egyptian experts in the World Congress in Belgrade and in its follow-up in Pilsen. They request invitation papers in order to settle the formalities in time.

7. Aside bentonites, up-grading and beneficiation of Egyptian kaolins is actual. Therefore, CMRDI has requested the Joint Programme in Pilsen to carry out orientation tests of selected Egyptian kaolins which will be sent to Pilsen. Sinai kaolins showing their geological reserves over 100 million tons prove a good quality containg 32 - 38% of Al_2O_3 in the raw ore. Until now kaolins have been used unwashed in the Egyptian ceramic and refractory industries.

IV. EL-TEBBIN INSTITUTE FOR METALLURGICAL STUDIES, Cairo

El-Tebbin Institute for Metallurgical Studies in Cairo has been co-operating with UNIDO and other International Agencies for a long time. It is well equipped for training purposes which are being conducted for Egyptian as well as for foreign participants.

As a result of mutual co-operation between the Government of Egypt and UNDP, a Project on "Energy Conservation in Industry" was initiated starting in June 1983 with a 3.5-year duration. The project budget is composed of the Governmental inputs amounting to 1,015,000 L.E. and of the UNDP inputs of 400,000 US $.

The project activities are as follows:

1. To prepare highly qualified industrial energy specialists from public and private companies trained in modern energy management techniques.
2. To appraise new industrial projects from the energy conservation point of view.
3. To establish research and testing facilities for the purpose of evaluation of energy saving technologies and their application.
4. To estimate standards for energy consumptions in different industrial processes.
5. To assist in the production and maintenance of energy efficient equipment.
6. To operate an energy data bank.
7. To promote national and international contacts with Energy Conservation Centres, ministries, universities, companies, agencies and organizations.
8. To organize and implement seminars, workshops and scientific conferences.

El-Tebbin Institute has ordered a Mobile Diagnostic Unit from abroad which is expected to be delivered in January 1985. Therefore, the Institute is interested in a training programme in the Czechoslovak Ceramic Works, in co-operation with the Research Institute for Ceramics, Refractories and Raw Materials in Pilsen as well as in co-operation with the UNIDO-Czechoslovakia Joint Programme for International Co-operation in the Field of Ceramics, Building Materials and Non-metallic Minerals Based Industries in Pilsen since it has its own financial resources from the on-going project.

Conclusions and Recommendations

1. To compare the equipment of the ordered Mobile Diagnostic Unit with the standard equipment used in the Mobile Diagnostic Units of the UNIDO-Czechoslovakia Joint Programme in Pilsen.
2. To arrange training programmes of selected Egyptian experts in Energy Conservation and Management in the UNIDO-Czechoslovakia Joint Programme with a special view to the Mobile Diagnostic Unit's application.
3. To participate in the UNIDO project on "Energy Conservation in the Egyptian Glass Industry" which is being formulated by UNIDO Vienna.

V. BENTONITE DEPOSITS IN EGYPT

According to the actual knowledge, there are 4 bentonite deposits in Egypt.

A newly discovered deposit is on the Cairo-Alexandria road about 170 km from Alexandria. This deposit is estimated to have over 2 million tons of good quality bentonites. This bentonite has been tested in the UNIDO-Czechoslovakia Joint Programme in Pilsen.

In the El-Fayoum locality, there are other three deposits of bentonites:

One deposit belongs to the Missr El-Fayoum Building Materials Company. This deposit is also estimated in tens of millions of tons. This bentonite has not yet been tested abroad.

The second deposit of bentonite belongs to the governmental Company - Sinai Manganese Company. This deposit is also estimated in tens of millions of tons. It is situated about 40 km far from the high-way. Bentonite is transported by lorries to a small plant where it is ground and wind-sorted with fine particles below 200 mesh. Then it is filled from bins to paper bags. This bentonite is now being tested in the UNIDO-Czechoslovakia Joint Programme in Pilsen.

The third deposit is claimed to be the biggest of the El-Fayoum locality. It does not belong to any company and its bentonite has not yet been tested abroad.

VI. APPLICATION OF EGYPTIAN BENTONITES IN AGRICULTURE

At present, Egypt has four bentonite deposits from which two are being exploited for tests on agricultural application.

1. The first deposit is at the Fayoum Oasis about 80 km south-west from Cairo. The deposit is very large and the quality of bentonites shows the possible direct application for soil reclaiming, but necessary up-grading for other applications. The Sinai Manganese Company is the owner of the deposit. Some years ago, the Company, having the stock of more than 12 000 t of bentonite, stopped the mining since the yearly consumption of local bentonites in Egypt fluctuated around 2 000 t in spite of the fact that the high quality bentonite has been imported to Egypt in large amounts.

2. The second deposit is on the Cairo-Alexandria road, about 170 km from Alexandria, situated on both sides of the high way. This deposit shows a higher quality of bentonites and it can be industrially exploited mostly without up-grading. The estimated geological reserve amounts to about 2 million tons.

Both the deposits were visited as their bentonites had been tested by the UNIDO-Czechoslovakia Joint Programme and by the Research Institute for Ceramics, Refractories and Raw Materials, both in Pilsen.

Following the recommendations of UNIDO, UNIDO-Czechoslovakia Joint Programme and the Czechoslovak Ceramic Works, the National Research Centre in Cairo has carried an extensive work in researching the possibility of the Egyptian bentonite application in agriculture.

The results,obtained until now, can be summarized as follows:

1. Application of bentonites to citrus and orange trees

/Fayoum bentonites/

a/ By establishing a new plantage with orange and citrus trees two years ago, an area of about 10 000 sq.m was selected on which 140 trees were inserted. A half of the area was left without bentonite only with organic sorbents, the other half was provided with bentonite without organic matters. Bentonite was added in the amount of 2.5%, 5%, 7.5% and 10% (in weight) to the pure sandy soil extracted from the pits of 0.5 x 0.5 metres and 1.0 x 1.0 metres with the same depth of 0.5 metre. After two years, only trees in the soil with the amount of 7.5% and 10% of bentonite have shown fruits being the biggest and well grown from all the inserted trees independently on the size of the extracted pit as their roots have not yet reached the soil without bentonite.

b/ To test the positive influence, an experiment was conducted with the application of bentonites to trees 10 to 12 years old. The pure sandy soil was removed from the roots of the trees and replaced gradually by the blend of sandy soil and bentonite in the amount of 2.5%, 5%, 7.5% and 10%. In spite of the fact that the quantitative evaluation of this experiment has not yet been completed, the President of the Tahrir Agriculture Company as the enduser, assured the UNIDO expert of excellent results obtained in the comparison with other trees. As far as the amount of bentonite addition is concerned, the same results were achieved as in para a/. 7.5% and 10% of bentonite in the soil show the best results and the difference between these two different additions is not too big. Therefore, the Company has concluded that the addition of 7.5% of bentonite to the sandy soil is the best economic way for soil conditioning of citrus and orange plantages.

Note: The irrigation of citrus and orange trees is made as the trench irrigation. The water consumption has been estimated to be lowered by one half when bentonite was applied. As water is a limiting factor for farming in Egypt, the lowered consumption of water is to be considered as one of the most economic factors.

2. Application of bentonites to a barley field

The area of about 10 000 sq.m was selected for conducting the trials based on bentonite application to the soil of a field for barley plantation. The amount of 2.5 tons, 5 tons, 7.5 and 10 tons was added gradually to the area of 1 Feddan (= 4,200 sq.m). A high increase of the harvest was reached by the addition of 7.5 and 10 tons of bentonite per one Feddan. The economic addition was evaluated to be 7.5 tons of bentonite per one Feddan. The savings in water have shown a similar relationship as in case of citrus and orange trees. The irrigation was made in the way of trenches.

The difference between the fields with and without bentonites was very clear. While the sandy soil with bentonite addition was agglomerated, that one without bentonite showed the structure of sand. This effect has demonstrated the soil structure improvements.

3. Application of bentonites to a field with beans and grapes

a/ A bean field was supplied with bentonites in stripes in the amount of 2.5, 5, 7.5 and 10 tons per one Feddan and drip irrigation was applied. After the first harvest evaluation, the addition of 7.5 tons per one Feddan increased the harvest of beans more than twice with the lowered water consumption cut to about a half.

b/ The plantages of grapes have also appreciated the addition of bentonites, however, the quantitative evaluation is to be made in a longer run.

4. Application of bentonites for cattle feeding

The NAD Company is interested in conducting tests of additing bentonites to the food of cattle. They have their own good programme on testing possibilities. At present, the basic fodder is a granulated mixture of basic nutrients. Bentonite can gradually be added in the amounts of 2% to 5% in weight to the basic fodder as powder. Later on, it can be considered to add bentonite to the granulated fodder of cattle. Three main functions of bentonites in the fodder will be evaluated scientifically: urea release (fermentation), buffering capacity and as the binder.

Conclusions and Recommendations

1. To carry out semi-industrial tests on the complex exploitation of Egyptian bentonites, both Fayoum and Cairo-Alexandria localities.

2. To import 20 tons of proven bentonites for soil reclamation and 20 tons of bentonites for cattle feeding to make comparative tests with Egyptian bentonites.

3. The Project Proposal on the integrated bentonite exploitation in Egypt, elaborated by the UNIDO-Czechoslovakia Joint Programme and revised by the Egyptian Authorities, is being considered to be sponsored by the UNDP and UNIDO Authorities. It will enable the Egyptian Government to
   a/ exploit local bentonite deposits
   b/ apply bentonite in a wider way in the agriculture as well as in other industrial activities
   c/ enlarge farming in Egypt to other desert areas
   d/ increase the manufacture of foodstuffs in Egypt
   e/ train Egyptian experts in the application of bentonite in the agriculture and in other industrial branches.

