

**69. PROFILE ON PRODUCTION OF SODIUM  
SILICATE**

**TABLE OF CONTENTS**

|  | <b><u>PAGE</u></b> |
|--|--------------------|
| I. SUMMARY                             | 69-2               |
| II. PRODUCT DESCRIPTION & APPLICATION  | 69-3               |
| III. MARKET STUDY AND PLANT CAPACITY   | 69-3               |
| A. MARKET STUDY                        | 69-3               |
| B. PLANT CAPACITY & PRODUCTION PROGRAM | 69-7               |
| IV. MATERIALS AND INPUTS               | 69-7               |
| A. RAW & AUXILIARY MATERIALS           | 69-7               |
| B. UTILITIES                           | 69-8               |
| V. TECHNOLOGY & ENGINEERING            | 69-8               |
| A. TECHNOLOGY                          | 69-8               |
| B. ENGINEERING                         | 69-10              |
| VI. MANPOWER & TRAINING REQUIREMENT    | 69-14              |
| A. MANPOWER REQUIREMENT                | 69-14              |
| B. TRAINING REQUIREMENT                | 69-15              |
| VII. FINANCIAL ANALYSIS                | 69-15              |
| A. TOTAL INITIAL INVESTMENT COST       | 69-15              |
| B. PRODUCTION COST                     | 69-16              |
| C. FINANCIAL EVALUATION                | 69-17              |
| D. ECONOMIC & SOCIAL BENEFITS          | 69-19              |

## **I. SUMMARY**

This profile envisages the establishment of a plant for the production of sodium silicate with a capacity of 4,050 tons of per annum. Sodium Silicate is used in soaps detergents and in the manufacture of silica gel. It is also used as a wall coating, in concrete, fire proofing material and as a sealant. Sodium Silicate also finds use in textile and pharmaceutical industries.

The demand for the product is met through local production and import. The present (2012) demand for the products is estimated at 3,694 tons per annum. The demand is projected to reach 7,091 tons and 12,649 tons by the years 2018 and year 2023, respectively.

The major raw materials required by the project are soda ash and silica sand which are locally available.

The total investment cost of the project including working capital is estimated at Birr 19.01 million. From the total investment cost, the highest share (Birr 13.53 million or 71.15%) is accounted by fixed investment cost followed by initial working capital (3.63 million or 19.10%) and pre operation cost (Birr 1.85 million or 9.75%). From the total investment cost Birr 5.80 million or 30.54% is required in foreign currency.

The project is financially viable with an internal rate of return (IRR) of 28.06% and a net present value (NPV) of Birr 16.93 million, discounted at 10%.

The project can create employment for 30 persons. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports. The project will also create forward and back ward linkage with the manufacturing sector and also generates income for the Government in terms of tax revenue and payroll tax.

## **II. PRODUCT DESCRIPTION AND APPLICATION**

Sodium Silicate is a colorless compound of oxides of sodium and silica. It has a range of chemical formula varying in sodium oxide ( $\text{Na}_2\text{O}$ ) and silicon dioxide or silica ( $\text{SiO}_2$ ) contents or ratios. It is soluble in water and it is prepared by reacting silica sand and sodium carbonate at a high temperature ranging from 1,200 to 14,000°C. Aqueous solution of sodium silicate is called water glass.

Sodium silicates are produced in the form of a variety of compounds ranging from  $\text{Na}_2\text{O} \cdot 4\text{SiO}_2$  to  $2\text{Na}_2\text{O} \cdot \text{SiO}_2$  by properly proportioning the reactants.

Sodium Silicate is used in soaps detergents and in the manufacture of silica gel. It is used as a cement, binder, filler and adhesive. And also used as a wall coating, in concrete, fire proofing material and as a sealant. It is also used to preserve eggs and wood. Sodium Silicate also finds use in textile and pharmaceutical industries. Neutral sodium silicate in liquid form is suitable for use in pharmaceutical and toilet preparations. Sodium silicates of certain ratios are used for application over concrete floors for hardening making dustless concrete floors and protecting pervious building materials against the effects of moisture. Sodium silicate is also used in foundries and welding electrode industries.

In ceramic industries, sodium silicate is used as a deflocculant in the preparation of casting slips for keeping solid particles in suspension without settling. Sodium silicate is used in refractory industries as an air-setting bond for manufacturing refractory cements and mortars. In vitreous enamel industries, it is used for cleaning the metal, known as pickling, and prior to enamelling.

## **III. MARKET STUDY AND PLANT CAPACITY**

### **A. MARKET STUDY**

#### **1. Past Supply and Present Demand**

Although sodium silicate has got various applications, in Ethiopia Soap and Detergent Factories are the major consumers. The Pulp and Paper Factories also require sodium silicate for

hardening corrugated paper board and packaging materials. Factories which produce pigments and adhesive and water treatment plants are among significant users of the product in Ethiopia.

