# PROFILE ON LIME PRODUCTION

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## I. SUMMARY

This profile envisages the establishment of a plant for the production of 10,000 tonnes of lime per annum.

The present demand for the proposed product is estimated to be 28,000 tonnes per annum and it is projected to reach 79,504 tonnes by the year 2010.

The plant will create employment opportunity for 34 persons. The total investment requirement is estimated at about Birr 17.47 million, out of which Birr 13.26 million is for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 16% and net present value ( NPV) of Birr 4.72 million, discounted at 10.5%.

## II. PRODUCT DESCRIPTION AND APPLICATION

Lime is inorganic chemical compound which is usually known as quick lime or unslaked lime obtained from a naturally occurring compound called limestone. Quick lime which is chemically expressed as calcium oxide, a strong caustic ingredient widely used in construction industry in the preparation of mortar and plasters.

It is also used for white washing of houses and building. Iron and steel plants and foundries use lime as fluxing agent in considerable quantities. Some drugs and pharmaceuticals, paper mills, pesticides formulation plants, and other chemical processing industries use it as additives. Moreover, it has a considerable contribution in agriculture as an agent for removal of excess soil acidity.

# III. MARKET STUDY AND PLANT CAPACITY

## A. MARKET STUDY

### 1. Present Supply & Demand

#### a) Supply of Lime

The current source of supply of lime to the domestic market are Dire Dawa Cement and Lime Factory, Ethio Llime Factory of Senkele, the Caustic Soda lime unit and the Wonji Shoa Sugar Estates supplemented with small quantity of imports. The Caustic Soda and the Showa Sugar Estates lime factories mainly produce for their own use, while the remaining two are primarily producing for the market. Dire Dawa Cement and Lime Factory mainly concentrates on production of cement and allocates only part of its capacity for production of lime. In addition to the above, the Ethiopian Educational Materials Production and Distribution Enterprise (EMPEDA) using its chalk production unit, produces small quantity of masonry lime for the market. As the major function of this unit is chalk production, only small proportion is allocated to masonry lime production.

There are small producer of lime in a traditional method scattered all over the country and such producers are also available around Negele. The contribution of traditional suppliers to the local market is quite small and the major source of supply are those factories which use the modern firing system.

Available statistics however, does not capture the total domestic supply of lime. Table 3.1 shows information from official document.

**Table 3.1**

**SUPPLY OF LIME (TONNES )**

| Year | Local production | Import % | Total % | Percentage charge |
|---|---|---|---|---|
| 1991/91 | 3680 | - | 3680 | -- |
| 1991/92 | 3680 | - | 3680 | -- |
| 1992/93 | 3680 | 102.0 | 3782 | 2.8 |
| 1993/94 | 2,727 | 6.0 | 2,733 | (27.7) |
| 1994.95 | 4,935 | - | 4,935 | 80.5 |
| 1995/96 | 7.207 | 10.0 | 7,212 | 46.4 |
| 1996/97 | 7,332 | 13.0 | 7,345 | 1.8 |
| 1997/98 | 6,619 | 0.3 | 6,619 | (9.9) |
| **Total** | **39,860** | **131.3** | | **93.9** |
| **Average** | **4982.5** | **16.4** | **4998.9** | **11.7** |

**Source**: CSA: Statistical abstract and survey of manufacturing industries for local production and Customs Authorities External Trade Statistics for imports.

As can be seen from Table 3.1, the average local production in the period under review is 4,982.5 tonnes, while import stands at 16.4 tonnes.

Information obtained from CSA may refer to production of a single plant. Data obtained from the factories indicate that, Ethiopian Lime Facotry annually produces 4,500 tonnes on the average. Dire Dawa Ccement and Lime Factory has been annually producing 3,000 tonnes on the average and Wonji Showa with similar amount of annual production. This brings annual domestic supply to 10,000 tonnes.

**b) Demand**

The present users of lime are the building construction sector, tanneries, sugar industries, chemical industries, textile mills, water & sewerage treatment plants, etc. In addition to industrial applications, lime has also important application in agricultural sector. It is used as a neutralizing agent in irrigated agriculture where soils are affected by acidity. The gold mine industries also apply lime in certain process. In general lime has wider application and hence has a growing demand in the industrial, agricultural, construction and mining sectors.

