PROFILE ON BORIC ACID

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I. SUMMARY

This profile envisages the establishment of a plant for the production of boric acid with a capacity of 71 tones per annum. Boric acid is used in glazing pottery, in fireproofing cloth, in making electroplating baths and artificial gems, and in hardening steels.

The major raw materials required for the production of boric acid are borax (salt) and sulphuric acid (98%). Borax have to be imported while sulphuric acid is locally available.

The present demand for the proposed product is estimated at 59 tonnes per annum. The demand is expected to reach at 153 tonnes by the year 2018.

The total investment requirement is estimated at Birr 5.54 million, out of which Birr 638 thousand is required for plant and machinery. The plant will create employment opportunities for 20 persons.

The project is financially viable with an internal rate of return (IRR) of 16.41 % and a net present value (NPV) of Birr 2.41 million, discounted at 8.5%.

The project has backward linkage to mining industry and forward linkage to non-metallic and pharmaceutical industries. 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

Boric acid is a white odorless, and nearly tasteless powdered substance which is not flammable, combustible, or explosive, and it presents no unusual hazard if involved in a fire. Boric acid is used as an antiseptic for minor burns or cuts, as eye drops, to treat yeast and fungal infections such as candidacies, as an insecticide for control of cockroaches, termites, fire ants, fleas, for manufacturing glass and fiber glass, halogen

light bulbs, laboratory glass ware and circuit boards, in nuclear power plants to slow down the rate at which fission is occurring.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

Boric acid is an industrial raw material mainly used in glazing pottery, fire proofing cloth, electroplating baths, hardwearing steels and the like. Since there is no plant that produces boric acid in the country the demand is entirely met through import. Import of boric acid during the past 10 years covering the period 1997-2000 is given in Table 3.1.

Table 3.1

IMPORT OF BORIC ACID

Year	Import (Tonnes)
1997	-
1998	2.0
1999	0.1
2000	0.6
2001	9.2
2002	2.2
2003	5.9
2004	0.9
2005	38.4
2006	59.4

Source:-*Compiled from Customs Authority.*

The time series data on import of boric acid reveals that demand was very low during the period 1997-2004 although there was a trend of increase. During year 1997 the country did not import the product. During the year 1998- 2000 the yearly average import was about 0.9 tonnes. A modest increase of import of the product has been observed during the period 2001-2003. During this period the yearly average import has been about 3.8 tonnes. After an abrupt decline in 2004, which was about 0.9 tonnes, the imported quantity during year 2005 and 2006 has sharply increased to 38.4 tonnes and 59.4 tonnes, respectively.

The sharp increase of import during the period 2005-2006 could be explained by the fact that a number of new industries that require boric acid have been established. The increase of import from year 2005 to year 2006 was 54.7%

Current (year, 2008) effective demand is estimated by taking the average quantity imported in the recent two years and applying a yearly average growth rate of 10% which is slightly lower than the forecasted growth of the manufacturing sector. Accordingly, current effective demand is estimated at 59 tonnes.

2. Projected Demand

The demand for boric acid is influenced by the development of the manufacturing sector. As per the Plan for Accelerated and Sustained Development to End Poverty (PASDEP), the target set for the industrial sector is to register an average annual growth rate of 11.5%. Considering this target demand for boric acid is forecasted to grow by 10% per annum. The forecasted demand up to of year 2018 is shown in Table 3.2.

Table 3.2

PROJECTED DEMAND FOR BORIC ACID (TONNES)

Year	Projected Demand
2009	64.9
2010	71.4
2011	78.5
2012	86.4
2013	95.0
2014	104.5
2015	115.0
2016	126.5
2017	139.1
2018	153.0

The demand for boric acid will grow from 64.9 tones during 2009 to 95 tones and 153 tones by the years, 2013 and 2018, respectively.

3. Pricing and Distribution

The average the CIF price of boric acid is calculated at Birr 24,819 per tone. Allowing 35% for taxes, inland transport, port handling and other charges Birr 26,505 per ton is taken to forecast the sales revenue.

