71. PROFILE ON REFRACTORY CERAMICS

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I. SUMMARY

This profile envisages the establishment of a plant for the production of refractory ceramics with a capacity of 2,000 tonnes per annum. Refractory ceramics are used for lining and construction of high temperature kilns and furnaces.

The principal raw materials required for the production of refractory ceramics are quartz, feldspar, lime, dolomite and kaolin, which are locally available.

The present demand for the proposed product is estimated at 913 tones per annum. The demand is expected to reach at 4,886 tonnes by the year 2020.

The total investment requirement is estimated at about Birr 23.04 million, out of which Birr 12.30 million is required for plant and machinery. The plant will create employment opportunities for 42 persons.

The project is financially viable with an internal rate of return (IRR) of 25.57 % and a net present value (NPV) of Birr 19.70 million, discounted at 8.5%.

A refractory ceramics manufacturing project will have backward and forward linkages with the mining and manufacturing sectors, respectively. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports.

II. PRODUCT DESCRIPTION AND APPLICATION

Refractory ceramics are used for lining and construction of high temperature kilns and furnaces. Hence, they have got wide applications in iron and steel plants, foundries, cement factories, and also in the glass, ceramic, fertilizer and chemical industries. Because of the incombustible and chemical resistant properties all sorts of ceramic products have played a constructive role in the construction industries.

III. MARKET STYDY AND PLANCT CAPACEITY

A. MARKET STUDY

1. Past Supply and Present Demand

The demand for refractory ceramics is entirely met through import. Import of refractory ceramics during the past eight years covering the period 1999-2006 is given in Table 3.1.

Table 3.1

IMPORT OF REFRACTORY CERAMICS (TONNES)

Year	Import
1999	5.1
2000	2.0
2001	7.1
2002	0.4
2003	110.9
2004	76.0
2005	352.5
2006	913.2

Source: *- Customs Authority.*

The demand for refractory ceramics during the period 1999-2002 was very low as depicted in Table 3.1. During this period annual imported quantity ranged from the lowest 0.4 tones (year 2002) to the highest 7.1 tones (year 2001) with a mean of 3.65 tones. However, during year 2003 and thereafter the demand has grown tremendously. By the year 2003 and 2004 the quantity imported rose to 110.9 tones and 76 tones respectively. A huge increase is observed during the last two recent years. About 352.5 tones and 913.2 tones of refractory ceramics were imported during year 2005 and 2006, respectively.

The huge increase in import, which implies the growth of demand, is mainly due to the establishment of new user industries in the iron and steel, cement and chemical industries in the country. Hence, allowing for some stock carry over the year 2006 imported quantity which is 913.2 tonnes is taken as the current effective demand for the product.

2. Projected Demand

Refractory ceramics are used for lining and construction of high temperate kilns and furnaces. Hence, they have got wide applications in iron and steel plants, foundries, cement factories, glass, ceramics, fertilizer and chemical industries.

Due to the fast growth of the construction sector and shortage of construction materials a number of iron and steel, cement, and glass producing plants are either becoming operational or under implementation. Moreover, efforts are underway to establish fertilizer plants and a number of chemical industries that would substitute import. Although the PASDEP document forecasted the manufacturing sector to grow by an average of about 11.5% per annum a 15% yearly growth rate is applied to project the future demand for refractory ceramics since its end users have direct linkage mainly with the fast growing sector of construction. The forecasted demand is given in Table 3.2.

Table 3.2

PROJECTED DEMAND FOR REFRACTORY CERAMICS (TONNES)

Year	Projected Demand
2009	1,050
2010	1,208
2011	1,389
2012	1,597
2013	1,837
2014	2,112
2015	2,429
2016	2,794
2017	3,242
2018	9,694
2019	4,248
2020	4,886

3. Pricing and Distribution

The price of refractory ceramics varies according to the specification and required application. As per the data from the Customs Authority, CIF Price varies from Birr 3,371 to Birr 10,179 per tonne. An average of Birr 6,771 per tonne is taken for the purpose of financial analysis.