4. To conduct extensive trials on the application of bentonites to pure sandy soils in Egypt, three different areas were selected:

   a/ The fields of the Tahrir Agriculture Company which is a direct associate of the Ministry of Agriculture.

   b/ The private land of a graduate who has got 30 acres from the Tahrir Agriculture Company he is associated with.

   c/ The land of the Agriculture High School on which all the experiments will be conducted under the High School's sponsorship also as a means of educating young generation in new technics and developments.

5. New findings made by the Egyptian Authorities in the field of application of Czechoslovak experience in bentonite application to desert areas are very interesting for many developing countries. Therefore, it is recommendable that the representatives of the National Research Centre, Cairo, participate in the World Congress on Non-metallics in Belgrade and in its follow-up in Czechoslovakia.

6. The Egyptian Authorities are interested in getting a publication on the role of bentonite in solving environmental problems as the resulting blends are very good for soil reclamation. The UNIDO-Czechoslovakia Joint Programme in Pilsen will incorporate this request into its work programme for 1985-86.

VII. EL-NASSR GLASS AND CRYSTAL COMPANY, MOSTOROD

El-Nassr Glass and Crystal Company is the biggest Egyptian manufacturer of glass producing annually 120,000 tons of different glass assortment and this Company was selected for the Energy Conservation Project elaborated as the UNDP and UNIDO project for the revolving fund.

The Company is composed of two big glass combined plants. One of them is situated in Mostorod, the other in Shobra.

The Shobra plant is the older one and it was established in 1932 and expanded afterwards. At present, this plant produces table ware, hand made and pressed, ornamental glass and sheet glass produced in five Fourcault machines.

The Mostorod plant was put into operation in 1968 with the projected capacity of 25,000 tons of hollow ware per year. At present, this plant produces over 42,000 tons of bottles and medicine glasses and 400 million ampullas per year. The weight of hollow ware produced fluctuates between 100gr up to 700 gr. 50% of it is produced as white ware with print, 50% as amber.

The Egyptian glass market has not been saturated and, therefore, the Company considers the expansion of the Mostorod plant by 40,000 tons of bottles, 100,000 tons of float glass and 400 million ampullas.

The Company has established the Plant Energy Management Committee which is dealing with energy savings problems in each factory. However, the Company will appreciate to be advised by UNIDO experts on precise evaluation of the energy consumption of each heat aggregate, on energy management survey, identification of energy conservation opportunities, on their analyses, evaluation and recommendations.

At present, the Mostorod plant buys raw glass sands from the locality MAADI. Sands are washed, screened and dried in a rotary drier outside the main manufacturing hall. The Company is also interested in more sophisticated up-grading methods in order to improve the quality of siliceous sands for white and semi-crystal glass.

The melting process of hollow ware, as being the biggest energy consumer, is realized in three basic manufacturing lines, started with the batch transport into the kilns, melting of the batch, shaping in automated machines and annealing. The white glass is then transferred for print and annealing furnaces. The packing of glass is made in a mechanical way only.

The three melting tanks differ very much. Melting tank I is after reconstruction, its fuel consumption is automatically regulated and controlled. It produces 15,000 tons of glass per year with the consumption of about 170 kgs of heavy fuel per one ton of glass.

Melting tank II shows lots of defects. It works without any regenerator and with the lack of draught. The kiln pushes the smoked gases from all its openings. It is operated with the limit output due to its defects. Its standard production is 25,000 tons per year with the heavy oil consumption about 350 kgs per one ton of glass.

Melting tank III is provided with two site regenerators which are out of the operation as their walls bend. The regenerators need to be reconstructed.

The annealing cooling furnaces are heated partly by electricity, partly by light fuel. The annealing kilns for firing the screen print are electrically heated.

No waste heat utilization is applied in the plant.

Refractories for kiln lining are imported as well as all insulating materials. The quality of imported goods is preferred.

The manufacture of ampullas is realized from imported glass tubes as the original project on the manufacture of own glass tubes was not completed years ago. There are two sections of this manufacture in the plant. The older one is equipped with shaping machines with the output of 1,500 ampullas per hour. The newer section shows more modern machines and produces, with the same energy consumption, 3,000 ampullas per hour. Therefore, the Company intends to modernize the older section by introducing a machine with the output of 6,000 ampullas per hour and thus to save 75% of the energy consumed presently in this section.

The plant is using butane gas and produces its own oxygen.

Findings and Recommendations

1. The El-Nassr Glass and Crystal Company is a suitable company for the execution of the UNDP and UNIDO project proposal on energy conservation.

2. The senior management of the Company is deeply interested in the co-operation with UNIDO experts in the field of energy conservation as well as with experts from the El-Tebbin Institute.

3. The Company is aware of different energy savings possibilities as having own Energy Management Committee and it hopes that, in co-operation with UNIDO experts, the expected results will be achieved.

4. The main steps in energy management in the glass manufacture were negotiated with the senior management of the Company. The Company's attention was also drawn to the following facts.

a/ No waste heat utilization has been established yet.

b/ Detailed temperature, draught and air measurements are necessary to be conducted especially in melting tanks II and III.

c/ Utilization of the preheated air in the glass melting tanks and in the annealing furnaces.

d/ The specific heat consumption depends on the output. It sinks with the efficient output and it grows when the output is not regular.

e/ The energy consumption also depends on different technological factors, such as the composition of glass batch, content of cullet, preheating, proper operation of regenerator and a lot of other factors which offer possibilities of energy conservation.

f/ The Company is ready to answer any Questionnaire which will be elaborated by the Contracting Company and UNIDO as an advance source of information for UNIDO experts.

VIII. THE BRICK INDUSTRY OF EGYPT

The Egyptian red brick industry is composed of two main sectors:

10 modern large capacity plants constructed in the desert and exploiting local desert raw materials, such as clays, bentonites, sands and silts. They are partly private, partly public companies.

Dozens of small plants of "artisan" type distributed close to the river Nile spoiling the fertile soil and using the Nile mud as the raw materials for brick making. All these small plants will be removed and demolished by a law after June 1985.

The modern large capacity plants, producing mostly hollow and perforated bricks, are lacking know-how on the exploitation of locally available raw materials. One of them was visited in the El-Fayoum locality, namely Missr El-Fayoum Building Materials Company which is a private enterprise.

The factory produces hollow blocks in the amount of 16,500,000 pieces per year equivalent to about 60 millions of brick units. The technology is established on the utilization of bentonites, extracted in the Company's own mine, and siliceous desert sands in the ratio 65% : 35% respectively. The produced bricks have a nice outlook, however, their mechanical properties are low, their water absorption is high and the abrasion of mechanical parts of the manufacturing equipment is too high. Therefore, the Company intends to dicrease or to eliminate the exploitation of desert sands and to replace them with silts in the ratio 50% of bentonite and 50% of silts. The content of silt in the batch can even be increased.

The manufacturing line is composed separately for plastic and non-plastic raw materials of a disintegrator and a mill.

The batch is then mixed in a double shaft mixer and afterwards it comes to an automated vacuum extruder. The blocks are cut, transferred automatically to trasport cars of Keller type and place into 14 high drying chambers, regulated in twins. The drying is preprogrammed and it is started at the temperature of 40°C. The regulated drying enables the producer to make green blocks from bentonites without hair cracks.

The products are fired in a tunnel kiln equipped with top pulsing burners. 60 kgs of heavy oil (preheated during the winter time) are consumed to produce 1 ton of bricks. The firing temperature amounts to 850°C.

Findings and Recommendations

1. The visited plant Missr El-Fayoum Building Materials Company is a well established and managed plant. The plant laboratory conducts daily tests on the entering raw materials, semi-products and fired bricks. It also makes the necessary research under limited possibilities.

2. The bentonite deposit is about 3 km far from the factory and geological research shows reserves in tens of millions of tons. The bentonite is uniform, the deposit has a very low overburden. The extraction of bentonite is made by a caterpillar loader by scratching the wall from down up in a very efficient way.

3. The Company is, however, lacking more experience in developing the batch composition in the relationship to the drying and firing conditions and to the properties of finished products.

4. In order to promote the development of the brick manufacture, which is the traditional Egyptian building material production, UNDP Cairo will require a 3-week UNIDO high level mission to visit all 10 big and modern enterprises, to advise them on the spot, if necessary, to take samples for testing and to realize training in order to develop these factories in order to make them ready for the supply of different types of bricks when the small producers have been closed.

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION

DRAFT PROJECT PROPOSAL

PART A - BASIC DATA

Country:	Egypt
Project Number:	
Project Title:	Integrated Utilization of Bentonite in Egypt
Scheduled Start:	After the approval
Scheduled Completion:	36 months after start
Origin and Data of Official Request:	
Government Counterpart Agency:	Central Metallurgical Research and Development Institute
UNIDO Contribution:	US $ 250,000
Government Contribution:	in kind
Currency Required:	Convertible: US $ 250,000
	Other :
UNIDO Substantive Backstopping Section:	Chemical Industries Branch, DIO
Programme Component Code:	

PART B - NARRATIVE

1. OBJECTIVES

a/ Development Objective

- To increase the cultivated area in Egypt by reclaming the sandy soil using bentonite.
- To raise agricultural production through more effective utilization of fertilizer using bentonite as a carrier.
- To increase dairy and poultry production in Egypt through utilization of bentonite in animal feeding.
- To introduce bentonite industry in Egypt providing materials suitable as bleaching earth for edible and mineral oils, binders for foundry sand and drilling mud for oil wells and civil engineering.

b/ Immediate Objective

- To exploit local deposits of bentonite.
- To reduce hard currency paid for importing bentonite.
- To introduce efficient methods of soil reclamation using local bentonite.
- To experiment technology of bentonite preparation for animal feeding.
- To introduce proper technologies for bentonite treatment (up-grading and activation) for industrial applications.
- To carry out a feasibility study on bentonite application in different fields.
- To carry out comparative tests with imported bentonites and perlites.

2. SPECIAL CONSIDERATIONS

The project has clear relevance to the global food problem especially in Egypt, Arab World and African countries still importing a great part of their food requirements. Any successful achievement in desert soil reclamation and increasing food production will be of interest to other countries with similar soil and climate conditions. The establishment of a consulting centre for other African countries within the African Industrial Development Decade (AIDD) for integrated utilization of bentonite in agriculture and industry is of great interest.

3. BACKGROUND AND JUSTIFICATION

Bentonites are characterized by various physical properties which suit numerous agricultural and industrial applications. As a soil conditioner, it functions in two ways. It reduces the wash-out of fertilizers, enhances the water retention and rehabilitates the soil. Based on its high ion exchange capacity, it provides plants with retained nutrients. The yield could be increased by 10 - 40% depending on the kind of plant, humus content, acidic power and grain size of the soil and climatic conditions when bentonite is applied.

Bentonite is used as additive to fodders in animal husbandry; more specifically, it affects amonia release in the rumen of animals fed poor quality roughage and non-protein nitrogen (NPN). It helps in producing protected proteins for ruminants. It is used also as a carrying material for micronutrients in animal feed industry.

For industrial applications, bentonite is used mainly as a drilling mud for oil and water wells as well as civil engineering works, as a binder for moulding sands in foundry and as bleaching earth in decolourization of vegetable and mineral oils. It is the variable properties of bentonite slurries, e.g. high viscosity, high swelling capacity, high plasticity, high surface area and high cation exchange capacity which determines its proper application. Acid treatment of bentonite increases its surface area and the bleaching ability is markedly improved. Alkali treatment of bentonite improves its viscosity and low filterability favouring its application as drilling muds and binder for foundry sands.

Through intensive research and development programmes, huge reserves of different grades of bentonite have been recently discovered in Egypt. The preliminary studies in the field of sandy soil reclamation revealed that raw bentonite could be used satisfactorily, but for industrial applications, the crude ore requires different processing techniques to satisfy each particular industrial application.

The Central Metallurgical Research and Development Institute (CMRDI), Cairo, Egypt, was a pioneer in exploring a programme for improving the local bentonite quality. This programme was initiated through UNIDO with the Czechoslovak expert participation. Based on the experience gained and the existing co-operation between CMRDI and the Egyptian industries, creation of bentonite industry in Egypt was claimed as vital.

For this purpose, the mission of five Egyptian experts was organized under UNIDO project US/EGY/82/233 who visited the UNIDO-Czechoslovakia Joint Programme for International Co-operation. Having got acquainted with the broad Czechoslovak practical and

theoretical experience as well as developed bentonite industry, the mission concluded that the wide UNIDO assistance provided by the UNIDO-Czechoslovakia Joint Programme would yield very promising results. Especially training of Egyptian technical staff, co-operation between the relevant Egyptian authorities and UNIDO and providing the necessary technical assistance both logistic and expert to the existing pilot plant unit was of concern.

4. PROJECT OUTPUTS

a/ Training of Egyptian staff on the application of bentonite for soil reclamation, animal feeding as well as acid and alkali activation of bentonite.

b/ Report on the results of field testing of bentonite application summarizing methods of bentonite application to desert soils and different types of plants.

c/ Report on the results of application of bentonite for increasing dairy and poultry production.

d/ Technological report on the proper technology of improving bentonite quality through acid and alkali activation techniques.

e/ Pre-feasibility study on the integrated utilization of bentonite.

f/ Project Proposal of UNIDO assistance in the overall build-up of Egyptian bentonite industry and bentonite application to Egypt's economy and final feasibility study elaboration.

g/ Technological instructions based on the technological verification tests and trials and concerned with different bentonite uses and processing techniques and application in agriculture, animal feeding and particular industries.

5. PROJECT ACTIVITIES

5.1. In Agriculture

a/ Green house experiments to study the interaction between added bentonite and the fertilizer programme under field crops and vegetable crops.

b/ Field experiments based on 500 feddans (pure sandy soils) under different methods of irrigation (flood, drip, sprinkels, subground).

c/ Training of two Egyptian experts abroad in the soil reclamation by bentonite who will be responsible for supervising the field trails - 2 man-months.

5.2. In Animal Feeding

a/ Improving the nutritive value of roughage materials using non-protein nitrogen and measuring feed intake and animal performance then finding the proper application of bentonite to improve the utilization of NPN.

b/ Development of the proper methods for using bentonite in protecting proteins using pilot scale.

c/ Manufacturing of animal feed supplements containing molasses, trace elements and vitamines necessary for better performance of ruminants fed on roughages.

d/ Training of two Egyptian experts abroad in the technology of bentonite preparation for animal feeding as well as increasing dairy and poultry production through using bentonite - 2 man-months.