Until recently ,sodium silicate in the country is solely produced and supplied by Gullele Soap Factory. The factory has an installed capacity of 200 tons per annum and has attained its full capacity. Since the existing local capacity is very low compared to the country`s demand, a substantial amount of sodium silicate is imported annually by spending scarce foreign exchange. The quantity and value of sodium silicate imported in the past 12 years to fill the unsatisfied demand is shown in Table 3.1.

**Table 3.1**  
**IMPORT OF SODIUM SILICATE**

| <b>Year</b> | <b>Qty. (Tons)</b> | <b>Value ( `000 Birr)</b> |
|-------------|--------------------|---------------------------|
| 2000        | 80.6               | 265.7                     |
| 2001        | 800.0              | 1,285.1                   |
| 2002        | 294.6              | 435.5                     |
| 2003        | 557.1              | 937.2                     |
| 2004        | 1,070.2            | 1,971.0                   |
| 2005        | 2,366.7            | 4,775.3                   |
| 2006        | 2,337.5            | 4,999.5                   |
| 2007        | 1,783.4            | 4,813.4                   |
| 2008        | 2,004.8            | 5,807.3                   |
| 2009        | 2,657.1            | 10,882.0                  |
| 2010        | 2,186.0            | 9,675.0                   |
| 2011        | 3,012.4            | 18,036.6                  |

*Source:- Ethiopian Revenues and Customs Authority.*

The 12 years time series data presented in Table 3.1 reveals that the imported quantity had generally an increasing trend although there were minor fluctuations in certain years. The actual increasing trend can be clearly shown when the data is analyzed by diving in to three years

intervals. Accordingly, the yearly average volume of import which was 391.7 tons during the period 2000--2002 has increased to 1,331.3 tons during the period 2003--2005. Compared to the previous three years average the imported quantity is higher by more than three fold. Similarly, the yearly average quantity imported during the period 2006--2008 and 2009--2011 has increased to 2,042 tons and 2,619 tons, respectively.

The above figures indicate that the yearly average level of import during the period 2006--2008 has increased by a total of about 53% or by 16% annually compared to the previous three years average. Similarly the yearly average volume of import during the period 2009--2011 is higher by a total of 28% or by 8.5% annually compared to the average imported volume during 2006 – 2008. Generally, in the past 10 years (taking year 2002 as a base) the annual average growth rate of import was nearly 30%.

To estimate the current demand first year 2011 import volume and the existing production level are taken as a base. Then, a conservative growth rate of growth rate of 15% is assumed to arrive at the present demand. Accordingly, present effective demand for sodium silicate is set at 3,694 tons  $(3,012 \text{ tons} + 200 \text{ tons}) + 0.15\%$ .

## **2. Demand Projection**

The future demand for sodium silicate is a function of growth of the end-user industries, mainly soap and detergent factories, pulp and paper mills, paint, pigment and adhesive factories. Information obtained from Ethiopian Investment Authority gives strong indication that private investment in the aforementioned industries is bound to grow. Hence, a modest growth rate of 12% would not be unwarranted to forecast future demand. The demand forecast and the unsatisfied demand executed accordingly is shown in Table 3.2.

**Table 3.2**  
**PROJECTED DEMAND FOR SODIUM SILICATE (TONS)**

| <b>Year</b> | <b>Forecasted Demand</b> | <b>Existing Domestic Production</b> | <b>Unsatisfied Demand</b> |
|-------------|--------------------------|-------------------------------------|---------------------------|
| 2013        | 4,137                    | 200                                 | 3,937                     |
| 2014        | 4,633                    | 200                                 | 4,433                     |
| 2015        | 5,189                    | 200                                 | 4,989                     |
| 2016        | 5,812                    | 200                                 | 5,612                     |
| 2017        | 6,510                    | 200                                 | 6,310                     |
| 2018        | 7,291                    | 200                                 | 7,091                     |
| 2019        | 8,166                    | 200                                 | 7,966                     |
| 2020        | 9,146                    | 200                                 | 8,946                     |
| 2022        | 11,472                   | 200                                 | 11,272                    |
| 2023        | 12,849                   | 200                                 | 12,649                    |

As could be seen from Table 3.2 if other domestic producers are not established, the unsatisfied demand for sodium silicate will grow from 3,793 tons in the year 2013 to 7,091 tons and 12,649 tons by the years 2018 and year 2023, respectively.

### **3. Pricing and Distribution**

Average CIF price of imported sodium silicate in the year 2011 is also found to be Birr 5,987 per ton. To be competitive with the imported as well as the existing local producer the recommended factory gate price is Birr 6,500 per ton.

Sodium silicate is sold directly to the consuming industries by Gullele Soap Factory. For the envisaged project, it is thus recommended either to establish a new trade channel by using the existing industrial input dealers wherever it is possible or distribute directly to the consuming industries by establishing its own store or commercial agent at major strategic towns.

## **B. PLANT CAPACITY AND PRODUCTION PROGRAM**

### **1. Plant Capacity**

Based on the market study and nature of the plant, a capacity of 4.5 tons per day is considered. On the basis of three shifts of 8 hours per day and 300 days per annum, the total annual production would then be 4,050 tons of sodium silicate.

### **2. Production Program**

Table 3.3 shows the production program of the envisaged project. It is prepared based on the selected plant capacity and expected market share to be captured by the project. At the initial stage of production, the plant may require some years to penetrate into the market. Therefore, the plant initially will operate at 75% of its rated annual capacity. During the second year the plant will operate at 85%, reaching 100% of capacity utilization in the third year and thereafter.

**Table 3.3**  
**PRODUCTION PROGRAM**

| <b>Year of Production</b> | <b>1<sup>st</sup></b> | <b>2<sup>nd</sup></b> | <b>3<sup>rd</sup>-10<sup>th</sup></b> |
|---------------------------|-----------------------|-----------------------|---------------------------------------|
| Sodium silicate(tons)     | 3,037.5               | 3,442.5               | 4,050                                 |
| Capacity utilization (%)  | 75                    | 85                    | 100                                   |

## **IV MATERIALS AND INPTUS**

### **A. RAW MATERIALS**

The major raw materials required for the production of sodium silicate are soda ash and silica sand. Soda ash will be supplied from Abijata Soda Ash Share Company and that of Silica sand from mugher valley. The total annual cost of raw material is estimated at Birr 14,107,500. The annual requirement for raw materials at 100% capacity utilization and associated estimated cost are given in Table 4.1.



**Table 4.1****ANNUAL RAW MATERIAL REQUIREMENT AND COST**

| <b>Sr. No.</b> | <b>Description</b> | <b>Quantity (Tons)</b> | <b>Unit Cost (Birr)</b> | <b>Cost ('000 Birr)</b> |
|----------------|--------------------|------------------------|-------------------------|-------------------------|
| 1              | Soda Ash           | 3,375                  | 4,000                   | 13,500.0                |
| 2              | Silica Sand        | 2,025                  | 300                     | 607.5                   |
|                | <b>Total</b>       |                        |                         | <b>14,107.5</b>         |

**B. UTILITIES**

Electricity, water and furnace oil are the major utilities required by the plant. The total annual cost of utility is estimated at Birr 4,566,532.5. The total annual requirement at 100% capacity utilization rate and the estimated costs are given in Table 4.2.

**Table 4.2****UTILITIES REQUIREMENT AND ESTIMATED COST**

| <b>Sr. No.</b> | <b>Description</b> | <b>UOM</b>     | <b>Quantity</b> | <b>Cost ( Birr)</b> |
|----------------|--------------------|----------------|-----------------|---------------------|
| 1              | Electricity        | KWh            | 112,125         | 65,032.5            |
| 2              | Furnace Oil        | lt             | 300,000         | 4,464,000.0         |
| 3              | Water              | M <sup>3</sup> | 3,750           | 37,500.0            |
|                | <b>Total</b>       |                |                 | <b>4,566,532.5</b>  |

**V. TECHNOLOGY AND ENGINEERING****A. TECHNOLOGY****1. Production Process**

The production of sodium silicate involves the following process steps.

**Step 1 - Cullet production**

Sodium silicates are manufactured by fusing  $\text{Na}_2\text{CO}_3$  and specially selected silica sands at 1100 - 1200°C. The resulting product is an amorphous glass (commonly called cullet) which can be dissolved to produce hydrated sodium silicate in a variety of forms.

The fusing of  $\text{Na}_2\text{CO}_3$  and silica is carried out to produce a cullet with a specific  $\text{SiO}_2/\text{Na}_2\text{O}$  ratio.

**Step 2 - Conversion to water glass**

The cullet prepared in the above process is fed into the reactor which is then sealed. Process water and steam are then fed into the reactor under pressure and the solid cullet begins to dissolve. Steam and process water are continually fed into the reactor until the cullet has dissolved and the required concentration of the soluble sodium silicate has been reached.

**Step 3 - Ratio alteration**

The soluble sodium silicate is then transferred to an intermediate tank where it is cooled and again transferred to storage. At this point solid sodium hydroxide may be added to produce soluble silicates with lower  $\text{SiO}_2/\text{Na}_2\text{O}$  ratios.

The product is analyzed for  $\text{Na}_2\text{O}$  and  $\text{SiO}_2$  content to calculate its mean weight ratio, total solids, specific gravity and viscosity in the laboratory before being dispatched to customers in 200L drums or bulk tankers.

**2. Environmental Impact Assessment**

Soluble silicates are derived from, and ultimately return to nature, as silica ( $\text{SiO}_2$ ) and soluble sodium compounds. Since these are among the Earth's most common chemical components they offer minimum potential for harmful environmental effects. The process described produces no effluent or by-products and any spills are contained and pumped to be either reused in the process or go to the effluent system on site.

## B. ENGINEERING

### 1. Machinery and Equipment

The total cost of machinery is estimated at Birr 8,296,640, of which Birr 5,807,648 is required in foreign currency. The list of major machinery and equipment for production of sodium silicate is indicated in Table 5.1.

**Table 5.1**

**LIST OF MACHINERY AND EQUIPMENT REQUIRED**

| <b>Sr. No.</b> | <b>Description</b> | <b>UOM</b> | <b>Qty.</b> |
|----------------|--------------------|------------|-------------|
| 1              | Furnace            | Pcs        | 1           |
| 2              | Autoclave          | Pcs        | 1           |
| 3              | Crusher            | Pcs        | 1           |
| 4              | Grinder            | Pcs        | 1           |
| 5              | Tank               | Pcs        | 1           |
| 6              | Pump               | Pcs        | 2           |
| 7              | Boiler             | Pcs        | 2           |
| 8              | Generator          | Pcs        | 1           |
| 9              | Weighing Hoppers   | Pcs        | 2           |

### 2. Land, Building and Civil Works

The total area requirement of the project is 1,200 m<sup>2</sup>, of which 800 m<sup>2</sup> is a built-up area. The cost of building of which at unit cost of Birr 5,000 per m<sup>2</sup> is, thus, estimated at Birr 4,000,000.

According to the Federal Legislation on the Lease Holding of Urban Land (Proclamation No 721/2004) 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 below 5,000 m<sup>2</sup>, 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<sup>2</sup>, 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.

Moreover, the Addis Ababa City Administration has recently adopted a new land lease floor price for plots in the city. The new prices will be used as a benchmark for plots that are going to be auctioned by the city government or transferred under the new "Urban Lands Lease Holding Proclamation."

The new regulation classified the city into three zones. The first Zone is Central Market District Zone, which is classified in five levels and the floor land lease price ranges from Birr 1,686 to Birr 894 per m<sup>2</sup>. The rate for Central Market District Zone will be applicable in most areas of the city that are considered to be main business areas that entertain high level of business activities.

The second zone, Transitional Zone, will also have five levels and the floor land lease price ranges from Birr 1,035 to Birr 555 per m<sup>2</sup>. This zone includes places that are surrounding the city and are occupied by mainly residential units and industries.

The last and the third zone, Expansion Zone, is classified into four levels and covers areas that are considered to be in the outskirts of the city, where the city is expected to expand in the future. The floor land lease price in the Expansion Zone ranges from Birr 355 to Birr 191 per m<sup>2</sup> (see Table 5.2).

**Table 5.2**

**NEW LAND LEASE FLOOR PRICE FOR PLOTS IN ADDIS ABABA**

| <b>Zone</b>             | <b>Level</b>    | <b>Floor Price/m<sup>2</sup></b> |
|-------------------------|-----------------|----------------------------------|
| Central Market District | 1 <sup>st</sup> | 1686                             |
|                         | 2 <sup>nd</sup> | 1535                             |
|                         | 3 <sup>rd</sup> | 1323                             |
|                         | 4 <sup>th</sup> | 1085                             |
|                         | 5 <sup>th</sup> | 894                              |
| Transitional zone       | 1 <sup>st</sup> | 1035                             |
|                         | 2 <sup>nd</sup> | 935                              |
|                         | 3 <sup>rd</sup> | 809                              |
|                         | 4 <sup>th</sup> | 685                              |
|                         | 5 <sup>th</sup> | 555                              |
| Expansion zone          | 1 <sup>st</sup> | 355                              |
|                         | 2 <sup>nd</sup> | 299                              |
|                         | 3 <sup>rd</sup> | 217                              |
|                         | 4 <sup>th</sup> | 191                              |

Accordingly, in order to estimate the land lease cost of the project profiles it is assumed that all new manufacturing projects will be located in industrial zones located in expansion zones. Therefore, for the profile a land lease rate of Birr 266 per m<sup>2</sup> which is equivalent to the average floor price of plots located in expansion zone 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 criteria are creation of job opportunity, foreign exchange saving, investment capital and land utilization tendency etc. Accordingly, Table 5.3 shows incentives for lease payment.

**Table 5.3**

**INCENTIVES FOR LEASE PAYMENT OF INDUSTRIAL PROJECTS**

| <b>Scored Point</b> | <b>Grace Period</b> | <b>Payment Completion Period</b> | <b>Down Payment</b> |
|---------------------|---------------------|----------------------------------|---------------------|
| 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 land lease period for industry is 60 years.

Accordingly, the total land lease cost at a rate of Birr 266 per m<sup>2</sup> is estimated at Birr 319,200 of which 10% or Birr 31,920 will be paid in advance. The remaining Birr 287,280 will be paid in equal installments with in 28 years i.e. Birr 10,260 annually.

## VI HUMAN RESOURCE AND TRAINING REQUIREMENT

### A. HUMAN RESOURCE REQUIREMENT

The total human resource required by the plant is 30 persons. The total annual cost of labor is estimated at Birr 537,000. Details of manpower requirement are given in Table 6.1.

**Table 6.1**  
**MANPOWER REQUIREMENT AND ANNUAL LABOR COST**

| Sr. No. | Job Title                                   | No. of Person | Salary (Birr)  |                |
|---------|---|---------------|----------------|----------------|
|         |   |               | Monthly Salary | Annual Salary  |
| 1       | Plant Manager                               | 1             | 5,000          | 60,000         |
| 2       | Chemist                                     | 3             | 4,500          | 54,000         |
| 3       | Secretary                                   | 1             | 1,200          | 14,400         |
| 4       | Salesman                                    | 1             | 2,000          | 24,000         |
| 5       | Accountant                                  | 1             | 2,000          | 24,000         |
| 6       | Personnel                                   | 1             | 1,500          | 18,000         |
| 7       | Shift Leader                                | 3             | 3,600          | 43,200         |
| 8       | Operator                                    | 9             | 8,100          | 97,200         |
| 9       | Store Keeper                                | 1             | 900            | 10800          |
| 10      | Purchaser                                   | 1             | 2,000          | 24,000         |
| 11      | Mechanic                                    | 2             | 2,400          | 28,800         |
| 12      | Driver                                      | 2             | 1000           | 12000          |
| 13      | Guard                                       | 4             | 1,600          | 19,200         |
|         | <b>Sub- total</b>                           | <b>30</b>     | <b>35,800</b>  | <b>429,600</b> |
|         | Employees' Benefit<br>(25% of Basic Salary) |               | 8,950          | 107,400        |
|         | <b>Total</b>                                |               | <b>44,750</b>  | <b>537,000</b> |

## **B. TRAINING REQUIREMENT**

Nine operators and shift leaders should be given two weeks on -the-job training during plant erection and commissioning by the experts of the machinery supplier. The cost of training is estimated at Birr 45,000.

## **VII. FINANCIAL ANALYSIS**

The financial analysis of the sodium silicate 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           | 3 years                |
| Bank interest          | 10%                    |
| Discount cash flow     | 10%                    |
| 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 19.01 million (see Table 7.1). From the total investment cost, the highest share (Birr 13.53 million or 71.15%) is accounted by fixed investment cost followed by initial working capital (3.63 million or 19.10%) and pre operation cost (Birr 1.85 million or 9.75%). From the total investment cost Birr 5.80 million or 30.54% is required in foreign currency.



**Table 7.1**  
**INITIAL INVESTMENT COST ( '000 Birr)**

| Sr. No   | Cost Items                     | Local Cost       | Foreign Cost    | Total Cost       | % Share      |
|----------|--------------------------------|------------------|-----------------|------------------|--------------|
| <b>1</b> | <b>Fixed investment</b>        |                  |                 |                  |              |
| 1.1      | Land Lease                     | 31.92            |                 | 31.92            | 0.17         |
| 1.2      | Building and civil work        | 4,000.00         |                 | 4,000.00         | 21.04        |
| 1.3      | Machinery and equipment        | 2,488.99         | 5,807.65        | 8,296.64         | 43.63        |
| 1.4      | Vehicles                       | 900.00           |                 | 900.00           | 4.73         |
| 1.5      | Office furniture and equipment | 300.00           |                 | 300.00           | 1.58         |
|          | <b>Sub total</b>               | <b>7,720.91</b>  | <b>5,807.65</b> | <b>13,528.56</b> | <b>71.15</b> |
| <b>2</b> | <b>Pre operating cost *</b>    |                  |                 |                  |              |
| 2.1      | Pre operating cost             | 609.83           |                 | 609.83           | 3.21         |
| 2.2      | Interest during construction   | 1,243.95         |                 | 1,243.95         | 6.54         |
|          | <b>Sub total</b>               | <b>1,853.78</b>  |                 | <b>1,853.78</b>  | <b>9.75</b>  |
| <b>3</b> | <b>Working capital **</b>      | <b>3,632.33</b>  |                 | <b>3,632.33</b>  | <b>19.10</b> |
|          | <b>Grand Total</b>             | <b>13,207.02</b> | <b>5,807.65</b> | <b>19,014.67</b> | <b>100</b>   |

\* *N.B Pre operating cost include project implementation cost such as installation, startup, commissioning, project engineering, project management etc and capitalized interest during construction.*

\*\* *The total working capital required at full capacity operation is Birr 2.87 million. However, only the initial working capital of Birr 2.12 million during the first year of production is assumed to be funded through external sources. During the remaining years the working capital requirement will be financed by funds to be generated internally (for detail working capital requirement see Appendix 7.A.1).*

## **B. PRODUCTION COST**

The annual production cost at full operation capacity is estimated at Birr 23.55million (see Table 7.2). The cost of raw material account for 59.90% of the production cost. The other major components of the production cost are utility, depreciation and financial cost, which account for 19.39%, 9.13% and 4.36%, respectively. The remaining 7.22% is the share of repair and maintenance, labor overhead and administration cost. For detail production cost see Appendix 7.A.2.

**Table 7.2****ANNUAL PRODUCTION COST AT FULL CAPACITY (YEAR FOUR)**

| <b>Items</b>                       | <b>Cost<br/>(in 000 Birr)</b> | <b>%</b>      |
|------------------------------------|-------------------------------|---------------|
| Raw Material and Inputs            | 14,108                        | 59.90         |
| Utilities                          | 4,567                         | 19.39         |
| Maintenance and repair             | 415                           | 1.82          |
| Labor direct                       | 430                           | 1.82          |
| Labor overheads                    | 107                           | 0.46          |
| Administration Costs               | 250                           | 1.06          |
| Land lease cost                    | 0                             | 0.00          |
| Cost of marketing and distribution | 500                           | 2.12          |
| <b>Total Operating Costs</b>       | <b>20,376</b>                 | <b>86.51</b>  |
| Depreciation                       | 2,151                         | 9.13          |
| Cost of Finance                    | 1,026                         | 4.36          |
| <b>Total Production Cost</b>       | <b>23,553</b>                 | <b>100.00</b> |

**C. FINANCIAL EVALUATION****1. Profitability**

Based on the projected profit and loss statement, the project will generate a profit throughout its operation life. Annual net profit after tax will grow from Birr 1.94 million to Birr 4.02 million during the life of the project. Moreover, at the end of the project life the accumulated net cash flow amounts to Birr 38.46 million. For profit and loss statement and cash flow projection see Appendix 7.A.3 and 7.A.4, respectively.

**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 for capacity utilization and sales value estimated by using income statement projection are computed as followed.

$$\text{Break -Even Sales Value} = \frac{\text{Fixed Cost} + \text{Financial Cost}}{\text{Variable Margin ratio (\%)}} = \text{Birr } 11,056,500$$

$$\text{Break - Even Capacity utilization} = \frac{\text{Break - even Sales Value}}{\text{Sales revenue}} \times 100 = 41.11\%$$

### 4. Pay-back Period

The pay- back period, also called pay – off period is defined as the period required for recovering 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 3 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 project is computed to be 28.06% indicating the viability 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 principle, a project is accepted if the NPV is non-negative.

Accordingly, the net present value of the project at 10% discount rate is found to be Birr 16.93 million which is acceptable. For detail discounted cash flow see Appendix 7.A.5.

## **D. ECONOMIC AND SOCIAL BENEFITS**

The project can create employment for 30 persons. The project will generate Birr 9.82 million in terms of tax revenue and also generates income for the Government in terms of tax payroll tax. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports. The project will also create forward and back ward linkage with the manufacturing sector

**Appendix 7.A**

**FINANCIAL ANALYSES SUPPORTING TABLES**



**Appendix 7.A.2**  
**PRODUCTION COST ( in 000 Birr)**

| Item                               | Year 2        | Year 3        | Year 4        | Year 5        | Year 6        | Year 7        | Year 8        | Year 9        | Year 10       | Year 11       |
|------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Raw Material and Inputs            | 9,875         | 11,286        | 12,697        | 14,108        | 14,108        | 14,108        | 14,108        | 14,108        | 14,108        | 14,108        |
| Utilities                          | 3,197         | 3,653         | 4,110         | 4,567         | 4,567         | 4,567         | 4,567         | 4,567         | 4,567         | 4,567         |
| Maintenance and repair             | 290           | 332           | 373           | 415           | 415           | 415           | 415           | 415           | 415           | 415           |
| Labour direct                      | 301           | 344           | 387           | 430           | 430           | 430           | 430           | 430           | 430           | 430           |
| Labour overheads                   | 75            | 86            | 97            | 107           | 107           | 107           | 107           | 107           | 107           | 107           |
| Administration Costs               | 175           | 200           | 225           | 250           | 250           | 250           | 250           | 250           | 250           | 250           |
| Land lease cost                    | 0             | 0             | 0             | 0             | 10            | 10            | 10            | 10            | 10            | 10            |
| Cost of marketing and distribution | 500           | 500           | 500           | 500           | 500           | 500           | 500           | 500           | 500           | 500           |
| <b>Total Operating Costs</b>       | <b>14,413</b> | <b>16,401</b> | <b>18,388</b> | <b>20,376</b> | <b>20,386</b> | <b>20,386</b> | <b>20,386</b> | <b>20,386</b> | <b>20,386</b> | <b>20,386</b> |
| Depreciation                       | 2,151         | 2,151         | 2,151         | 2,151         | 2,151         | 190           | 190           | 190           | 190           | 190           |
| Cost of Finance                    | 0             | 1,368         | 1,197         | 1,026         | 855           | 684           | 513           | 342           | 171           | 0             |
| <b>Total Production Cost</b>       | <b>16,564</b> | <b>19,920</b> | <b>21,737</b> | <b>23,553</b> | <b>23,393</b> | <b>21,260</b> | <b>21,089</b> | <b>20,918</b> | <b>20,747</b> | <b>20,576</b> |

**Appendix 7.A.3**  
**INCOME STATEMENT ( in 000 Birr)**

| Item                      | Year<br>2    | Year<br>3    | Year<br>4    | Year<br>5    | Year<br>6    | Year<br>7    | Year<br>8    | Year<br>9    | Year 10      | Year 11      |
|---------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| Sales revenue             | 19,744       | 22,376       | 26,325       | 26,325       | 26,325       | 26,325       | 26,325       | 26,325       | 26,325       | 26,325       |
| Less variable costs       | 13,913       | 15,901       | 17,888       | 19,876       | 19,876       | 19,876       | 19,876       | 19,876       | 19,876       | 19,876       |
| <b>VARIABLE MARGIN</b>    | <b>5,831</b> | <b>6,476</b> | <b>8,437</b> | <b>6,449</b> | <b>6,449</b> | <b>6,449</b> | <b>6,449</b> | <b>6,449</b> | <b>6,449</b> | <b>6,449</b> |
| in % of sales revenue     | 29.53        | 28.94        | 32.05        | 24.50        | 24.50        | 24.50        | 24.50        | 24.50        | 24.50        | 24.50        |
| Less fixed costs          | 2,651        | 2,651        | 2,651        | 2,651        | 2,662        | 700          | 700          | 700          | 700          | 700          |
| <b>OPERATIONAL MARGIN</b> | <b>3,179</b> | <b>3,824</b> | <b>5,785</b> | <b>3,798</b> | <b>3,788</b> | <b>5,749</b> | <b>5,749</b> | <b>5,749</b> | <b>5,749</b> | <b>5,749</b> |
| in % of sales revenue     | 16.10        | 17.09        | 21.98        | 14.43        | 14.39        | 21.84        | 21.84        | 21.84        | 21.84        | 21.84        |
| Financial costs           |              | 1,368        | 1,197        | 1,026        | 855          | 684          | 513          | 342          | 171          | 0            |
| <b>GROSS PROFIT</b>       | <b>3,179</b> | <b>2,456</b> | <b>4,588</b> | <b>2,772</b> | <b>2,932</b> | <b>5,065</b> | <b>5,236</b> | <b>5,407</b> | <b>5,578</b> | <b>5,749</b> |
| in % of sales revenue     | 16.10        | 10.98        | 17.43        | 10.53        | 11.14        | 19.24        | 19.89        | 20.54        | 21.19        | 21.84        |
| Income (corporate) tax    | 0            | 0            | 0            | 831          | 880          | 1,519        | 1,571        | 1,622        | 1,673        | 1,725        |
| <b>NET PROFIT</b>         | <b>3,179</b> | <b>2,456</b> | <b>4,588</b> | <b>1,940</b> | <b>2,053</b> | <b>3,545</b> | <b>3,665</b> | <b>3,785</b> | <b>3,904</b> | <b>4,024</b> |
| in % of sales revenue     | 16.10        | 10.98        | 17.43        | 7.37         | 7.80         | 13.47        | 13.92        | 14.38        | 14.83        | 15.29        |



**Appendix 7.A.4**  
**CASH FLOW FOR FINANCIAL MANAGEMENT ( in 000 Birr)**

| Item                            | Year 1        | Year 2        | Year 3        | Year 4        | Year 5        | Year 6        | Year 7        | Year 8        | Year 9        | Year 10       | Year 11       | Scrap         |
|---------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| <b>TOTAL CASH INFLOW</b>        | <b>14,138</b> | <b>24,669</b> | <b>22,383</b> | <b>26,332</b> | <b>26,325</b> | <b>26,325</b> | <b>26,325</b> | <b>26,325</b> | <b>26,325</b> | <b>26,325</b> | <b>26,325</b> | <b>8,848</b>  |
| Inflow funds                    | 14,138        | 4,926         | 7             | 7             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             |
| Inflow operation                | 0             | 19,744        | 22,376        | 26,325        | 26,325        | 26,325        | 26,325        | 26,325        | 26,325        | 26,325        | 26,325        | 0             |
| Other income                    | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 8,848         |
| <b>TOTAL CASH OUTFLOW</b>       | <b>14,138</b> | <b>19,339</b> | <b>19,999</b> | <b>21,816</b> | <b>24,464</b> | <b>23,832</b> | <b>24,300</b> | <b>24,180</b> | <b>24,061</b> | <b>23,941</b> | <b>22,111</b> | <b>0</b>      |
| Increase in fixed assets        | 14,138        | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             |
| Increase in current assets      | 0             | 3,682         | 520           | 520           | 520           | 1             | 0             | 0             | 0             | 0             | 0             | 0             |
| Operating costs                 | 0             | 13,913        | 15,901        | 17,888        | 19,876        | 19,886        | 19,886        | 19,886        | 19,886        | 19,886        | 19,886        | 0             |
| Marketing and Distribution cost | 0             | 500           | 500           | 500           | 500           | 500           | 500           | 500           | 500           | 500           | 500           | 0             |
| Income tax                      | 0             | 0             | 0             | 0             | 831           | 880           | 1,519         | 1,571         | 1,622         | 1,673         | 1,725         | 0             |
| Financial costs                 | 0             | 1,244         | 1,368         | 1,197         | 1,026         | 855           | 684           | 513           | 342           | 171           | 0             | 0             |
| Loan repayment                  | 0             | 0             | 1,710         | 1,710         | 1,710         | 1,710         | 1,710         | 1,710         | 1,710         | 1,710         | 0             | 0             |
| <b>SURPLUS (DEFICIT)</b>        | <b>0</b>      | <b>5,331</b>  | <b>2,384</b>  | <b>4,516</b>  | <b>1,861</b>  | <b>2,493</b>  | <b>2,025</b>  | <b>2,145</b>  | <b>2,264</b>  | <b>2,384</b>  | <b>4,214</b>  | <b>8,848</b>  |
| <b>CUMULATIVE CASH BALANCE</b>  | <b>0</b>      | <b>5,331</b>  | <b>7,715</b>  | <b>12,231</b> | <b>14,092</b> | <b>16,584</b> | <b>18,609</b> | <b>20,754</b> | <b>23,018</b> | <b>25,402</b> | <b>29,616</b> | <b>38,464</b> |

**Appendix 7.A.5**  
**DISCOUNTED CASH FLOW ( in 000 Birr)**

| Item                            | Year 1         | Year 2        | Year 3        | Year 4        | Year 5        | Year 6        | Year 7        | Year 8        | Year 9        | Year 10       | Year 11       | Scrap         |
|---------------------------------|----------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| <b>TOTAL CASH INFLOW</b>        | <b>0</b>       | <b>19,744</b> | <b>22,376</b> | <b>26,325</b> | <b>26,325</b> | <b>26,325</b> | <b>26,325</b> | <b>26,325</b> | <b>26,325</b> | <b>26,325</b> | <b>26,325</b> | <b>8,848</b>  |
| Inflow operation                | 0              | 19,744        | 22,376        | 26,325        | 26,325        | 26,325        | 26,325        | 26,325        | 26,325        | 26,325        | 26,325        | 0             |
| Other income                    | 0              | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 8,848         |
| <b>TOTAL CASH OUTFLOW</b>       | <b>17,771</b>  | <b>14,926</b> | <b>16,914</b> | <b>18,901</b> | <b>21,208</b> | <b>21,266</b> | <b>21,906</b> | <b>21,957</b> | <b>22,008</b> | <b>22,059</b> | <b>22,111</b> | <b>0</b>      |
| Increase in fixed assets        | 14,138         | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             | 0             |
| Increase in net working capital | 3,632          | 513           | 513           | 513           | 1             | 0             | 0             | 0             | 0             | 0             | 0             | 0             |
| Operating costs                 | 0              | 13,913        | 15,901        | 17,888        | 19,876        | 19,886        | 19,886        | 19,886        | 19,886        | 19,886        | 19,886        | 0             |
| Marketing and Distribution cost | 0              | 500           | 500           | 500           | 500           | 500           | 500           | 500           | 500           | 500           | 500           | 0             |
| Income (corporate) tax          |                | 0             | 0             | 0             | 831           | 880           | 1,519         | 1,571         | 1,622         | 1,673         | 1,725         | 0             |
| <b>NET CASH FLOW</b>            | <b>-17,771</b> | <b>4,818</b>  | <b>5,463</b>  | <b>7,424</b>  | <b>5,117</b>  | <b>5,059</b>  | <b>4,419</b>  | <b>4,368</b>  | <b>4,317</b>  | <b>4,266</b>  | <b>4,214</b>  | <b>8,848</b>  |
| <b>CUMULATIVE NET CASH FLOW</b> | <b>-17,771</b> | <b>12,953</b> | <b>-7,490</b> | <b>-67</b>    | <b>5,050</b>  | <b>10,109</b> | <b>14,529</b> | <b>18,897</b> | <b>23,214</b> | <b>27,479</b> | <b>31,694</b> | <b>40,542</b> |
| Net present value               | -17,771        | 4,380         | 4,515         | 5,578         | 3,495         | 3,141         | 2,495         | 2,242         | 2,014         | 1,809         | 1,625         | 3,411         |
| Cumulative net present value    | -17,771        | 13,391        | -8,876        | -3,299        | 196           | 3,337         | 5,832         | 8,074         | 10,087        | 11,896        | 13,521        | 16,932        |

NET PRESENT VALUE                   16,932  
INTERNAL RATE OF RETURN       28.06%  
NORMAL PAYBACK                       3 years