Lime has the following important uses in each sector:-

- **Use of lime in building construction**

Lime is used as a binder for bedding bricks and blocks in wall construction until it was partly replaced by portland cement. Its cohesiveness, plasticity, strength, etc. render it suitable as a mortar material for plastering and block and masonry works.

- **Use of lime in water and sewerage treatment**

Potable water should be colourless, free from suspended impurities and should not contain dissolved impurities hazardous to health. This is partially achieved by the treatment of the raw water with lime. Lime treatment reduces the acidity in water and clears the water by settling out cloudy suspensions.

- **Use of lime in Chemical Industries**

The biggest chemical use of lime is in the production of caustic soda and other alkalis. Much lime is also used to prepare precipitated calcium carbonate which is used as filler material for papers, paints, rubber and pharmaceutical. Acetylene gas and calcium cyananide fertilizers are made from calcium carbide, which itself is made from lime and coke.

- **Use of lime in sugar industries**

The addition of lime milk to crude sugar extract allows the insoluble compounds to precipitate and to leave behind the socehasate solutions. The solution is then treated with carbondioxide, which precipitates the lime as carbonate, to obtain the precipitate sugar solution. Finally, the solution is evaporated to crystallize the sugar. Lime requirement for cane sugar refining may reach up to about 15 kgs per tonnes of sugar produced.

- **Agricultural uses of Limes**

Calcium has a dual function in soil. It is an essential nutrient and is also the dominant base and keeps soils neutral in reaction. If calcium ions which are normally lost by bleaching are not replaced regularly, positively charged hydrogen ion take their place, raising the acidity level of the soil i.e. its $p^H$ falling below the neutral point of $p^H7$.

It alters the structure of soil and leaves in a suitably friable state to be compacted in just a few hours after it is applied. With time the lime can form pozzolanic cement compounds which considerably raise the load bearing capacity of the soils and prevent it from falling apart.

- **Lime use in Metallurgical Industries**

Enormous quantities of high quality lime are required in steel making plant to form the flux which carries away the impurities as a slug. Lime is used with caustic soda in melting aluminum. Substantial amount of lime are used in the preparation of nonferrous metals by the floatation of their ores. The lime acting as a settling agent control the acidity during the process.

Lime is also used in the textile industries.

## 2. Demand Projection

Lime has various application in construction, mining, industry and agriculture. The agricultural sector is not currently using lime but it is a potential market for the product. Other sectors consume lime to a varying degree. Due to limited size of supply and old age of the existing suppliers (Senkle and Dire Dawa Cement and Lime Facotry ) the adequacy and stability of current supply is questionable. Due to lack of dependable supplies, new projects are being forced to install their own lime producing unit as in the case of Caustic Soda Factory which makes project costs quite expensive.

If users operate at their full capacity, the Fincha Sugar Estate and Caustic Soda Factory have a combined demand of 16,000 tonnes/per year. The construction secor, the water treatment plant, the tanneries the gold mine and other users of lime have a combined demand of 12,000 tonnes at current level of production. This brings the current effective demand to 28,000 tonnes.

It is assumed that other than the existing national market, new demands will be generated in the Somali Region if some of the envisaged projects like tanneries, road construction and urban housing construction are implemented by the public and private sectors. Based on the above assumption, the average growth rate (11%) of historical data shown in Table 3.1 has been applied to the current effective demand to project future demand of lime.

**Table 3.2**

**PROJECTED DEMAND AND DEMAND GAP OF LIME**

| Year | Existing Supply | Projected Demand | Demand Gap |
|---|---|---|---|
| 2000 | 10,000 | 28,000 | 18,000 |
| 2001 | 10,000 | 31,080 | 21,080 |
| 2002 | 10,000 | 34,499 | 24,449 |
| 2003 | 10,000 | 38.294 | 28,294 |
| 2004 | 10,000 | 42,506 | 32,506 |
| 2005 | 10,000 | 47,182 | 37,182 |
| 2006 | 10,000 | 52,372 | 42,372 |
| 2007 | 10,000 | 58,133 | 48,133 |
| 2008 | 10,000 | 64,527 | 54,527 |
| 2009 | 10,000 | 71,625 | 61,625 |
| 2010 | 10,000 | 79,504 | 69,504 |

As can be seen from the above table, the total demand of lime will reach 79,504 tonnes by year 2010 from its current level of 28,000 excluding the demand for agricultural sector. The demand gap will grow from the current level of 18,000 tonnes to 69,504 tonnes by year 2010.