5.3. In Industry

a/ Pilot plant processing of bentonite by acid and alkali activation techniques.

b/ Testing of the activated bentonite for bleaching of edible and mineral oils, as binder for foundry sand, as drilling mud for oil and water wells as well as civil engineering works.

c/ Training of two Egyptian experts abroad on the technology of acid and alkali activation - 4 man-months.

5.4. General

a/ Preparatory mission to collect all the necessary data and information about bentonite and negotiate with the counterparts the necessary training and elaborate detailed working plans (agriculturist, animal feeding expert, technologists for acid and alkali activation - for 4 weeks, total 4 man-weeks).

b/ Elaboration of pre-feasibility study on bentonite application in agriculture, animal feeding and industry.

c/ Elaboration of an integrated project on the build-up of bentonite industry in Egypt.

d/ Elaboration of feasibility study on the proper processing technology of bentonite.

6. PROJECT INPUTS

a/ Government Inputs

- National team leader — 36 m/m
- 3 group leaders for agriculture, animal feeding and industrial applications — 108 m/m
- Assisting staff for performing the pilot and field tests — 324 m/m
- Bentonite for all pilot and field tests
- Laboratory, secretarial and others assistance to the international experts
- Local transport and internal travel of experts and national team within the country
- Access to available information and data

b/ UNIDO Inputs

	duration	US $
- International experts		
agriculture	1 m/m	7 650
animal feeding	1 m/m	7 650
acid activation	1 m/m	7 650
alkali activation	1 m/m	7 650
economist	2 m/m	15 300
Subtotal	6 m/m	45 900
- Expert travels		4 000
- Other costs - UNIDO staff mission cost for final tripartite negotiation		10 000
- Training Egyptian specialists		
4 general directors	1 m/m	8 000
agriculture	2 m/m	7 400
animal feeding	2 m/m	7 400
acid activation	2 m/m	7 400
alkali activation	2 m/m	7 400
Subtotal	9 m/m	37 600

- participation in International Conferences	3 m/m	25 000
- Egyptian specialists travels		5 200
- Team leaders missions	2 m/m	15 300
- Technological verification tests abroad		10 000
- Completion of pilot equipment (computer, kneader, mills, filter)		76 150
- Project materials and supplies, including subcontractors for erection of pilot plant, bentonite and perlite		42 000
- Contingency 5%		1 250
Project Total		275.000

Note: 20 tons of bentonite for soil reclamation
10 tons of bentonite for animal feeding
10 tons of bentonite for drilling, foundries
1 ton of acid activated bentonite
10 cu.m. of agroperlite

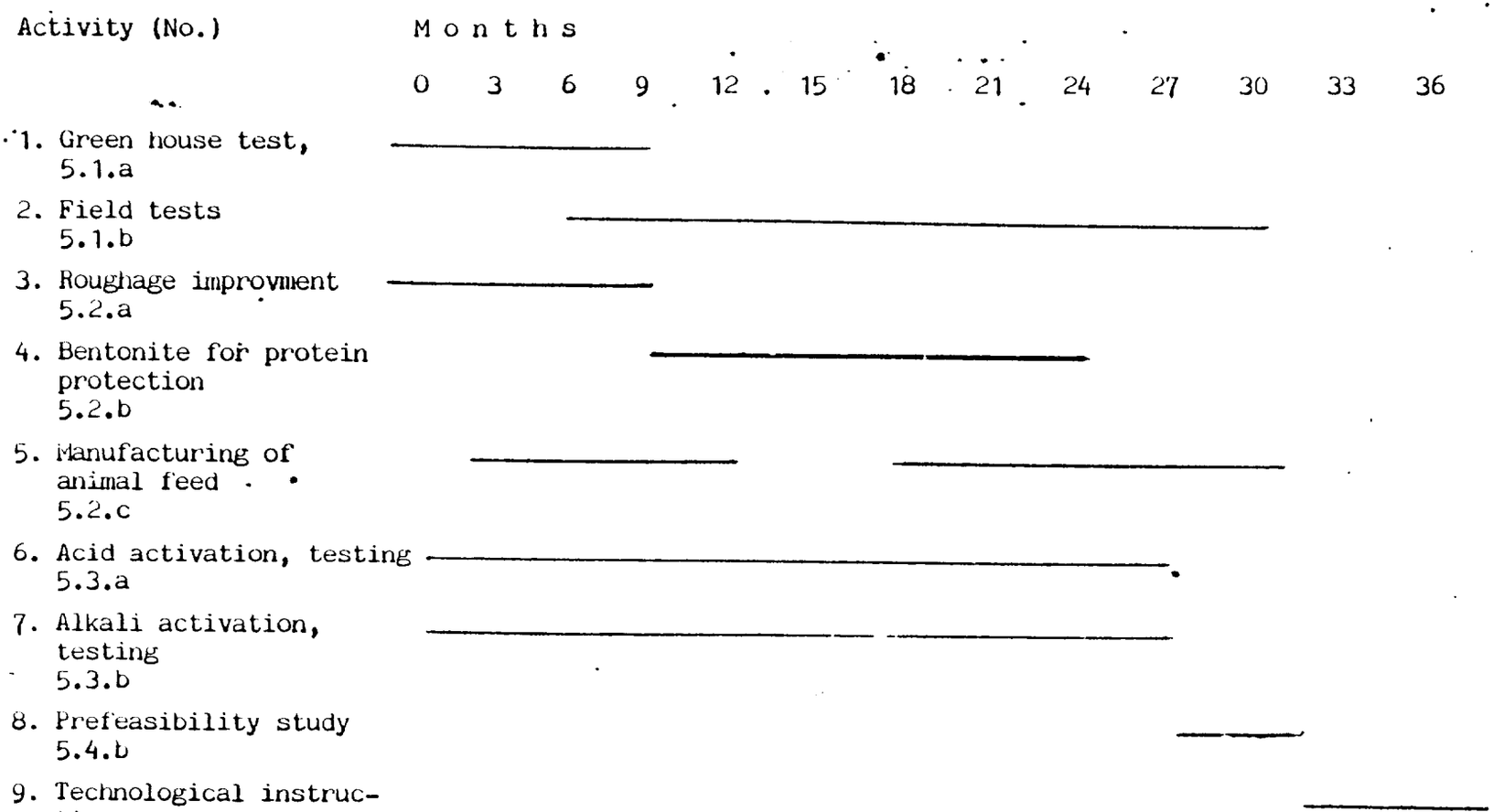
7. EVALUATION PLANS

The project will be subject to evaluation following established UNIDO practice.

8. FUTURE UNIDO ASSISTANCE

If the government so wishes, UNIDO could be called upon to assist in the integrated project build-up of the Egyptian bentonite industry and in the future agricultural and animal feeding applications.

BAR CHART


Activity (No.)
Months
0 3 6 9 12 15 18 21 24 27 30 33 36
1. Green house test, 5.1.a
2. Field tests 5.1.b
3. Roughage improvment 5.2.a
4. Bentonite for protein protection 5.2.b
5. Manufacturing of animal feed 5.2.c
6. Acid activation, testing 5.3.a
7. Alkali activation, testing 5.3.b
8. Prefeasibility study 5.4.b
9. Technological instructions 5.4.c,d

MAIN EGYPTIAN TEAM

1. *Prof. Dr. Ahmed Adel Abdul Azim*
   Director CMRDI*
   Principal Investigator

2. *Dr. Adel Kamal Ismail*
   Head of Division, CMRDI*
   Co-principal Investigator, Industrial Applications

3. *Prof. Dr. Ahmed Fouad El-Sherif*
   Head of Laboratory, Soil and Water Use Lab., NRC**
   Co-principal Investigator, Agricultural and Animal Feeding Applications

4. *Prof. Dr. Hatem Mohamed Ali*
   Head of Laboratory, Animal and Poultry Nutrition, NRC**
   Animal Feeding Group Leader

5. *Dr. Nabil Sobby Felix*
   Deputy Head of Laboratory, Foundry, CMRDI*
   Bentonite Testing Group Leader

* *Central Metallurgical Research and Development Institute*

** *National Research Centre*

PROJECT CONCEPT

Revised version

Energy Conservation in the Egyptian Glass Industry

Objectives

To reduce the consumption of fuel oil per unit of finished product;
To indicate the scope for further improvement in the energy management of the industry;
To train national staff in modern principles of energy audits and energy management to motivate them to apply these principles in practice.

Scope

In the first instance, the assistance will be limited to one factory or, maybe, only one furnace. Following the successful completion of this pilot exercise which roughly will follow the plan of activities outlined below, the project will be extended to other furnaces or factories with the aim of, eventually, improving the energy management of all heat consuming units in the industry.

In due course the same (or a similar) concept may be applied to other industrial sectors such as iron and steel, cement and ceramics.

Background Information

The National Glass Company of Egypt operates several individual factories many of which are applying more or less outdated technologies especially in the field of melting and annealing. A consumption of over 8,000 kcal/kg of glass or 4 - 6 times the consumption in optimally functioning glass furnaces elsewhere is not exceptional in the company indicating an important potential for energy savings.

In Egypt, energy-related questions are dealt with at the El Tebbin Institute which belongs under the Ministry of Industry. Energy conservation is a matter of top priority especially since oil not utilized by domestic consumers, who buy it at a price of only E£ 20/ton, could be exported at world market price equivalent

to E£ 120/ton.