As the end users in the country are known and limited in number direct sale is the best option in marketing the product.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

According to the market study presented above and three years period for attaining full capacity, the envisaged refractory ceramics production plant will have a production capacity of 2,000 tonnes per year working 300 days, single shift of eight hours a day.

2. Production Programme

The plant is assumed to start production at 70% of its capacity in the first year, 85% in the second year, and at 100% in the third year and thereafter. The production programme is shown in Table 3.3 below.

Table 3.3

PRODUCTION PROGRAMME

Year	1	2	3
Capacity Utilization (%)	70	85	100
Production (tonnes)	1400	1700	2,000

IV. MATERIALS AND INPUT

A. RAW MATERIALS

The main raw materials of refractory bricks are kaolin, feldspar, quartz, lime and dolomite. All raw materials required by the envisaged plant are locally available. Kaolin and feldspar are found in Hossaena, Buambuawiha and Kenticha in the SNNPRS, while quartz and lime are found in the Muger valley. The annual raw materials costs at full capacity operation are estimated at Birr 2.33 million.

The detail annual raw materials requirement at full production capacity is presented in Table 4.1.

Table 4.1

RAW MATERIALS REQUIREMENT & COST AT FULL CAPACITY OPERATIONS

Sr. No.	Description	Qty. (tonnes)	Unit Cost ('000 Birr)	Total Cost ('000 Birr)		
				FC	LC	Total
1	Kaolin	1175	1200.00	-	1,410.00	1,410.00
2	Feldspar	380	1036.00	-	393.68	393.68
3	Quartz	250	1000.00	-	250.00	250.00
4	Lime	167	880.00	-	146.96	146.96
5	Dolomite	83	1600.00	-	132.80	132.80
	Total				**2,333.44**	**2,333.44**

B. UTILITIES

Electricity, water and fuel are the three basic utilities required by the envisaged plant. Annual electric energy required is 250,000kWh. The annual expenditure on electricity is therefore Birr 118,400. Annual water consumption is estimated at 12,000m^3, which costs Birr 39,000 and annual furnace oil cost is estimated at Birr 1.752 million. Thus, the total annual utilities requirement is estimated at Birr 1.909 million. The annual utility consumption is shown in Table 4.1.

Table 4.2

ANNUAL CONSUMPTION OF UTILITIES AND COST

Sr. No.	Description	Rate	Qty	Cost(Birr)
1	Electric power (kWh)	0.4736birr/Kwh	250,000	118,400
2	Water (m^3)	3.25birr/m^3	12,000	39,000
3	Furnace oil (Liters)	5.84birr/lit	300,000	1,752,000
	Total			**1,909,400**

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

The production process of refractory bricks plant involves the following major manufacturing operations:

a) Body Preparation

The raw materials are roughly crushed by the jaw crusher and roll crusher, and then sieved into designated particle sizes, weighed, and then mixed with the required amount of water to be micro-reduced by a ball mill. The slip is further sieved and passed through the magnetic filter so that it is free from iron impurity as well as being uniform in particle size.

b) Shaping

Shaping is done by the pressing method. Before the pressing operation done, the mixing slip is pumped through an atomizer device that produces fine droplets in to the main drying chamber. The hot drying gas can be passed as a counter flow to the atomizer direction. Then the fine powders falls from the spray dryer on the belt conveyer and fed to the pressing machine for forming and pressing.

c) Firing

When pressing operation is completed the refractory ceramics are ready for firing. Then the products are fed to the tunnel kiln for firing. The firing operation will be done with in the range of $1{,}060^0$c to $1{,}100^0$c.

d) Inspection

After the final inspection carried out, the items will be palletized and wrapped using polypropylene for dispatch.

The technological process involves size reduction and high temperature firing. So the dust to be generated in the process will be controlled by the wet process operation. The

only waste to be generated in the process is scrapes which are recyclable. The technological process has no any adverse impact on environment.

2. Source of Technology

The technology for the manufacture of refractory ceramics plant can be obtained from the following companies.

HANGZHOU XINYI SANITARY WARE CO. LTD
Street No.: Yinong Industrial Zone
State: east
Zip: 311247
City: Hangzhou
Country: China
Tel: 86-571-82591376
Fax: 86-571-82591877
Cell: 86015925620553

B. ENGINEERING

1. Machinery and Equipment

Plant machinery and equipment required for refractory ceramics plant is presented in Table 5.1. The total investment cost of plant machinery and equipment is estimated at Birr 12.3 million.

Table 5.1

MACHINERY AND EQUIPMENT REQUIREMENT & COST FOR REFRACTORY CERAMICS PLANT

Sr. No.	Description	Qty.	Cost (Birr)		
			LC	FC	Total
1	Body preparation				
	Ball mill	2		2,764,945.00	2,764,945.00
	Empty pipe line	Set			
	Concrete blunger	3			
	Discharge line, water dosing etc.	Set			
2	Forming				
	Spray dryer	1		1,435,000.00	1,435,000.00
	Pumps	2			
	Belt conveyor	2			
4	Pressing				
	Hydraulic press	1		975,650.00	975,650.00
5	Firing				
	Tunnel kiln	1		2,345,560.00	2,345,560.00
	Kiln car	20		1,650,767.00	939,014.30
	Truck	LS		670,500.00	670,500.00
Total			**-**	**9,842,422.00**	**9,842,422.00**
Insurance, Customs Duty, Inland Transport, Bank Charge, Etc.			2,460,605.50	-	2,460,605.50
Grand Total			**2,460,605.50**	**9,842,422.00**	**12,303,027.50**

2. Land, Building and Civil Works

The envisaged plant will require a total land area of 2,000m^2. The floor space required for the building of and other facilities will be about 1,500m^2. 200 m^2 areas is to be covered by office building, 1300m^2 area is to be used for the production hall and the finished product store. The raw material will be stored in the open air. The total estimated cost of building and civil works at the rate of Birr 2,300 per m^2 is about Birr 3,450,000.

According to the Federal Legislation on the Lease Holding of Urban Land (Proclamation No 272/2002) in principle, urban land permit by lease is on auction or negotiation basis, however, the time and condition of applying the proclamation shall be determined by the concerned regional or city government depending on the level of development.

The legislation has also set the maximum on lease period and the payment of lease prices. The lease period ranges from 99 years for education, cultural research health, sport, NGO , religious and residential area to 80 years for industry and 70 years for trade while the lease payment period ranges from 10 years to 60 years based on the towns grade and type of investment.

Moreover, advance payment of lease based on the type of investment ranges from 5% to 10%.The lease price is payable after the grace period annually. For those that pay the entire amount of the lease will receive 0.5% discount from the total lease value and those that pay in installments will be charged interest based on the prevailing interest rate of banks. Moreover, based on the type of investment, two to seven years grace period shall also be provided.

However, the Federal Legislation on the Lease Holding of Urban Land apart from setting the maximum has conferred on regional and city governments the power to issue regulations on the exact terms based on the development level of each region.

In Addis Ababa the City's Land Administration and Development Authority is directly responsible in dealing with matters concerning land. However, regarding the manufacturing sector, industrial zone preparation is one of the strategic intervention measures adopted by the City Administration for the promotion of the sector and all manufacturing projects are assumed to be located in the developed industrial zones.

Regarding land allocation of industrial zones if the land requirement of the project is blow 5000 m^2 the land lease request is evaluated and decided upon by the Industrial Zone Development and Coordination Committee of the City's Investment Authority. However, if the land request is above 5,000 m^2 the request is evaluated by the City's Investment Authority and passed with recommendation to the Land Development and Administration Authority for decision, while the lease price is the same for both cases.

The land lease price in the industrial zones varies from one place to the other. For example, a land was allocated with a lease price of Birr 284 /m^2 in Akakai-Kalti and Birr 341/ m^2 in Lebu and recently the city's Investment Agency has proposed a lease price of Birr 346 per m^2 for all industrial zones.