Since boric acid is an industrial in put the method of distribution to be adopted should be direct sale to the end user industries.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

The market study conducted on the demand of boric acid has shown that there is no local producer and the country's requirement is totally met through import. Basing on the market study and growth rate of the product users the proposed plant capacity for the envisaged plant is 71 ton per annum, working in single shift for 300 days.

2. Production Programme

The production programme considers that for the first production year the plant will utilize 80% of its capacity, and 90% in the second year. For the third year on ward the plant will utilize its full capacity.

Table 3.3

PRODUCTION PROGRAMME

Year	**1**	**2**	**3-10**
Capacity utilization (%)	80	90	100
Production (tones)	56.8	63.9	71

IV. MATERIALS AND INPUTS

A. RAW MATERIALS

The main raw materials used for manufacturing of Boric acid are borax and Sulfuric acid. Borax will be imported while sulfuric acid will be obtained from Awash Melkassa Aluminium sulphate and sulfuric acid plant. The total cost of annual raw materials and utilities is estimated Birr 517,896 out of which Birr 352,320 will be in foreign currency.

Table 4.1

ANNUAL CONSUMPTION OF RAW- MATERIALS AND THEIR COSTS

Description	Unit of Measure	Qty.	Unit price	Cost in 000 Birr		
				FC	LC	Total
Borax	Ton	110.1	3,20	352.32	-	352.32
Sulfuric acid (98 %)	Ton	28.3	3.85	-	108.95	108.95
Total cost						**461.27**

B. UTILITIES

Utilities required for manufacturing Boric acid include electric power and water. The annual raw materials and utilities requirement of the plant is given in Table 4.2.

Table 4.2

ANNUAL CONSUMPTION OF UTILITIES AND THEIR COSTS

Description	Unit of Measure	Qty.	Cost in '000 Birr		
			F.C	L.C	T.C
Electricity	kWh	65,000	-	30.78	30.78
Water	m^3	7,950	-	25.83	25.83
Total cost				**56.62**	**56.62**

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Process Description

For manufacturing boric acid, borax is charged into an acidifier and dilute sulfuric acid is added slowly until the solution becomes strongly acidic. It is produced by acidifying a saturated solution of borax or orthoborate materials. The following reaction take place:-

$$Na_2B_4O_7.10H_2O + H_2SO_4 – H_3P_2O_3 + No_2SO_4 + 5H_2O$$

Borax in hot water with concentrated sulfuric acid is mixed in a lead lined vessel. The hot solution is vacuum crystallized and is cooled. First crop comes of boric acid and on further cooling sodium sulphate.

The crude boric acid is purified by re crystallization from hot water to give the final pure boric acid.

Boron is an essential micronutrient for healthy growth of plants. It can be harmful to boron sensitive plants in higher quantities, and care should be taken to minimize the amount of boric acid released to the environment to avoid ecological effects by adopting clean technology or closed system which avoids leakage of the raw material and finished product as well.

2. Source of Technology

The technical data and information related to this technology can be obtained from India. One of the machineries and equipment supplier address is given below:-

Zewtech India
El-2614 J. Block I.D.C., Bhosari, pune-411026, India
Tel. +91-20-27128909/27125647

Fax. +91-20-27128035

B. ENGINEERING

1. Machinery and Equipment

The list of production machinery and equipment required for the plant is provided in Table 5.1. The total cost of plant machinery and equipment is estimated at Birr 638,000, out of which Birr 542,300 is in foreign currency.

Table 5.1

LIST OF MACHINERY REQUIRED

SR. No.	Description	Qty	Cost in Birr'000		
			LC	FC	Total
1	Lead lined reaction vessel	1	33.49	189.81	223.30
2	Sulfuric acid storage tank	1	23.92	135.57	159.50
3	crystallizer	1	19.14	108.46	127.60
4	Tray dryer	1	4.78	27.12	31.90
5	Cooler	1	9.57	54.23	63.80
6	Wooden filter press	1	4.78	27.12	31.90
Total cost			**95.70**	**542.3**	**638.0**

2. Land, Building and Civil Works

The total land requirement for the envisaged plant is estimated at 1,250 m^2out of this 500 m^2 is built-up area. 350m^2 of the total built up area is used for production facility, 80m^2 for store and 70 m^2 for office purpose. Cost of building construction with at rate of Birr 2400 per m^2 amounts to Birr 1,200,000.

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 5,000 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 this profile, which 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 25.95 million of which 10% or Birr 2,595,000 will be paid in advance. The remaining Birr 23.36 million will be paid in equal installments with in 28 years i.e. Birr 834,107 annually.

VI. MANPOWER AND TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

In order to run the envisaged plant efficiently, it needs 20 employees. The estimated annual cost of manpower is birr 262,500. The detail of which is shown in table 6.1.

Table 6.1

MANPOWER REQUIREMENT AND ESTIMATED ANNUAL COST

Sr. No.	Description	Req. No.	Monthly Salary (Birr)	Annual Salary (Birr)
1	Manager	1	3,000	36,000
2	Administration + Finance Head	1	2,500	30,000
3	Secretary	1	900	10,800
4	Sales and purchase Head	1	1,500	18,000
5	Production Supervisors	1	1,500	18,000
6	Chemist	2	2,000	24,000
7	Operators	4	2,400	28,800
8	Technicians	1	600	7,200
9	Laborers	4	1,400	16,800
10	Store keeper	1	500	6,000
11	Guard	2	700	8,400
12	Driver	1	500	6,000
	Sub-Total	**20**		**210,000**
	Employees benefit 20 %			52,500
	Grand Total			**262,500**

B. TRAINING REQUIREMENT

The process involves reactions, which are taking place in the reactors that need a good operation parameter control. The supervisor and the chemist need to be trained by experts of the machinery suppliers during the commissioning period. The total cost for training is estimated at Birr 32,000.

VII. FINANCIAL ANALYSIS

The financial analysis of the boric acid 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
Raw material import	90 days
Work in progress	1 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 5.54 million, of which 10 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	2,595.00	-	2,595.00
2	Building and Civil Work	1,200.00	-	1,200.00
3	Plant Machinery and Equipment	95.7	542.30	638.00
4	Office Furniture and Equipment	100.00	-	100.00
5	Vehicle	450.00	-	450.00
6	Pre-production Expenditure*	472.99	-	472.99
7	Working Capital	90.74	-	90.74
	Total Investment cost	**5,004.43**	**542.30**	**5,546.73**

** N.B Pre-production expenditure includes interest during construction (Birr 340.99 thousand, training (Birr 32 thousand) and Birr 130 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 1.28 million (see Table 7.2). The raw material cost accounts for 36.01 per cent of the production cost. The other major components of the production cost are depreciation, financial cost and direct labour which account for 19.82%, 16.77% and 9.84%, respectively. The remaining 15.57% is the share of maintenance and repair and other administration cost.

Table 7.2

ANNUAL PRODUCTION COST AT FULL CAPACITY ('000 BIRR)

Items	Cost	%
Raw Material and Inputs	461.27	36.01
Utilities	56.62	4.42
Maintenance and repair	31.90	2.49
Labour direct	126.00	9.84
Labour overheads	52.50	4.10
Administration Costs	84.00	6.56
Land lease cost	-	-
Total Operating Costs	**812.29**	63.42
Depreciation	253.80	19.82
Cost of Finance	214.73	16.77
Total Production Cost	**1,280.82**	**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 258.28 thousand to Birr 655.04 thousand during the life of the project. Moreover, at the end of the project life the accumulated cash flow amounts to Birr 7.06 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.

$$BE = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 23\ \%$$

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 6 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 16.41 % 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 2.41 million which is acceptable.

D. ECONOMIC BENEFITS

The project can create employment for 20 persons. In addition to supply of the domestic needs, the project will generate Birr 1.33 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. The project has backward linkage to mining industry and forward linkage to non-metallic and pharmaceutical industries