The present project will introduce a mechanism for reducing the energy consumption in the glass industry and demonstrate the benefit of this methodology to the industry concerned. The work will be financed initially by a revolving fund, established by UNIDO for this purpose. Upon successful completion of its work UNIDO will be reimbursed by the national authorities in accordance with an agreement between the two parties concluded at the beginning of the co-operation. The replenished revolving fund will allow a repetition of the work in another factory.

El-Nassr Glass and Crystal Company in Mostorod was selected for the energy conservation project. The Company is composed of two big glass combined plants one of which is situated in Mostorod, the other in Shobra. The Mostorod plant started its operation in 1968 with the projected capacity 25,000 tons of hollow ware per year. At present, this plant produces yearly over 42,000 tons of bottles and medicine glasses and 400 millions of ampullas. The weight of hollow ware fluctuates between 100 gr and 700 gr. 50% are produced as white ware with screen print, 50% as amber. The Company considers to expand its capacity in the manufacture of bottles, float glass and ampullas.

The Company established the Plant Energy Management Committee which is dealing with energy savings problems in each factory.

The hollow ware produced in the Mostorod glass plant is manufactured in three independent lines. Three melting tanks are completely different in outputs and energy consumptions. Melting tank I attained the annual capacity of 15,000 tons with the heavy fuel consumption of 170 kgs per one ton of glass, melting tank II then 25,00 tons with the fuel consumption of 350 kgs per one ton of glass and melting tank II 25,000 tons and the heavy fuel consumption per one ton of glass 250 kgs.

No waste heat is exploited in the plant.

Activities

Phase I

A team of three consultants,a glass technologist and 2 specialists in energy management (one month-mission) and an industrial economist (one-week mission) will visit the selected glass factory in order to

a/ make an Energy Management Survey and identify energy conservation possibilities in close co-operation with the Company;

b/ carry out an energy audit of the glass furnaces and annealing lehrs and collect full information on the construction and operation of these energy consuming units; and

c/ collect other relevant data on the production technology used including raw material batch composition, product design, production planning and management, etc.

d/ present a report on the "base-line" situation of the plant in terms of energy consumption and management; and

e/ formulate a set of recommendations aiming at the reduction of energy consumption per unit of finished product including quantitative estimates of the savings which might be achieved related to the proposed improvements in technology and management deviding them into

1. immediate - to be realized through counterparts
2. intermediate
3. prospective;

f/ advise the factory staff and the El-Tebbin Institute on the immediate executions of those recommendations for energy conservation, requiring no further preparation;

g/ define necessary inputs from UNIDO as well as from the Company and El-Tebbin Institute for carrying out the recommendations;

h/ after consulting the UNIDO staff member, advise the Project Management Committee on the establishment of a formal contract between the parties involved regarding the execution of the work as well as the provisions for repayment to the Revolving Fund.

i/ The international team will also draw up the Terms of Reference for the operational phase of the project with full description of responsibilities of various parties concerned.

Phase II

During the period - the duration depending on the importance of the changes and improvements suggested - the recommendations of the consultant team will be implemented with the assistance of a full-time glass technologist supported,as required, by short-term specialized technicians. Apart from changes in technologies, operational procedures, control procedures, etc., the activities will also include introduction of new equipment (especially control equipment) and repair and/or reconstruction of the furnaces and lehrs.

All work will be carried out with full involvement of the factory's own technical staff and El-Tebbin Institute that thus will share the sence of responsibility and eventual achievement and will receive an on-the-job training of great importance for the future successful operation of the plant. Before the Contractor leaves, he will carry out a report on energy situation and recommendations for further actions.

Phase III

The project will be concluded by a second energy audit which will provide information on the final energy balance achieved (a feedback of considerable importance for the enhanced effectiveness of similar future exercises) and, specifically, document the exact energy consumption figures resulting from the changes introduced.

The quantitative energy saving achieved will be a determining factor for the reimbursement to the Revolving Fund for the work performed, reimbursement financed from the Company's savings in operating costs.

In co-operation with the Company and El-Tebbin Institute a report will be produced evaluating energy savings and technology improvements. Under the presence of the UNIDO staff member to negotiate the conclusions with the Project Management Committee.

Inputs

a/ Government Contribution

- Counterpart staff to work together with the international consultant;
- Logistic support (transport, secretariat, etc.), required for the smooth execution of the work;
- Free availability of all pertinent information including past production records;
- Technicians and labour to carry out work at the plant level.
- All locally available necessary equipment, materials and services for energy savings.

b/ UNDP Contribution

Subcontract Phase I	US $	35 000
Subcontract Phase II	US $	60 000
2 Staff Missions	US $	6 000
Provision for independent supervision of Phase I and..... Phase III - Energy Auditing	US $	10 000
Training - 3 man/months	US $	15 000
Equipment needed	US $	150 000
Miscellaneous	US $	4 000
Other consultants - 3 man/months ...	US $	20 000
T o t a l	US $	300 000