77. PROFILE ON PLASTER OF PARIS

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I. SUMMARY

This profile envisages the establishment of a plant for the production of 300 tonnes of plaster of Paris per annum.

The present demand for the proposed product is estimated at 60 tonnes and it is projected to reach at 408 tonnes by the year 2019.

The plant will create employment opportunities for 13 persons.

The total investment requirement is estimated at Birr 1.37 million, out of which Birr 350,000 is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 14% and a net present value (NPV) of Birr 271,550, discounted at 10.5%.

II. PRODUCT DESCRIPTION AND APPLICATION

Chemically, Plaster of Paris is calcium Sulphate having molecular formula $CaSo_4½H_2O$. It is a white hygroscopic powder very slightly soluble in water particularly at high temperature. It is widely used in the manufacture of models in pottery industry, for making ornamental castings, plaster boards and chalk crayons, etc. Other uses of this cheap commodity are for building decoration as wall plaster and floor cement and dentist plaster. It is also used as orthopedic plaster in surgery for setting of broken bones, etc.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

The bulk of demand for Plaster of Paris is met through local production though some amount is also imported for medical and decorative use. The Education Materials Production and Distribution Agency and a few private firms are the domestic suppliers.

The import data of Plaster of Paris during ten years period (1993-2002) is shown in Table 3.1

Table 3.1
IMPORTS OF PLASTER OF PARIS (1993-2002)

Year	Quantity Imported (Tonnes)
1993	12.4
1994	0.97
1995	434
1996	110.6
1997	60.7
1998	17.2
1999	0.2
2000	88.4
2001	39.74
2002	34.6

Source: *Excise and Tax Authority, External Trade Statistics, Annual Issues.*

A glance at the above table easily shows that import of Plaster of Paris is not characterized by a growth trend. The average import of the last three years was about 54 tonnes.

A large part of domestic demand for Plaster of Paris is derived from its use for prime coating of new buildings and /or filling pores and cracks. Since transporting and selling Plaster of Paris over a long distance is not a profitable operation, the relevant market is the local or regional market. Data and information on the amount of public and private sector building construction activity is, thus, critical to determine the present effective demand as well as project future demand.

According to the Three Year Development Plan of Benishagul-Gumuz region, 10 health posts, 6 health centers, 2 hospitals, 33 primary village schools(PVS), 15 complete primary schools (CPS) and 4 secondary schools are envisaged to be built in different woredas during the planned period. Apart from these public investments, as a consequence of increased economic activity in the region, the private sector is also bound to invest in the construction of low rising (upto ground plus two) commercial offices and residential buildings.

Table 3.2 details out the anticipated realization of the foregoing building construction activities over a three years period.

Table 3.2

PROJECTED IMPLEMENTATION OF CONSTRUCTION PROJECTS

Sr. No.	Item	YEAR			Total
		2005	2006	2007	
1	Health post	2	3	5	10
2	Health center	1	2	3	6
3	Hospital	1	1	-	2
4	Primary village	8	10	15	33
5	Complete primary school (CPS)	4	5	6	15
6	Secondary school	1	1	2	4
7	Residential house (G+0)	70	0	100	250
8	Commercial & office building G+0 G+1 G+2	 30 1 -	 35 3 1	 40 5 2	 105 9 3

In order to establish the wall area of various types of buildings, the Education and Health Sub-sector Handbooks of ESRDF were referred. For commercial and residential buildings a sample of bill of quantity of various buildings was assessed to establish the average wall area. It is also known that for one meter square area of wall, 7 kg of Plaster of Paris is required for prime coating.

The Plaster of Paris requirement calculated by type of building on the basis of the above is provided in Table 3.3.

Table 3.3

PLASTER OF PARIS REQUIREMENT IN BENISANGUL-GUMUZ

Sr. No.	Type of Building	Wall Area (m^2)	Forecasted Number of Buildings			Forecasted Plaster of Paris Requirement (Tonnes)		
			2005	2006	2007	2005	2006	2007
1.	Health post	157.4	2	3	5	0.53	0.80	1.34
2	Health center	1143.8	1	2	3	1.94	3.88	5.82
3.	Hospital	2300	1	1	-	3.91	3.91	-
4.	Primary village school (pvs)	398	8	10	15	5.41	6.77	10.15
5.	Complete primary school	783	4	5	6	5.32	6.65	7.98
6.	Secondary school	1570	1	1	2	2.67	2.67	5.34
7.	Residential house	230	70	80	100	2.73	3.13	3.1
8	Commercial & Office buildings							
	a) G+0	800	30	35	40	4.08	4.76	5.44
	b) G+1	1600	1	3	5	2.72	8.16	13.6
	c) G+2	2400	-	1	2	-	4.08	8.16
	Total					**29.31**	**44.81**	**61.74**

As shown in Table 3.3, the total demand estimated for the year 2005, without considering wastage, is about 29 tonnes of Plaster of Paris. When allowance is made for 5% wastage, the estimate comes to about 30 tonnes. In addition, the same amount of Plaster of Paris is expected to be sold to neighbouring towns of other region. Hence, the total present demand for the project to be established in BGRS for the year 2005 is estimated at 60 tonnes.