Accordingly, in order to estimate the land lease cost of the project profiles it is assumed that all manufacturing projects will be located in the industrial zones. Therefore, for the this profile since it is a manufacturing project a land lease rate of Birr 346 per m^2 is adopted.

On the other hand, some of the investment incentives arranged by the Addis Ababa City Administration on lease payment for industrial projects are granting longer grace period and extending the lease payment period. The criterions are creation of job opportunity, foreign exchange saving, investment capital and land utilization tendency etc. Accordingly, Table 5.2 shows incentives for lease payment.

Table 5.2

INCENTIVES FOR LEASE PAYMENT OF INDUSTRIAL PROJECTS

Scored Point	Grace Period	Payment Completion Period	Down Payment
Above 75%	5 Years	30 Years	10%
From 50 - 75%	5 Years	28 Years	10%
From 25 - 49%	4 Years	25 Years	10%

For the purpose of this project profile the average, i.e., five years grace period, 28 years payment completion period and 10% down payment is used. The period of lease for industry is 60 years .

Accordingly, the total lease cost, for a period of 60 years with cost of Birr 346 per m^2, is estimated at Birr 41.52 million of which 10% or Birr 4,152,000 will be paid in advance. The remaining Birr 37.37 million will be paid in equal installments with in 28 years, i.e., Birr 1,334,571 annually.

VI. MANPOWER & TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

The refractory ceramics plant will require manpower both for administration and production activities. The total number of manpower is 42, of which 12 are administration staff and 30 are involved in production activities.

The total labor cost is Birr 606,940. The detail manpower requirement and estimated annual salaries are presented in Table 6.1.

Table 6.1

MANPOWER REQUIREMENT AND ANNUAL LABOR COST

Sr. No.	Description	Req. No.	Monthly Salary (Birr)	Annual Salary (Birr)
A. Administration				
1	General Manager	1	3,500	42,000
2	Executive Secretary	1	1,200	14,400
3	Finance and Administration Head	1	2,500	30,000
4	Accountant	1	1,800	21,600
5	Store Man	1	750	9,000
6	Clerk	1	550	6,600
7	General Service	6	400	28,800
	Sub-Total	**12**		**152,400**
B. Production				
8	Engineer (Production & Technique)	1	3,000	36,000
9	Supervisor	2	1,800	43,200
10	Quality Control Staff	3	1,500	54,000
11	Laboratory Staff	3	850	30,600
12	Pressing machine operator	1	1,600	19,200
13	Skilled Workers	10	750	90,000
14	Assistant Skilled Workers	10	500	60,000
Sub-Total		**30**		**333,000**
Total		**42**		**485,552**
Worker's Benefit (25%)		-		121,388
Grand Total				**606,940.00**

B. TRAINING REQUIREMENT

The production supervisor, kiln operations, press operators need to be given two months training on production activities, repairing and maintenance activities. The training cost is estimated to Birr 50,000.

VII. FINANCIAL ANALYSIS

The financial analysis of the refractory ceramics project is based on the data presented in the previous chapters and the following assumptions:-

Construction period	1 year
Source of finance	30 % equity
	70 % loan
Tax holidays	2 years
Bank interest	8.5%
Discount cash flow	8.5%
Accounts receivable	30 days
Raw material local	30 days
Work in progress	2 days
Finished products	30 days
Cash in hand	5 days
Accounts payable	30 days
Repair and maintenance	5% of machinery cost

A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at Birr 23.04 million, of which 43 per cent will be required in foreign currency. The major breakdown of the total initial investment cost is shown in Table 7.1.

Table 7.1

INITIAL INVESTMENT COST ('000 Birr)

Sr. No.	Cost Items	Local Cost	Foreign Cost	Total Cost
1	Land lease value	4,152.00	-	4,152.00
2	Building and Civil Work	3,450.00	-	3,450.00
3	Plant Machinery and Equipment	2460.61	9,842.42	12,303.03
4	Office Furniture and Equipment	150.00	-	150.00
5	Vehicle	660.00	-	660.00
6	Pre-production Expenditure*	1,391.28	-	1,391.28
7	Working Capital	942.48	-	942.48
	Total Investment cost	**13,206.37**	**9,842.42**	**23,048.79**

* *N.B Pre-production expenditure includes interest during construction (Birr 1.19 million), training (Birr 50 thousand) and Birr 150 thousand costs 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 is estimated at Birr 7.96 million (see Table 7.2). The raw material cost accounts for 29.31 per cent of the production cost. The other major components of the production cost are utility depreciation and financial cost which account for 23.98%, 20.92% and 10.44% respectively. The remaining 15.35 % is the share of direct labour, repair and maintenance, labour overhead and other administration cost.

Table 7.2

ANNUAL PRODUCTION COST AT FULL CAPACITY ('000 BIRR)

Items	Cost	%
Raw Material and Inputs	2,333.44	29.31
Utilities	1,909.40	23.98
Maintenance and repair	615.15	7.73
Labour direct	291.33	3.66
Labour overheads	121.39	1.52
Administration Costs	194.22	2.44
Land lease cost	-	-
Total Operating Costs	**5,464.93**	68.64
Depreciation	1,665.40	20.92
Cost of Finance	831.17	10.44
Total Production Cost	**7,961.50**	**100**

C. FINANCIAL EVALUATION

1. Profitability

Based on the projected profit and loss statement, the project will generate a profit through out its operation life. Annual net profit after tax will grow from Birr 2.72 million to Birr 4.05 million during the life of the project. Moreover, at the end of the project life the accumulated cash flow amounts to Birr 41.90 million.

2. Ratios

In financial analysis financial ratios and efficiency ratios are used as an index or yardstick for evaluating the financial position of a firm. It is also an indicator for the strength and weakness of the firm or a project. Using the year-end balance sheet figures and other

relevant data, the most important ratios such as return on sales which is computed by dividing net income by revenue, return on assets (operating income divided by assets), return on equity (net profit divided by equity) and return on total investment (net profit plus interest divided by total investment) has been carried out over the period of the project life and all the results are found to be satisfactory.

3. Break-even Analysis

The break-even analysis establishes a relationship between operation costs and revenues. It indicates the level at which costs and revenue are in equilibrium. To this end, the break-even point of the project including cost of finance when it starts to operate at full capacity (year 3) is estimated by using income statement projection.

$$BE = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 21\ \%$$

4. Payback Period

The pay back period, also called pay – off period is defined as the period required to recover the original investment outlay through the accumulated net cash flows earned by the project. Accordingly, based on the projected cash flow it is estimated that the project's initial investment will be fully recovered within 4 years.

5. Internal Rate of Return

The internal rate of return (IRR) is the annualized effective compounded return rate that can be earned on the invested capital, i.e., the yield on the investment. Put another way, the internal rate of return for an investment is the discount rate that makes the net present value of the investment's income stream total to zero. It is an indicator of the efficiency or quality of an investment. A project is a good investment proposition if its IRR is greater

than the rate of return that could be earned by alternate investments or putting the money in a bank account. Accordingly, the IRR of this porject is computed to be 25.57 % indicating the vaiability of the project.

6. Net Present Value

Net present value (NPV) is defined as the total present (discounted) value of a time series of cash flows. NPV aggregates cash flows that occur during different periods of time during the life of a project in to a common measuring unit i.e. present value. It is a standard method for using the time value of money to appraise long-term projects. NPV is an indicator of how much value an investment or project adds to the capital invested. In principal a project is accepted if the NPV is non-negative.

Accordingly, the net present value of the project at 8.5% discount rate is found to be Birr 19.70 million which is acceptable.

D. ECONOMIC BENEFITS

The project can create employment for 42 persons. In addition to supply of the domestic needs, the project will generate Birr 12.36 million in terms of tax revenue. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports. A refractory ceramics manufacturing project will have backward and forward linkages with the mining and manufacturing sectors, respectively