## 3. Pricing and Distribution

Currently, the retail price of lime in Jigiga is Birr 120/quintal. Allowing 30% profit mark up for retailers an ex-factory selling price of Birr 84/quintal is proposed for the envisaged project.

The product can be distributed directly from the plant to major users or it can be sold by making use of agents in case of masonry lime.

## B. PLANT CAPACITY AND PRODUCTION PROGRAMME

### 1. Plant Capacity

In determining the plant capacity of the lime production plant the future demands of the product and the economic of scale of the available technologies were taken into consideration. According to the data obtained from the market study, the demand gap for lime raises from 18,000 tonnes to 69,504 tonnes from years 2001 to 2010, respectively.

Hence, based on the demand gap and the minimum economic of scale for lime production, a plant with a capacity of 10,000 tonnes per annum is selected.

### 2. Production Programme

It is assumed that the lime plant will start at 70% in the first year, and then raise its production by 85% in the second year and finally operates at 100% capacity in the third year.

## IV. MATERIALS AND INPUTS

## A. MATERIALS

The principal raw material for the production of lime is lime stone. This raw material is a sedimentary rock dominantly composed of carbonate minerals, particularlly carbonates of calcium and magnesium. The commonly known chemical composition of limestone is calcium oxide, (CaO), and carbon dioxide, ($CO_2$). However, small amounts of impurities such as silica and aluminum may be present in lime stone mineral. Thus, the major raw material for the production of lime at the Somali Region is lime stone, which is one of the largest mineral reserve in the region. Wachile area, which is south of Neghele has an enormous reserve of best quality lime stone known as Jurassic. The annual requirement of this raw material is shown in Table 4.1

**Table 4.1**

**ANNUAL RAW & AUXILIARY MATERIALS REQUIREMENT**

| No. | Description | Qty/year | Cost ' 000 Birr | | |
|---|---|---|---|---|---|
| | | | F | L | T |
| 1 | Lime Stone (tonne) | 18,000 | - | 810 | 810 |
| 2 | Packing material (50 kg bag) | 200,000 pieces | - | 500 | 500 |
| | **Total** | | **--** | **1310** | **1310** |

## B. UTILITIES

The utilities required are fuel oil/Mazut for furnace, electric power for drive of motors, and water for process as well as for general purpose. The annual requirment of these utilities is indicated in Table 4.2

**Table 4.2**

**ANNUAL REQIREMENT OF UTILITIES**

| Description | Qty | Cost '000 Birr | | |
|---|---|---|---|---|
| | | F | L | T |
| 1. Fuel Oil/Mazu/, (tonnes) | 2000 | - | 3150 | 3150 |
| 2. Electricity, (Kwh) | 370,000 | - | 181.3 | 181.3 |
| 3. Water, ($m^3$) | 1250 | - | 1.25 | 1.25 |
| **Total** | | **-** | **3,332.55** | **3,332.55** |

# V. TECHNOLOGY AND ENGINEERING

## A. TECHNOLOGY

### 1. Process Description

The principal unit operation taking place in a lime production is calcination, which is carried out in kilns of appropriate design depending upon the raw materials characteristics. To-date two types of kilns are known. These are vertical shaft kilns and horizontal rotary kilns. For

the envisaged plant a horizontal rotary kiln is found to be appropriate for the calcination process. A quarried or mined lime stone raw material is first crushed and screened to produce the required size before it is fed to the kiln. In the horizontal rotary kiln a decomposition reaction takes place at a high temperature ranging (900-1100) degree centigrade.

The burnt lime stone results into calcium oxide ($C_aO$) and carbondioxide ($CO_2$). The lime thus formed is cooled in drum cooler to about $80^0$c. and then packed for storage or delivery.

## 2. Source of Technology

MOVERS (INDIA) PRIVATE LTD.
BASAVA BHAMAN, HIGH GROUNDS
FAX 91-802263606

The above mentioned company is a leading Indian Company in the manufacture of cement, lime and mineral product producing machinery.

# B. ENGINEERING

## 1. Machinery and Equipment

One of the core machine in lime production is the kiln. Others such as crusher, elevetor, belt conveyor are secondary equipments which argument the kiln by preparing and transporting both the raw and finished materials to and out of the same. The total cost of machinery and equipment is estimated at about Birr 13.26 million, out of which 11.91 million is required in foreign currency. Lists of required machinery and equipment is shown in Table 5.1

## 2. Land, Building and Civil Works

The envisaged plant requires an estimated area of 5000 $m^2$, of which 1000 $m^2$ is built up area. The construction cost of building at a rate of Birr 1,600 per $m^2$ is estimated at about Birr 1.6 million. Lease value of land at a rate of Birr 0.95 per $m^2$ for 95 years amounts to Birr 450,000. Thus, total lease and construction cost is estimated at about Birr 1.95 million.

**Table 5.1**

**LIST OF MACHINERY AND EQUIPMENT**

| Description | Qty. |
|---|---|
| 1. Rotary Kiln | 1 |
| 2. " Cooler | 1 |
| 3. Crusher | 1 |
| 4. Belt Conveyer | 1 |
| 5. Elevetor | 2 |
| 6. Pump | 3 |
| 7. Fan | 2 |
| 8. Mist Eleminator | 1 |
| 9. Venturi | 1 |
| 10. Smoke flue | 2 |
| 11. Curtain chains | |
| 12. Control Instruments | Set |
| 13. Micellaneous equipment & tools | - |
| 14. Fittings | - |

**3. Proposed Location**

Neghele is suggested to be ideal location because of its proximity to raw material deposit and availability of utilities

## VI. MANPOWER AND TRAINING REQUIREMENT

### A. MANPOWER REQUIREMENT

The plant requires both administrative and Technical personnels for its smooth operation thus, the total manpower requirement by type is listed in Table 6.1 below.

**Table 6.1**
**MANPOWER REQUIREMENT AND LABOUR COST**

| Type | Qty. | Salary '000 Birr | |
|---|---|---|---|
| | | Monthly | Annually |
| A. Administrative | | | |
| 1 Manager | 1 | 1800 | 21,600 |
| 2 Secretary | 1 | 350 | 4,200 |
| 3 Accountant | 1 | 700 | 8,400 |
| 4 Store Man | 1 | 500 | 6,000 |
| 5 Guard | 4 | 180 | 8,640 |
| 6 Driver | 1 | 300 | 3,600 |
| **Sub Total** | 9 | | 52,440 |
| B. Technical | | | |
| 1 Production & Technical Head | 1 | 1600 | 19,200 |
| 2 Senior Mechanic | 3 | 1000 | 36,000 |
| 3 Operation /Skilled/ | 6 | 700 | 50,400 |
| 4 Assistant Operators | 3 | 500 | 18,000 |
| 5 Unskilled workers | 9 | 180 | 19,440 |
| 6 Technicians | 3 | 500 | 18,000 |
| **Sub Total** | 25 | | 161,000 |
| **Total (A+B)** | 34 | | 213,440 |
| Benefits 25% | | | 42,688 |
| **Grand Total** | 34 | | 256,128 |

## B. TRAINING REQUIREMENT

Training of key personnels such as the Production & Technical Head and the senior mechanics is very essential. Thus, these staff have to be trained abroad by arranging training programmes with the machinery supplier. The cost of such training has to be covered by the suppliers themselves. The rest of the production and technical personnels can be given on–the-job training during the erection and commissioning period.