2. Projected Demand

The demand for Plaster Paris in BGRS in the next three years is forecasted on the basis of projected implementation of buildings construction projects as depicted in Table 3.1 (with 5% adjustment for waste). Moreover, the same amount is assumed to be demanded in neighbouring towns of other region. For the part of the forecasted period extending beyond the coming three years, an annual average growth rate of 10% is used to execute demand projection. The base for the assumption is that as observed in many countries, both developed and underdeveloped, the rate of growth of the construction sector had been consistently higher than that of the economy as a whole. Since the Ethiopian economy has been growing at an average rate of 7% in the recent past a 10% growth rate in the construction sector is not an unlikely scenario in the future. Hence taking the estimated demand for year 2005 as a base, the project demand for plaster of Paris is given in Table 3.4

Table 3.4

PROJECTED DEMAND FOR PLASTER OF PARIS

Year	Projected demand
2005	60
2006	94
2007	130
2008	143
2009	157
2010	173
2011	190
2012	209
2013	230
2014	253
2015	279
2016	307
2017	337
2018	371
2019	408

2. Pricing and Distribution

The current price of gypsum produced by Educational Materials Production and Distribution Enterprise is Birr 140 per quintal and could be used as a base for financial analysis of the project.

The product can find its market outlet through the existing building materials distribution enterprises.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

Considering the market study and minimum economic scale, the plant is proposed to have a theoretical production capacity of 300 tonnes of Plaster of Paris per annum assuming 300 working days a year.

2. Production Programme

The plant is assumed to start production at 60% of the full capacity due to the problem of market penetration with a 10% capacity build-up until it reaches 100% in the fifth year and thenafter.

IV. RAW MATERIALS AND INPUTS

A. RAW MATERIALS

The raw material required for the manufacture of Plaster of Paris is the dehydrated gypsum rock ($CaSo_4. 2H_2O$) which is available in the region. The plant will have its own gypsum quarry. It also needs water-proof bag for packing the product in 10kg, 20 kg and 50kg. The annual demand of raw materials and their costs is depicted in Table 4.1.

Table 4.1

ANNUAL RAW MATERIAL REQUIREMENT AND COST AT FULL PLANT CAPACITY

Sr. No.	Description	Consumption	Cost (000 Birr)
1	Royalty (3% of sales)	336 tonnes	12.6
2	Packing material	12,000 pcs	36.0
	Grand Total		**48.6**

B. UTILITIES

Electricity, fuel oil and water are the basic utilities required by the plant. Annual requirements of utilities at full capacity operation of the plant and their costs are depicted in Table 4.2.

Table 4.2

ANNUAL UTILITIES REQUIREMENT AND ESTIMATED COSTS

Sr. No.	Description	Consumption	Total Cost (Birr)
1	Electric power	40,000 kWh	18,960
2	Fuel	12,500 lt	28,750
3	Water	1000 m^3	1,500
	Grand Total		**49,210**

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

The process of manufacture consists the following operations.

1. Quarrying of gypsum
2. Grinding of gypsum
3. Heating in the iron retort
4. Grinding and packing

Gypsum or calcium sulphate dehydrate is quarried from the quarry and than it is first ground to powder in a ball mill or roller mill. It is, then, charged into vertical retort. As soon as the powder gypsum strikes the hot bottom, dehydration begins. The mass is, then, heated to 120 to 130^{o}C and the heating is continued. Agitator is used in the retort to facilitate the mixing of non-hydrated gypsum with the Plaster of Paris. Temperature rises rapidly and when the temperature reaches 160^{o}C, the charge is thrown out. The product obtained is calcined gypsum or Plaster of Paris. It is cooled and stored. It is again ground in the same ball mill and then screened in a 200 mesh size screen. It is packed in 10 kg, 20 kg and 50 kg water proof bags in order to avoid contact with moisture.

2. Source of Technology

The equipment for the manufacture of Plaster of Paris can be obtained from Denmark, India, Turkey, China or Italy. Contact can be made with the following suppliers.

i) HAJUNG
Korea heavy industries
Fax. 0551-278-551
httpll: www.hanjung. co.kr

ii) DATE MYUNG ENG Co. LTD
Add: 13783, chong way. Desy
Shishung.shi, kyonggi
Tel. 0345 - 498-2670

iii) Wonji a heavy Industries Co. LTD
Add. 89-13,Kway-and dong suyong.gu, pusan
Tel. 051-759 - 5090
Fax. 051 - 759 -5092
httpll: www Wonjinhi. com.

B. ENGINEERING

1. Machinery And Equipment

The list of machinery and equipment required by the project is shown in Table 5.1. The cost of machinery and equipment is estimated to be Birr 350,000 of which Birr 275,000 is required in foreign currency.

Table 5.1
LIST OF MACHINERY AND EQUIPMENT REQUIRED

Sr. No.	Descriptions	Qty.
1	Quarry equipment	set
2	Mining equipment	set
3	Disintegrator	1
4	Calcinations kettle	1
5	Pulverizer with air classification	1
6	Miscellaneous equipment like iron trays, thermocouple, weiging scale and testing equipment etc.	ls

2. Land, Building and Civil Works

The total area of land required by the project is estimated to be 2000 m^2, out of which 250 m^2 will be built-up area. The cost of land lease at a rate of Birr 1 per m^2 and for 70 years of land holding is estimated to be Birr 140,000. The processing building will be constructed with hollow block walls, and concrete floor covered with egga sheet roof. Construction cost, at a rate of Birr 800 per m^2, is estimated to be Birr 200,000. The total cost of land, building and civil works, assuming that the total land lease cost will be paid in advance is estimated to be Birr 340,000.

3. Proposed location

Gypsum and Plaster of Paris are bulky and low cost. Therefore, the plant should be located near the raw material source. Accordingly, Metekel zone is proposed as the most appropriate location.

VI. MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

The total manpower requirement of the plant is 13 persons. Details of manpower and estimated annual labour cost is indicated in Table 6.1.

Table 6.1

MANPOWER REQUIREMENT AND ESTIMATED LABOUR COST (BIRR)

Sr. No.	Description	Req. No.	Salary	
			Monthly	Annual
1	Manager	1	1500	18,000
2	Supervisor	1	900	10,800
3	Secretary	1	750	9,000
4	Operator / technicians	3	600	21,600
5	Accountant	1	900	10,800
6	Guard	3	250	9,000
7	Store keeper	1	400	4,800
8	Driver	2	300	7,200
	Sub-total	**13**		**90,200**
	Employee's benefit (20%)			18,040
	Grand total	**13**		**108,240**

B. TRAINING REQUIREMENT

The technology of production of Plaster of Paris is so simple that the production supervisor and operators will be trained on-site for one week by the equipment supplier expert during erection and commissioning. The cost of training is estimated to be Birr 10,000.

VII. FINANCIAL ANALYSIS

The financial analysis of Plaster of Paris project is based on the data provided in the previous chatpers and the following assumptions:-

Construction period	2 years
Source of finance	30% equity
	70% loan
Tax holidays	3 years
Bank interest	10.5%
Discounted cash flow	10.5%
region	
Repair and maintenance	3 % of Plant machinery and equipment
Accounts receivable	30 days
Raw material (local)	60 days
Work in progress	3 days
Finished products	30 days
Cash at hand	5 days
Accounts payable	30 days

A. TOTAL INITIAL INVESTMENT COST

The total initial investment cost of the project including working capital is estimated at Birr 1.37 million. Details are indicated in Table 7.1.

Table 7.1

INITIAL INVESTMENT COST ('000 BIRR)

Sr. No.	Cost Items	Total
1	Land	140.00
2	Building and Civil Work	200.00
3	Plant Machinery and Equipment	350.00
4	Office Furniture and Equipment	75.00
5	Vehicle	250.00
6	Pre-production Expenditure*	328.32
	Total Investment Cost	**1,343.32**
7	Working Capital	26.51
	Grand Total	**1,369.83**

* *Pre-production expenditure include interest during construction (Birr 178,320), training (Birr 10,000) and cost of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

B. PRODUCTION COST

The annual production cost at full operation capacity of the plant is estimated at Birr 419,480 (see Table 7.2). The material and utility cost accounts for 23 per cent while repair and maintenance take 1.17 per cent of the production cost.

Table 7.2
ANNUAL PRODUCTION COST
('000 BIRR)

Items	Year			
	3	**4**	**7**	**10**
Raw Material and Inputs	29.19	34.10	48.64	48.64
Labour Direct	32.51	37.97	54.17	54.17
Utilities	29.56	34.53	49.21	49.21
Maintenance and repair	2.97	3.47	4.94	4.94
Labour overheads	10.84	12.66	18.06	18.06
Administration Cost	21.67	25.32	36.11	36.11
Total operating costs	**126.74**	**148.04**	**210.99**	**210.99**
Depreciation	134.50	134.50	134.50	54.50
Cost of Finance	103.44	97.10	90.10	42.39
Total Production Cost	**384.68**	**379.64**	**419.48**	**307.88**

C. FINANCIAL EVALUATION

1. Profitability

According to the projected income statement, the project will start generating profit in the fourth year of operation. Important ratios such as the percentage of net profit to total sales, net profit to equity (return on equity) and net profit plus interest to total

investment (return on total investment) will show an increasing trend throughout the production life of the project.

The income statement and other profitability indicators show that the project is viable.

2. Break-even Analysis

The break-even point of the project is estimated by using income statement projection.

$$BE = \frac{\text{Fixed Cost}}{\text{Sales-Variable Cost}} = 50\ \%$$

3. Pay-Back Period

The investment cost and income statement projection are used to project the pay-back period. The project will fully recover the initial investment and working capital within 7 years time.

4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 14 % and the net present value at 10.5% discount rate is Birr 271,550.

D. ECONOMIC BENEFITS

The project can create employment opportunities for 13 persons. In addition to supply of the domestic needs, the project will generate Birr 2.2 million in terms of tax revenue. Moreover, the Regional Government can collect employment, income tax and sales tax revenue. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports.