

**PROFILE ON CALCIUM CHLORIDE  
PRODUCTION**

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## **I. SUMMARY**

This profile envisages the establishment of a plant for the production of calcium chloride with a capacity of 58 tonnes per annum. The project will also produce 23 tonnes of carbon dioxide as a by product. Calcium chloride has several application such as brine for refrigeration plants, ice and dust control on roads, and in cement production. However, the largest use of calcium chloride is as a starting material for production of calcium carbonate, calcium sulphate and barium chloride.

The raw materials required to produce calcium chloride are lime and hydrochloric acid. Hydrochloric acid has to be imported while lime can be obtained locally.

The demand for calcium chloride is highly influenced with the expansion and development of the user industries. The present demand for the product is estimated at 53 tones per annum. The demand is expected to reach at 137.5 tonnes by the year 2018.

The total investment requirement is estimated at about Birr 5.22 million, out of which Birr 638 thousand is required for plant and machinery. The plant will create employment opportunities for 21 persons.

The project is financially viable with an internal rate of return (IRR) of 16.23 % and a net present value (NPV) of Birr 1.36 million discounted at 8.5%.

The project has a backward and forward linkage effect with the industrial sector. Moreover, such factory will have a foreign exchange saving effect to the country by substituting the current imports.

## II. PRODUCT DESCRIPTION AND APPLICATION

Calcium chloride is an ionic compound of calcium and chlorine. It is highly soluble in water and it is deliquescent. It is a salt that is solid at room temperature and behave as a typical ionic halide. It is generally available in crystals or granules lumps or flakes.

It has several common application such as brine for refrigeration plants, ice and dust control on roads, and in cement the largest use of calcium chloride is because it is the starting material for production of calcium carbonate, calcium sulphate and barium chloride.

## III . MARKET STUDY AND PLANT CAPACITY

### A. MARKET STUDY

#### 1. Past Supply and Present Demand

Calcium chloride has various applications in the manufacturing sector. Up to the present time there is no plant in the country that manufactures calcium chloride. Hence, the entire requirement of calcium chloride is met through import. Import of calcium chloride for the past eight years is shown in Table 3.1.

**Table 3.1**  
**IMPORT OF CALCIUM CHLORIDE (TONNES)**

<b>Year</b>	<b>Imported Quantity</b>
1999	13.4
2000	4.4.
2001	19.3
2002	27.9
2003	17.1
2004	18.2
2005	24.9
2006	66.8

*Source :- Ethiopian Customs Authority, unpublished.*

As could be observed from Table 3.1, the imported quantity of calcium chloride during the period 1999-2006 was very erratic showing a big Jump in one year and a decline in another year. For instance, the imported quantity during 1999 was 13.4 tonnes while it sharply declined to 4.4 tonnes by the year 2000. Again, a big increase has been registered during the two consecutive years, i.e. 2001 and 2003, which was 19.3 tonnes and 27.9 tonnes respectively. But after year 2003 the amount imported has shown a consistent increase. The amount of import which was 17.1 tonnes in the year 2003 has increased to 18.3 tonnes, 24.9 tonnes and 66.8 tonnes by the year 2004, 2005 and 2006, respectively.

In order to estimate the current effective demand the recent two years average has been taken as a base. By taking 46 tonnes as the effective demand for year 2006 and applying a 7% annual average growth (past growth of the manufacturing sector) current effective demand is estimated at 53 tonnes.

## **2. Projected Demand**

The demand for calcium chloride is highly influenced with the expansion and development of the user industries. Considering the future growth of the industrial sector, an annual average growth rate of 10% (which is less than the indicated figure in the PASEDP document) is applied to project the demand (see Table 3.2.).

**Table 3.2**  
**PROJECTED DEMAND FOR CALCIUM CHLORIDE (TONNES)**

<b>Year</b>	<b>Projected Demand</b>
2008	53.0
2009	58.3
2010	64.1
2011	70.5
2012	77.6
2013	85.4
2014	93.9
2015	103.3
2016	113.6
2017	125.0
2018	137.5

Demand for calcium chloride will increase from 53 tonnes in the year 2008 to 77 tonnes and 137 tonnes during year 2012 and year 2018, respectively.

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

Based on the average CIF price and other charges, Birr 35,000 and 17,000 per tonne for calcium chloride and carbon dioxide, respectively is recommended as a factory gate price. The product can be sold directly to the user industries without involving other channels.

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

### **1. Plant Capacity**

The market study has shown that the product is totally imported. Based on the market study the envisaged plant capacity will be 194 kg/day and considering 300 working day per annum, the annual production capacity will be 58 tonnes.

## 2. Production Programme

The plant will utilize 85 % of its capacity in the first year, 95 % of its capacity in the second year and in the third year and onwards will utilize its full capacity. The production programme is shown in the Table 3.2.

**Table 3.2**  
**PRODUCTION PROGRAMME**

Sr. No.	Product	Production Year		
		1	2	3-10
1	Calcium chloride (tonnes)	49	55	58
2	By product Carbon dioxide (tonnes)	19.55	21.85	23
3	Capacity utilization (%)	85	95	100

## IV. MATERIAL AND INPUTS

### A. RAW MATERIALS

The raw materials used for manufacturing calcium chloride are limestone and hydrochloric acid. Lime is locally available abundantly either from Mughar or Caustic Soda Share Company while hydrochloric acid will be imported. The quantity and cost of these raw materials is given in Table 4.1.

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

Sr. No.	Item	Qty (Tonnes)	Unit cost (Birr)	Cost (Birr)		
				L.C	FC	TOTAL
1	Lime (90-95 %)	45	950	42,750	-	42,750
2	Hydrochloric acid (30 %)	150	3,382	101,468.6	405,874	507,343
	<b>Total</b>			<b>144,219</b>	<b>405,874</b>	<b>550,093</b>

## B. UTILITIES

Utilities required for manufacturing calcium chloride includes water, electricity and furnace oil. Quantity required and their cost in local currency is given in Table 4.2.

**Table 4.2**  
**ANNUAL UTILITIES REQUIREMENT AND COST**

Sr. No.	Item	Annual Consumption	Unit of Measure	Total Cost ( Birr)
1	Water	20,000	m <sup>3</sup>	65,000
2	Electricity	31,500	kWh	14,918
3	Furnace oil	50,000	Lt.	292,000
<b>Total</b>				<b>371,918</b>

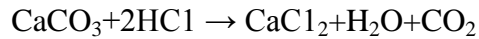


## **V. TECHNOLOGY AND ENGINEERING**

### **A. TECHNOLOGY**

#### **1. Process Description**

Burnt lime is treated with hydrochloric acid to produce calcium chloride. The addition of the acid should be so calculated and adjusted that almost a neutral solution is obtained. The clear solution of calcium chloride is decanted from the top. A portion of calcium chloride solution is taken in evaporators and crystallized in suitable crystallizer.



#### **2. Source of Technology**

A possible machinery supplier's address is shown below.

Ome Sea Interlink private limited  
 A-48, Krishnangar, Opp. Adinathnagar Odhav  
 Ahmedabad Gujrat- 382 415 (India)

#### **3. Environmental Impact**

The production process of calcium chloride is environmental friendly

### **B. ENGINEERING**

#### **1. Machinery and Equipments**

The list of machineries and equipments required by the envisaged plant are shown in Table 5.1.

**Table 5.1****MACHINERIES AND EQUIPMENT REQUIREMENT AND COST**

Sr. No.	Description	Qty.	Cost '000 Birr		
			F.C	L.C	Total
1	Polyethylene buckets	20	116.160	-	116.160
2	Evaporator	2	84.480	-	84.480
3	Crystallizers	2	95.040	-	95.040
4	Tray drier	1 set	184.8	-	184.8
5	Pulverizer	1	47.52	-	47.52
6	Furnace	1	-	110	110
<b>Total</b>			<b>528</b>	<b>110</b>	<b>638</b>

The cost of machineries and equipment is estimated to be Birr 638,000 out of which Birr 528,000 is required in foreign currency.

## **2. Land Building and Civil Works**

The total land requirement for the envisaged plant is estimated at 1000 m<sup>2</sup> out of this 600 m<sup>2</sup> is built-up area. The 350 m<sup>2</sup> area will be covered by production facility, 150m<sup>2</sup> will be covered by stores and 100m<sup>2</sup> will be covered by office building. Cost of building construction at rate of birr 2,400 per m<sup>2</sup> amounts to be Birr 1,440,000 .

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<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.

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<sup>2</sup> in Akakai-Kalti and Birr 341/ m<sup>2</sup> in Lebu and recently the city's Investment Agency has proposed a lease price of Birr 346 per m<sup>2</sup> 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<sup>2</sup> 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 5.2 shows incentives for lease payment.

**Table 5.2**

**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 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<sup>2</sup>, is estimated at Birr 20.76 million of which 10% or Birr 2,076,000 will be paid in advance.

The remaining Birr 18.68 million will be paid in equal installments with in 28 years i.e., Birr 667,286 annually.

## V. MANPOWER AND TRAINING REQUIREMENT

### A. MANPOWER REQUIREMENT

In order to run the envisaged plant efficiently, it needs 21 employees. The estimated cost of manpower is Birr 241,500. The detail of which is shown in the Table 6.1.

**Table 6.2**  
**MAN POWER REQUIREMENT AND ASSOCIATED COST**

<b>Sr. No.</b>	<b>Description</b>	<b>Req. No.</b>	<b>Monthly salary (Birr)</b>	<b>Annual Salary (Birr)</b>
1	Manager	1	3,500	42,000
2	Secretary	1	800	9,600
3	Administration +Finance Head	1	2,00	33,600
4	Accountant	1	1,200	14,400
4	Chemist	1	1,200	14,400
5	Electrician	1	900	10,800
6	Mechanic	1	900	10,800
7	Operators	3	2,700	32,400
8	Laborers	6	2,100	25,200
9	Drivers	1	400	4,800
10	Guards	4	1,400	16,800
	<b>Sub-Total</b>	<b>21</b>		<b>214,800</b>
	Employee's benefit (25%)			53,700
	<b>Total</b>	<b>21</b>		<b>268,500</b>

## B. TRAINING REQUIREMENT

The training of chemists, operators, mechanics and electricians would be essential. It has to be arranged during the erection and commissioning period by machinery suppliers without additional cost.

## VII. FINANCIAL ANALYSIS

The financial analysis of the calcium carbide 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 5.22 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)**

<b>Sr. No.</b>	<b>Cost Items</b>	<b>Local Cost</b>	<b>Foreign Cost</b>	<b>Total Cost</b>
1	Land lease value	2,076.00	-	2,076.00
2	Building and Civil Work	1,440.00	-	1,440.00
3	Plant Machinery and Equipment	110.00	528.00	638.00
4	Office Furniture and Equipment	100.00	-	100.00
5	Vehicle	450.00	-	450.00
6	Pre-production Expenditure*	444.59	-	444.59
7	Working Capital	74.53	-	74.53
	<b>Total Investment cost</b>	<b>4,695.12</b>	<b>528.00</b>	<b>5,223.12</b>

\* *N.B Pre-production expenditure includes interest during construction ( Birr 344.59 thousand) and Birr 100 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 1.67 million (see Table 7.2). The raw material cost accounts for 32.93 per cent of the production cost. The other major components of the production cost are cost of utility, depreciation and financial cost which account for 22.26 %, 12.75% and 14.07%, respectively. The remaining 17.98 % is the share of cost of labour overheads, repair and maintenance, direct labour and other administration cost.

**Table 7.2****ANNUAL PRODUCTION COST AT FULL CAPACITY ('000 BIRR)**

<b>Items</b>	<b>Cost</b>	<b>%</b>
Raw Material and Inputs	550.09	32.93
Utilities	371.92	22.26
Maintenance and repair	31.90	1.91
Labour direct	128.88	7.72
Labour overheads	53.70	3.21
Administration Costs	85.92	5.14
Land lease cost	-	-
<b>Total Operating Costs</b>	<b>1,222.41</b>	<b>73.18</b>
Depreciation	213.00	12.75
Cost of Finance	235.02	14.07
<b>Total Production Cost</b>	<b>1,670.43</b>	<b>100</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 488.26 thousand to Birr 711.40 thousand during the life of the project. Moreover, at the end of the project life the accumulated cash flow amounts to Birr 5.61 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



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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.

$$\text{BE} = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 27 \%$$

### **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 5 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 16.23 % 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 into 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 8.5% discount rate is found to be Birr 1.36 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 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 a forward linkage effect with the industrial sector.