## VII. FINANCIAL ANALYSIS

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

| | |
|---|---|
| Construction period | 2 years |
| Source of finance | 30% equity |
| | 70% loan |
| Tax holidays | 2 years |
| Bank interest | 10.5 % |
| Discounted cashflow | 10.5% |
| Land value | based on lease rate of the region |
| Repair and maintenance | 1% plant and machinery |
| Accounts receivable | 30 days |
| Raw material local | 30 days |
| Work in progress | 5 days |
| Finished products | 30 days |
| Cash in hand | 5 days |
| Accounts payable | 30 days |

## A. TOTAL INITIAL INVESTMENT COST

The total initial investment cost of the project including working capital is estimated at about Birr 17.47 million, out of which about 68% will be required in foreign currency. See Table 7.1 for details.

**Table 7.1**

**SUMMARY OF THE INITIAL INVESTMENT COST ('000)**

| No. | Cost Items | Foreign Currency | Local Currency | Total |
|---|---|---|---|---|
| 1 | Land | - | 450.00 | 450.00 |
| 2 | Building and Civil Work | - | 1,600 | 1,600.00 |
| 3 | Plant Machinery and Equipment | 11,909.60 | 1353.60 | 13,266.20 |
| 4 | Office Furniture and Equipment | - | 50.00 | 50.00 |
| 5 | Vehicle | - | 250.00 | 250.00 |
| 6 | Pre-production Expenditure* | - | 1,460.40 | 1,460.40 |
| | **Investment Cost** | **11,909.6** | **5,167.00** | **17,076.60** |
| 7 | Working Capital | | 393.40 | 393.40 |
| | **Total** | **11,909.60** | **5,560.40** | **17,469.90** |

## B. PRODUCTION COST

The annual production cost at full operation capacity of the plant is estimated at Birr 7.63 million (see Table 7.2). The material and utility cost accounts for 61 per cent while repair and maintenance take 1.7 per cent of the production cost.

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** Pre-production expenditure include interest during construction (Birr 1.2 million), cost of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

**Table 7.2**

**ANNUAL PRODUCTION COST ('000 BIRR)**

| Items | Year | | | |
|---|---|---|---|---|
| | 3 | 4 | 7 | 10 |
| Raw Material and Inputs | 917 | 1,113.50 | 1,310.00 | 1,310.00 |
| Labour, direct | 112.73 | 136.88 | 161.04 | 161.04 |
| Utilities | 2,332.79 | 2,832.67 | 3,332.55 | 3,332.55 |
| Energy and power | | | | |
| Spare parts | | | | |
| Maintenance and repair | 92.86 | 112.76 | 132.66 | 132.66 |
| Factory overheads | 29.90 | 36.30 | 42.70 | 42.70 |
| Administration Overheads | 52.40 | 52.40 | 52.40 | 52.40 |
| **Total Operating Costs** | **3,537.70** | **4,284.50** | **5,031.40** | **5,031.40** |
| Depreciation | 1,470.40 | 1,470.40 | 1,470.40 | 1,416.40 |
| Cost of Finance | 1,291.60 | 1,262.20 | 1,123.50 | 938.40 |
| **Total Production Cost** | **6,299.70** | **7,01`8.10** | **7,627.30** | **7,386.10** |

## C. FINANCIAL EVALUATION

### 1. Profitability

According to the projected income statement, the project will start generating profit in the second year of operation. Important ratios such as profit to total sales, net profit to equity (Return on equity) and net profit plus interest on total investment (return on total investment) will show an increasing trend during the life-time of the project.

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

## 2. Break-even Analysis

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

$$BE = \frac{\text{Fixed Cost}}{\text{Sales - Variable Cost}} = 43\%$$

## 3. Pay Back Period

The investment cost and income statement projection are used to project the pay-back period. The project's initial investment will be fully recovered within 8 years.

## 4. Internal Rate of Return and Net Present Value

Based on the cashflow statement, the calculated IRR of the project is 16% and the net present value at 10.5% discount rate is Birr 4.72 million.

# D. ECONOMIC BENEFITS

The project can create employment opportunity for 34 persons. In addition to supply of the domestic needs, the project will generate Birr 7 million interms of tax revenue. Moreover, the Regional Government can collect employment, income tax and sales tax revenue. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports.