PROJECT PROFILE ON CALCIUM CARBONATE PRODUCTION

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I. Executive summary

This project profile is prepared to assess the viability of running Calcium carbonate manufacturing factory, in Addis Abeba city administration. Hence Market, Technical, Organizational and Financial study was made to investigate the viability of the envisaged project.

This project profile on Calcium carbonate manufacturing factory has been developed to support the decision –making process based on a cost benefit analysis of the actual project viability. This profile includes marketing study, production and financial analysis, which are utilized to assist the decision-makers when determining if the business concept is viable. Ethiopia has a private sector driven chemical industry. According to the latest data sourced from Ethiopian investment commission (EIC) there are more about 7 companies registered to involve in production of calcium carbonate manufacturing. The status of these companies is: all are on pre-implementation, stages.

The location of the plant will be decided on the basis of access to raw materials, infrastructure namely power, water, transport and telecom to easy access to international market. The most locally available raw materials for the factory are limestone.

The factory at full capacity operation can process 45,000 tons of limestone to produce 15,000 tons of precipitated calcium carbonate, per year based on 260 working days and their shifts of 24 hours per day.

The total investment capital including establishing the factory is Birr 220.42 million. Out of the total investment capital, the owners will cover Birr 66.12 million (30 %) while the remaining balances amounting to Birr 154.29 million (70 %) will be secured from bank in the form of term loan.

As indicated in the financial study, the cash flow projection of the project shows surplus from the first year on. The net cash flows of the project range from Birr 42.16 Million in the first year to Birr 62.78 million at the end of the 10^{th} year of operation. At the end of the 10^{th} year of operation period the cumulative cash balance reaches Birr 619million. The Benefit-cost ratio and Net present value (NPV) have been calculated at 17% discount factor (D.F) for 10 years of the project activity. Accordingly, the project has NPV of 359 million Birr at 17%D.F. and the benefit-cost ratio of 1.29 at 17% D.F.

Therefore, from the aforementioned overall market technical and financial analysis we can conclude that the calcium carbonate manufacturing factory business is a viable and worthwhile.

1. BACKGROUND INFORMATION

1.1 Introduction

This document was undertaken to show calcium carbonate production sector investment profile in Addis Ababa. In compiling the report, information from Addis Ababa investment commission, Addis Ababa trade and industry development, Ethiopian custom commission and published sources have been augmented.

The production of calcium carbonate in Ethiopia is minimal compared to its raw materials availability in the country. One of the main causes of this disparity is absence of potential investor involved in the area.

The provision of adequate calcium carbonate is of fundamental importance to Ethiopian's present and future demand of paper, plastics, paints, coatings, personal health and food production, building and construction materials. In Ethiopia, the demand for calcium carbonate is expected to increase considerably in the next few decades as a result of increased population growth, urbanization and increasing income levels. The country demand for calcium carbonate is met through import from different countries.

1.2 Product Description and Application

Calcium carbonate is derived from lime stone. It is found naturally in the forms of lime stone, chalk and marble. Precipitated calcium carbonate and Activated calcium carbonate are produced industrially. The natural ground Calcium carbonate and the precipitated material compete industrially, based primarily on particle size and the characteristics imparted to the product.

Precipitated calcium carbonate is an in organic chemical obtained by calcining naturally occurring lime stone, slaking and carbonation. Precipitated calcium carbonate is pure form of lime stone used in the chemical industries. Limestone (mainly $CaCO_3$), is an abundant rock found in all parts of the world, and is the main component of shells of marine organisms, snails, pearls, and eggshells. Industrial calcium carbonate is produced in two ways; by extracting and grinding the natural ore (ground calcium carbonate GCC) and by chemical precipitation (precipitated calcium carbonate PCC). The applications of calcium carbonate are described below.

Paper, Plastics, Paints, and Coatings: Calcium carbonate is the most widely used mineral in the paper, plastics, paints and coatings industries both as a filler – and due to its special white color - as a coating pigment. In the paper industry it is valued worldwide for its high brightness and light scattering characteristics, and is used as an inexpensive filler to make bright opaque paper. Filler is used at the wet-end of paper making machines, and calcium carbonate filler allows for the paper to be bright and smooth. As an extender, calcium carbonate can represent as much as 30% by weight in paints. Calcium carbonate also is used widely as filler in adhesives, and sealants.

Personal Health and Food Production: Calcium carbonate is used widely as an effective dietary calcium supplement, antacid, phosphate binder, or base material for medicinal tablets. It also is found on many grocery store shelves in products such as baking powder, toothpaste, dry-mix dessert mixes, dough, and wine. Calcium carbonate is the active ingredient in agricultural lime, and is used in animal feed. Calcium carbonate also benefits the environment through water and waste treatment.

Building Materials and Construction: Calcium carbonate is critical to the construction industry, both as a building material in its own right (e.g. marble), and as an ingredient of cement. It contributes to the making of mortar used in bonding bricks, concrete blocks, stones, roofing shingles,

rubber compounds, and tiles. Calcium carbonate decomposes to form carbon dioxide and lime, an important material in making steel, glass, and paper. Because of its antacid properties, calcium carbonate is used in industrial settings to neutralize acidic conditions in both soil and water.

1.3 Project Location and Justification

1.3.1 Location of Addis Ababa

Addis Ababa is the seat of the Ethiopian federal government. It is located on the central highlands of Ethiopia in the middle of Oromia Region. The absolute location is around the intersection point of 901'48''N latitude and 38°44′24″E longitudes. This is very near to the geographical center of the country. It is, therefore, equidistant to the peripheral areas or is equally accessible to almost all parts of Ethiopia. Addis Ababa is located on a well-watered plateau surrounded by hills and mountains. The city is in the highlands on the edge of the Ethiopian rift valley or the eastern slopes of the Entoto Mountain ranges bordering the Great Rift Valley. The total area of Addis Ababa is about 540 km^2 of which 18.2 km^2 are rural. Addis Ababa's built-up urban area spans 474 km^2. It is also the largest city in the world located in a landlocked country.

1.3.2 Demography of Addis Ababa

According to the CSA (2013) population projection, Ethiopia's total population reaches about 105 million people in 2022. Of the total population 22.9% (24 million people) live in urban areas. Ethiopia's urban population is expected to triple by 2037 (World Bank, 2015). Addis Ababa hosts an estimated 3,859,638 people. Currently, Addis Ababa is experiencing an annual growth rate of 3.8% and is estimated to reach 4,696,629 inhabitants by 2032 (CSA, 2015).

1.3.3 Economic activity of Addis Ababa

The transformation of Addis Ababa has especially been rapid since 1991. According to the data from the city's Bureau of Finance and Economic Development (2006), per capital income of Addis Ababa has grown from USD 788.48 in 2010 to USD 1,359 in 2015. The city also achieved a decline in the poverty index from a high of 29.6 in 2012 to 22.0 in 2014. Moreover, the current poverty headcount index for Addis Ababa is estimated at 18.9 while the poverty severity account for 5 and 1.8 index points respectively. Even though, the poverty status of Addis Ababa has an improvement over previous years, there is still much work to be done to curb both the incidence and severity of poverty.

The major contributor to the economic growth of the city is the implementation of publicly financed mega urban projects like condominium housing, the Light Rail Transit, the international airport and industrial zone development (The state of Addis Ababa, 2017). The existence of international large and medium-size enterprises in and around Addis Ababa have also significant role in creating huge opportunity for employment and technology transfer. Furthermore, there are strong demand for goods and services following the existence of many embassies and inter-governmental organizations like the African Union, the United Nations Economic Commission for Africa.

The manufacturing sector's contribution to Addis Ababa's GDP is high. Despite the fact that 86% of the industries in the city are micro and small scale (cottage and handicrafts, and small-scale), the majority of the country's large and medium scale industries are found in the city. Noticeable increases are also registered currently in other aspects of industrial growth.

The service sector is both the largest contributor to the city's economy and the largest employer. It contributes to 76.4% of the city's GDP while industry's share makes up (almost all) the rest. This sector is dominated by three major sub-sectors: Transport and communication; Real estate, Renting

and Business services; and Trade, Hotel and Restaurants. According to the state of Ethiopian Cities 2015 report, the service sector has also been responsible for more than 50% of the growth in the estimated annual growth of the city's GDP. Although 75% of employment in the city is also generated in the service sector, a large proportion of the employed work in low skill and low paying jobs as shop salespersons, petty and 'gullit' traders, sales workers in small shops, domestic helpers or doorkeepers and restaurant service workers.

Analysis of the economic structure of Addis Ababa reveals that the services sectors (63%) dominates with industry (36%) in second place indicating that these sectors account for almost all of the Addis Ababa's GDP (The State of Addis Ababa, 2017).

Addis Ababa has a great share in the economy of the country due to its attractiveness to businesses, companies, individuals and foreign direct investment. Overall primacy index of the city is 24.8 based on urban employment and unemployment survey (CSA 2015). According to the State of Addis Ababa 2017 report, the simultaneous high rates of economic growth and urbanization in Addis Ababa indicates a likely further rising dominance of the city in Ethiopia's economy as well as growing agglomeration of economic activities in and around the city.

1.4. Is it beneficial to invest in Addis Ababa?

Addis Ababa is the largest and most economically significant city in the country. Ethiopia's urban population share is only 17 percent (as of 2012, World Bank 2015). The city is the only urban area in Ethiopia capable of delivering scale economies in terms of concentrated demand, specialization, diversity and depth of skills, innovation, and technology transfers. Thus, investors will be benefited in getting capable human power from the market.

The capital is the country's main industrial hub. The city dominates industrial capacity in almost all the braches of light manufacturing that Ethiopia prioritizes. As a result Addis Ababa completely dominates production in various subsectors. This can be taken as the political and social stability of the city.

Overall, the city has a beautiful environment, favorable location, and strong industrial base. Its advantage as an economic powerhouse of the country and human resource center are the most attractive features for local and overseas investors.

Moreover, investors will be getting a comprehensive set of incentives for priority sectors. These include:

- Customs duty free privilege on capital goods and construction materials, and on spare parts whose value is not greater than 15% of the imported capital goods' total value.
- Investors have the right to redeem a refund of customs duty paid on inputs (raw materials and components) when buying capital goods or construction materials from local manufacturing industries.
- Income tax exemption of up to 6 years for manufacturing and agro-processing, and up to 9 years for agricultural investment.
- Additional 2-4 years income tax exemption for exporting investors located within industrial parks and 10-15 years exemption for industrial park developers.
- Loss Cary forward for half of the tax holiday period. Several export incentives, including Duty Draw-Back, Voucher, Bonded Factory, and Manufacturing Warehouse, and Export Credit Guarantee schemes.

1.4.1. The city benefit from the investment

The city will be benefited from investment. These are discussed below.

- Employment opportunity

  Investment is expected to provide direct and indirect employment. These range from unskilled causal workers, semi-skilled and skilled employees.

- Improving growth of the economy

  Through the use of locally available materials and exporting products, the investment contributes towards growth of the economy by contributing to the growth of domestic product. These eventually attract taxes including VAT which will be payable to the government hence increasing government revenue while the cost of local materials will be payable directly to the producers. In addition, domestic products save foreign exchange and exports also bring money to the country.

2. Marketing study

2.1 Market analysis summary

The current drive and emphasis by the government on the diversification of the industrial base away from the other sector presents an opportunity for production industry to a valuable contribution towards achieving goal. Having undertaken a thorough and comprehensive research of the market we realized that there was a vast opportunity for domestic products. Aware of the fact operating in such a market is largely dependent on good networking; the promoter intends to establish networks and strategic relationships with various wholesalers and retailers to ensure a steady stream of orders. In so doing the owner intend to ensure that the products they produce are of extremely high quality and fully serve the customers purpose.

2.2 The Supply of Calcium Carbonate

2.2.1 Local Calcium Carbonate Supply

The demand for calcium carbonate in Ethiopia is entirely met through import. Thus, there is no production company involved in producing calcium carbonate in the country.

2.2.2 Import

As shown in table 1, import of calcium carbonate has been growing from year to year with minor fluctuations. The yearly average level of import which was about 8,285.77 tons during the period 2012-2014 has increased to a yearly average of 10,258.05 tons during the period 2015 - 2018. In the recent two years (2020-2021) the yearly average level of import has reached to a level of 11,392.50 tons. Compared to the preceding years (2015 - 2018) the total increase is about 11% or annual average growth rate of 21%. Table 2 also shows forecast of future import of calcium carbonate.

Table 1: Import calcium carbonate from 2012 to 2021

Year	Quantity (Tons)	Value (`000 Birr)
2012	7,788	69,276.81
2013	8,039	69,936.86
2014	9,031	81,908.59
2015	12,900	131,040.52
2016	7,592	61,754.66
2017	15,290	163,668.91
2018	5,250	91,269.92
2019	-	-
2020	10,551	166,939.58
2021	12,234	248,866.48
Total	7,788	1,084,662.32

Sources: Ethiopian Revenue and customs Authority, compiled by consultant

Table 2: Future forecast of import of calcium carbonate by trend adjusted exponential smoothing method

Year	Actual	Trend adjusted exponential smoothing
2012	7,788	
2013	8,039	
2014	9,031	
2015	12,900	
2016	7,592	
2017	15,290	
2018	5,250	
2019	-	
2020	10,551	
2021	12,234	
2022		88,675
2023		96,028
2024		103,381
2025		110,735
2026		118,088
2027		125,441
2028		132,795
2029		140,148
2030		147,501
2031		154,855
2032		162,208

Since the only source of calcium carbonate to the country is through import and no domestic supply, the effective demand for the present year (2022) is 88,675 tons of calcium carbonate; as presented in table 2.

2.3 Calcium Carbonate Demand Projection

The future demand for calcium carbonate can be influenced by a number of factors. Mainly on the growth of the chemical and allied industries, which are using it to paper, plastics, paints, coatings, personal health and food production, building and construction materials, disposable income and prices are few among many variables.

During the past ten years, the annual average growth of demand has been more than 21% per annum. As per the data of the Ethiopian Investment Agency there are a number of chemical projects which are licensed for implementation. When the projects become operational the demand for the product will undoubtedly increase significantly. By considering the past trend, which was 21% annual growth rate, and future prospects of the industrial sector demand for calcium carbonate is assumed conservatively to grow by 10% per annum.

Table 3: Projected demand for calcium carbonate in Ethiopia (000')

Year	Calcium Carbonate (tons)
2023	12,532
2024	13,785
2025	15,163
2026	16,680
2027	18,348
2028	20,183
2029	22,201
2030	24,421
2031	26,863
2032	29,549

As it is indicated in table 3, the demand for calcium carbonate will grow from 12,532 tons in the year 2023 to 18,348 tons and 29,549 tons by the year 2027 and year 2032, respectively.

3. Production Technology and engineering

3.1 Technology

Calcium carbonate is derived from lime stone. It is found naturally in the forms of lime stone, chalk and marble. Precipitated calcium carbonate and Activated calcium carbonate are produced industrially. The natural ground Calcium carbonate and the precipitated material compete industrially, based primarily on particle size and the characteristics imparted to the product. The precipitated types are distinguished by a finer and more uniform particle size, a narrower particle size range and a higher degree of chemical purity.

Bleakley and Johns (1996) described a method of preparing precipitated calcium carbonate which comprises:

1) slaking quick lime in an aqueous medium,
2) subjecting the aqueous medium to continuous agitation during the said slaking,
3) passing the suspension of calcium hydroxide obtained after slaking through a sieve having an aperture size of 40 – 70 microns,
4) subjecting the suspension to high shear agitation with an impeller having a peripheral speed of 40 – 70 m/sec., so as to obtain finely dispersed calcium hydroxide,
5) terminating the said high energy high shear agitation on achieving finely dispersed slaked lime,
6) carbonating the finely dispersed slaked lime by passing sufficient carbon dioxide gas to neutralize the pH of the suspension during this carbonation step,
7) subjecting the suspension to continuous agitation with an impeller speed of 200 – 700 cm/sec to maintain the suspension, and

8) Separating the precipitated calcium carbonate formed in the process.

Moreover, step by step process description of precipitated calcium carbonate production which involves calcination, slaking, carbonation, drying and packing is presented as follows.

The Calcinations Process: Limestone is converted into calcium oxide and carbon dioxide by means of calcinations at temperatures in excess of 900°C. To ensure a high level of purity, the calcinations process is carried out using natural gas.

$$CaCO_3 \longrightarrow CaO + CO_2$$

The temperature, flow of Natural Gas and Fresh Air has to be controlled properly to ensure the high quality Calcium Oxide. Unless the calcinations process is done properly, the quality of the product cannot be maintained. The first and the foremost important process of manufacturing Calcium Carbonate is Calcination.

Milk of Lime / Calcium Hydroxide: The Calcium Oxide (Calcined Lime) derived through the Calcinations process is then slacked with water to obtain Calcium Hydroxide (Milk of Lime). The resultant slurry contains some impurities originated from the limestone and to remove the impurities it is screened through sieve which removes some unburnt or over burnt lime hence a better quality is ensured.

$$CaO + H_2O \longrightarrow Ca(OH)_2$$

Carbonation: Precipitated calcium carbonate is commonly manufactured by the reaction of gaseous carbon dioxide with a colloidal suspension of calcium hydroxide which is sufficiently versatile to allow specific crystal morphologies to be developed. The purified milk of lime is then carbonated by bubbling carbon dioxide gas which is derived during the first process of Calcinations into the

slurry to precipitate $CaCO_3$. This process ensures the Calcium Carbonate and water. Proper temperature and concentration has to be maintained during this process to ensure desired product. The resultant mixture of calcium carbonate and water is again passed through the sieve to remove any impurity if still left.

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$$

Drying: The drying is a physical process and no chemical changes to the material are made at this stage. The final stage of the process is water solid separation; water is to be removed from calcium carbonate. This process is completed in two stages viz. making cake by use of centrifuge which contains around 30% moisture. The cake then is dried through spindle dryer where the material travels with hot air at a temperature of more than 300^oC.

The material is then packed in HDPE bags at the outlet. The material is packed in inner laminated HDPE bags to ensure no further quality problems to the material.

Table 4 Materials input for manufacturing of calcium carbonate

S/No	Description	Unit of measure	Quantity	Unit price	Total Amount
1	Limestone	Ton	45,000	4,500	202,500,000.00
2	Packing material, 50 kg HDPE lined bag	Pcs	300,000	25	7,500,000.00
	TOTAL				210,000,000.00

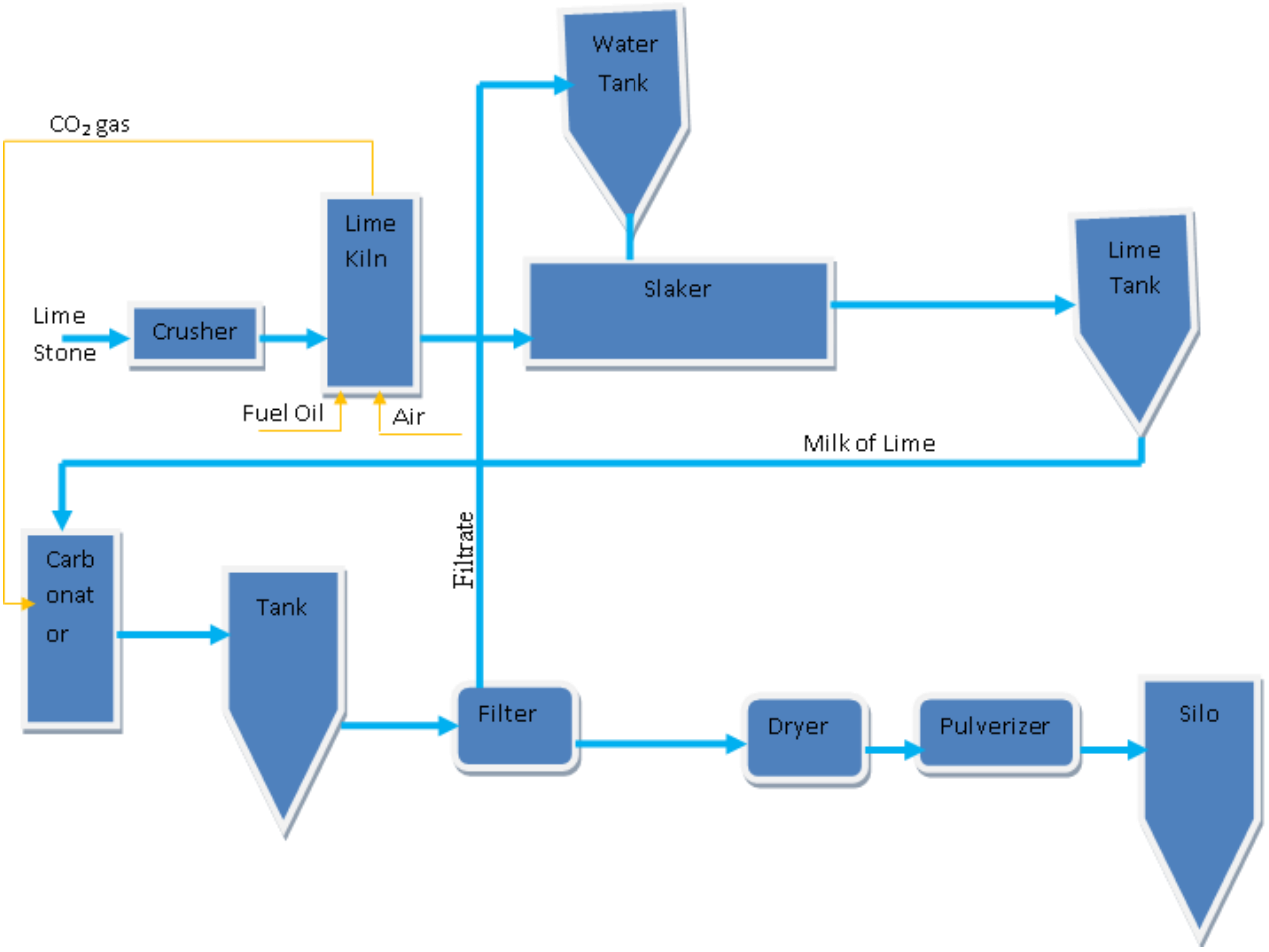

Figure 1: Calcium carbonate production process flow diagram

3.1.1 Environmental and Social Impact Assessment

Typically, any developmental projects also trigger a set of environmental and social impacts. These environmental and social due to development projects occur in different forms. An Environmental and Social Impact Assessment (ESIA) has to be carried out to study the potential environmental and social impacts due to the production calcium carbonate. Potential environmental and social impacts due to the production of calcium carbonate on attributes like air quality, noise, water quality, soil, flora, socio-economic, etc. have to be assessed as part of the ESIA study. Appropriate mitigation measures to help minimize/avoid impacts from the development have to be recommended in the

study. The measures include avoidance measures, mitigation measures and environmental enhancement measures. For the purpose of including environmental costs, the costs of wastewater treatment plant and solid waste incineration systems are included in the cost of machinery and equipment. Social responsibility cost estimated to be 1% of fixed investment costs.

3.1.2 Production program and plant capacity

It is assumed that the precipitated calcium carbonate plant will start at 70% in the first year, and then raise its production by 80% in the second year and finally operates at 100% capacity in the four year and then after. The production program of the envisaged plant is given in table 5.

Table 5: Calcium carbonate production program

Year of Production	**1st Year**	**2nd Year**	**3rd Year**	**4th-10th Year**
Capacity utilization (%)	70	80	90	100
Precipitated calcium carbonate(tons)	10,500	12,000	13,500	15,000

In determining the plant capacity of the calcium carbonate production plant, the future demands of the product and the economies of scale of the available technologies were taken into consideration. According to the data obtained from the market study, the demand for precipitated calcium carbonate raises from 12,532 tons to 29,549 tons from years 2023 to 2032.

Hence, based on the demand gap and the minimum economic of scale for precipitated calcium carbonate production, a plant with a capacity of 15,000 of precipitated calcium carbonate per annum is proposed.

3.2 Engineering

3.2.1 Land, buildings and civil works

The required area (m^2) and construction cost for the production facilities essential for the successful operation of the processing plant is shown in Table 6. A total area ready for the processing plant is 10,000 m^2 out of which 4,670 m^2 is to be covered by building while uncovered area of 5,330m^2 is left storage of waste materials and future expansions. In order to estimate the land lease cost of the project profiles it is assumed that all the project will be located in different land level from level 1/1 to level 4/3, their current market lease price is from 39,073.31 birr per M ^{2} to 2,800.71 birr per M ^{2}respectively. Therefore, for the profile a land lease rate of birr 3,885 per M ^{2} have been taken, which is between the ranges.

The cost of construction of building should be appropriate to the size and expected profitability of business, costs of building generally differs by the type of construction materials used, the type of foundation, wall height and location. The current building cost for simple storage and processing room is from 10,000.00 Birr per m^2 to 25,000.00 Birr per m^2. The total construction cost of buildings and civil works, at a rate of Birr 20,000 per m^2 is estimated at Birr 93.10 million. Therefore, the total cost of land lease and construction of buildings and civil works is estimated at Birr 151.95 million.

The proposed plant layout comprises the following buildings and structures.

Table 6 Building costs

S/No	Descriptions	Total area in M^2	Estimated cost per square meter (in Birr)	Total estimated cost (in Birr)
1	Raw materials receiving and store	1,000	20,000.00	20,000,000.00
2	Production room	150	20,000.00	3,000,000.00
3	Ingredients store	500	20,000.00	10,000,000.00
4	Filling and packing room	500	20,000.00	10,000,000.00
5	Packing materials store	500	20,000.00	10,000,000.00
6	Final products store	500	20,000.00	10,000,000.00
7	Finished products delivery veranda	100	20,000.00	2,000,000.00
8	Boiler room	100	20,000.00	2,000,000.00
9	workshop	120	20,000.00	2,400,000.00
10	Generator room	20	20,000.00	400,000.00
11	Power station room	20	20,000.00	400,000.00
12	Administration office 5,360=13,400,000	300	20,000.00	6,000,000.00
13	Production and technical office	200	20,000.00	4,000,000.00
14	Toilet and shower for female	40	20,000.00	800,000.00
15	Room for cloth changing for female	40	20,000.00	800,000.00
16	Toilet and shower for male	40	20,000.00	800,000.00
17	Room for cloth changing for male	40	20,000.00	800,000.00
18	parking	500	5,000.00	2,500,000.00
19	Fence	1,200 M*2	3,000.00	7,200,000.00
	TOTAL	4,670 M^2		93,100,000.00

Table 7 Land lease period in Addis Abeba

Sector of development activity	Period of lease	Down payment
Education, health, culture and sports	90	10%
Industry (manufacturing)	70	10%
commerce	60	10%
For urban agriculture	15	10%
For others	60	10%

Sources: - city government of Addis Abeba land development and management bureau

Table 8 Land lease floor price in Addis Abeba

S/No	Land level	Current land lease floor price per M^2	Current lease price per M^2 (Market price)
1	1/1	2,213.25	39,073.31
2	1/2	2,165.47	36,825.73
3	1/3	1,900.19	34,578.15
4	¼	1,552.93	31,119.21
5	1/5	1,531.91	29,096.45
6	2/1	1327.39	27,073.71
7	2/2	1,221.18	25,050.96
8	2/3	1,191.17	23,028.21
9	2/4	1,074.39	21,005.46
10	2/5	1,027.84	18,982.71
11	3/1	994.71	16,959.96
12	3/2	960.21	14,937.21
13	3/3	927.84	12,914.46
14	¾	904.77	10,891.71
15	3/5	873.74	8,868.96
16	4/1	814.06	6,846.21
17	4/2	786.45	4,823.46
18	4/3	748.80	2,800.71

Sources: - city government of Addis Abeba land development and management bureau

3.2.2 Machinery and equipment

One of the core machines in precipitated calcium carbonate production is the kiln. Others such as slacker, carbonator, centrifuge, dryer, wire mesh, crusher, elevator, belt conveyor are secondary equipment which augment 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 57.40 million, out of which 43.05 million is required in foreign currency. Lists of required machinery and equipment are shown in Table 9.

Table 9: List of machineries and equipment's for calcium carbonate production

S.No.	**Description**	**Quantity**	**Price, in Birr (000')**
1	Crusher	1	45,250,000.00
2	Rotary Kiln	1	
3	Water tanker	1	
4	Slaking unit	1	
5	Slaked lime storage tank	1	
6	Carbonation Tank	2	
7	Calcium carbonate suspension storage tank	1	
8	Drum Filter	1	
9	Centrifuge	1	
10	Dryer	1	
11	Mill	1	
12	Storage Silo	2	
13	Packing Machine	1	
14	Dust control equipment	1	
		Total	

3.2.3. Lists of machinery suppliers

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4. Organizational structure

The selection of structure of the envisaged project is made based on the existing structure of manufacturing plants operating in the country, the capacity, complexity and technology mix of the plant. Organizational structure principles such as specialization, coordination, and departmentalization are also considered for design of structure that best suits the envisaged project

4.1 Manpower Requirement and Estimated Annual manpower costs

Description	Number	Monthly salary	Annual salary, Birr
plant manager	1	30,000.00	360,000.00
Administration and finance manager	1	15,000.00	180,000.00
Human resource manager	1	7,500.00	90,000.00
Secretary	1	5,000.00	60,000.00
Marketing and sales officer	1	10,000.00	120,000.00
Sales manager	1	15,000.00	180,000.00
Accountant	1	10,000.00	120,000.00
Production unit leader	1	15,000.00	180,000.00
Senior Mechanic	3	10,000.00	360,000.00
Senior Electrician	3	10,000.00	360,000.00
Purchaser	1	10,000.00	120,000.00
Operator	16	4,000.00	704,000.00
Ass. Operator	16	2,000.00	352,000.00
Store keeper	2	5,000.00	120,000.00
Quality manager	1	15,000.00	180,000.00
Microbiologist	1	10,000.00	120,000.00
Sugar dissolving team	1	6,000.00	72,000.00
Boiler technician	1	3,000.00	36,000.00
Guard	4	1,400.00	67,200.00
Driver	1	3,000.00	36,000.00
Cleaners	12	1,500.00	216,000.00
Sub total	70		4,033,200.00
Grand total			4,865,200.00

5. Financial Analysis

5.1 General

The financial analysis evaluation of calcium carbonate manufacturing project is mainly consisted of capital investment as well as operating and maintenance costs. The capital investment costs include fixed investment costs (initial fixed investment and replacement costs) and working capital, while operating and maintenance costs comprise current expenses related to material inputs, manpower cost, utility, repair and maintenance costs, spare parts, Overheads, Sales and distribution, interest and depreciation expenses.

The financial analysis and evaluation has been conducted taking assumptions:

1. It is assumed that about 70% of the total capital investment costs including the working capital requirement could be covered through development bank loans of short and long-term credits. The remaining balance 30% will be covered by equity capital contribution of the project owner.
2. Even though the project might secure loans under different term and conditions as well as from different financial sources, for the purpose of calculation of debt service scheduling, the current development bank of Ethiopia credit terms and conditions have been used. Consequently. It is assumed that the project will secure loan facility on the basis of 11.5 % annual interest rate.
3. Even though the estimated project production life is more 10 years, the financial analysis has been undertaken for a period interval covering the first 10 years only, during which time

most of the capital assets are assumed to be deprecated, debts recovered and pay-back period accomplished.

4. It is assumed that the project will be start up production activity at 70 % capacity. During years 2 & year 3 the projects is anticipated to gradually increase capacity utilization to reach 100% in year 4. Therefore, starting from year 4 the project will be operational at full capacity.
5. For the project under reference promotional, sales and distribution expenses have been estimated at 3% of the sales revenue.
6. Maintenance and spare parts costs are 1.5% of the fixed investment costs.
7. Furniture and fixture costs assumed to be 500,000.00

5.2 Initial Fixed investment costs

Table 10 Initial Fixed investment costs

S/No	Fixed investment type	Unit of measurement	Quantity	Unit price	Total Amount	Remarks
1	Land	Square meter	10,000	3,885 birr/M^2	38,850,000.00	The period of land lease will be 70 years and 10% of the total lease amount will be paid in the first year
2	Buildings and civil works	Square meter	5,670	lump sum	93,100,000.00	
	Sub total				**131,950,000.00**	
3	Machineries	set	2	Lump sum	45,250,000.00	
4	Transformer	set	1	Lump sum	2,000,000.00	
5	Weighbridge	Set	1	Lump sum	4,000,000.00	
6	Truck and vehicles	Pcs	2	Lump sum	6,000,000.00	
7	Furniture and fixture	Pcs			500,000.00	
	SUB TOTAL				57,750,000.00	
	Fixed capital investment costs				189,700,000.00	
8	pre-operational expenses				2,000,000.00	
	Working capital				28,716,000.00	
	TOTAL INVESTMENT COSTS				220,416,000.00	

5.3 Working capital

Working capital is the financial means required for smooth operation and maintenance of a project mathematically, it is a difference between current assets and current liabilities. In the particular case of the project under consideration, the current assets comprise receivables, inventories (local and imported material inputs, spare parts, work in progress, and products ready for delivery) and cash in hand, while current liabilities comprise accounts payable to creditors.

5.4 Project Financing

Fixed capital investment costs and working capital requirements are assumed to be financed by equity capital of the owner and through loans of short and long-term credits.

The company obtains loans under different terms and condition as well as from different sources, for the purpose of calculation of debt service scheduling the current development bank of Ethiopia credit terms and conditions have been used. Accordingly, it is assumed that the company will be able to obtain loan 70% of the total investment costs for construction of different buildings for purchase of machineries. The remaining balance that of the total investment costs will be expected to be covered by equity contribution of the project promoter.

5.5 Production costs

As it is depicted in Annex Table 14 major categories of the total production costs are assembled into the following cost elements.

5.5.1 Material inputs

In the project under study the basic material inputs (see in table 4) are limestone and, packing materials etc. Therefore, the current prevailing local and international market prices have been used for estimation of material inputs costs. At full capacity operation the material inputs costs are estimated at Birr 210 million per annum.

5.5.2 Utilities

In estimating costs of utility expenses for operation and maintenance of the project, Costs of fuel, oil and lubricant, electricity and water consumptions have been taken in to consideration, the rates of which have been estimated on the basis of the proposed capacity utilization program of the project and at the current official charging rates. At full capacity operation the project will have the following utility expense per annum which amounts to Birr 6.089 million.

Table 11 Utilities of the factory'000"Birr

Utility"000"Birr		Start-up			Full Capacity
Capacity utilization		70 %	80 %	90 %	100 %
Project year		1	2	3	4
Item description	Unit of measurement				
Fuel					
Gasoline for service vehicle	100km*260days*32Birr/LIT*8km/Li	104	104	104	104
Gasoline for transport truck	(200km*300days*32Birr/LIT*5km/Li)*3	1,152	1,152	1,152	1,152
Sub-Total		1,256	1,256	1,256	1,256
Change of oil and lubricant	10% of the fuel consumption	126	126	126	126
Sub-Total		1,382	1,382	1,382	1,382
Electricity	260days*24 hrs*650kwh* 1.00Birr/kwh	2,839	3,245	3,650	4,056
Sub- Total		2,839	3,245	3,650	4,056
Water	365days*100m^3/day*15 Birr/m^3	384	438	493	548
Sub -Total		384	438	493	548
Telecommunication					
Telephone	5 lines* 1,500Birr/month/line+18Birr/line/month	31.08	31.08	31.08	31.08
Mobile	5 lines*1,500 Birr/month/line	30.00	30.00	30.00	30.00
Fax	2line*1,000Birr/month + 17 Birr/line/month	12.40	12.40	12.40	12.40
Internet	2,500 Birr/month	30.00	30.00	30.00	30.00
Sub-Total		**103.48**	**103.48**	**103.48**	**103.48**
TOTAL		**4,708.48**	**5,168.48**	**5,628.48**	**6,089.48**

5.5.3 Over heads

In the expenses under this title have been included land and building taxes, buildings, vehicles as well as machinery and equipment insurance, vehicles annual inspection; postage, telephone and e. mail, stationery and office supplies; printing and copying; audit fee; cash indemnity etc. The overhead costs and divided in to direct overheads and administration overheads.

Table 12 Overhead costs

Direct Overhead"000"Birr		Year 1	Year 2	Year 3	Year 4
Annual land lease Payment		5,550	5,550	5,550	5,550
Insurance					
Building and Civil works	0.10%	113.10	113.10	113.10	113.10
Machinery and Equipment	0.20%	94.50	94.50	94.50	94.50
Motor vehicle and Truck	1%	60	60	60	60
Vehicles annual inspection and registration	25,000 Birr per annum per vehicle	50.00	50.00	50.00	50.00
Work cloth	Two times per annum per workers at 1,000 Birr	140	140	140	140
Cleaning and sanitation	An estimate of 300 Birr/day	78.00	78.00	78.00	78.00
Sub Total		6,085.60	6,085.60	6,085.60	6,085.60
Administration Overhead "000' Birr					
Audit fee	40,000 Birr per annum	40.00	40.00	40.00	40.00
Office cleaning and sanitation	2,000 Birr per month	24.00	24.00	24.00	24.00
Stationery and office supplies	2,000 Birr per month	20.00	20.00	20.00	20.00
Printing and Copy	2,000 Birr per month	24.00	24.00	24.00	24.00
Sub Total		**108.00**	**108.00**	**108.00**	**108.00**
GRAND TOTAL		**6,193.60**	**6,193.60**	**6,193.60**	**6,193.60**

5.5.4 Financial costs

As it has been outlined earlier under" project Financing" the current Development Bank of Ethiopia credit terms and conditions for newly establishing projects have been used to compute the financial costs, estimated to be incurred in connection with that of the total investment costs assumed to be covered through loan financing. The amount of the loan capital to be obtained and the financial costs to be incurred thereof have been determined depending on the amount of fixed investment cost and pre-production expenses.

5.5.5 Depreciation

Table 13 Depreciation in Birr"000"

Period			Start-up			
Capacity utilization			70 %	80 %	90 %	100 %
Project year			1	2	3	4
Item description	Original Value					
Structure and civil works	93,100,000.00	5% of original value	4,655	4,655	4,655	4,655
Machinery and equipment	45,250,000.00	15 % of original value	6,788	6,788	6,788	6,788
Transformer	2,000,000.00	15 % of original value	300	300	300	300
Motor vehicles and trucks	6,000,000.00	15% of original value	900	900	900	900
Weighbridge	4,000,000.00	15 % of original value	600	600	600	600
Office equipment and furniture	500,000.00	20 % of original value	100	100	100	100
Pre-production expenses	2,000,000.00	25% of original value	500	500	500	500
Total			13,843	13,843	13,843	13,843

5.6 Break Even point and ROI

5.6.1 Break Even point (BEP)

Three kinds of break-even point

A. BEP Sales Revenue(BR)

B. BEP production (Volume)

C. BEP Percentage (%)

A. Break-even point(BEP) Sales

To determine BEP Annual Sales, multiply annual sales found in income statement by the annual fixed cost, and divided by Annual sales less Annual variable cost.

$$\text{BEP (sales)} = = \frac{\text{Annual sales x Annual fixed costs}}{\text{Annual sales} - \text{Annual variables costs}}$$

Annual sales = 262,500,000Birr

Unit selling price = 2,500 Birr/quintal

$$\text{BEP (sales)} = = \frac{\text{Annual sales x Annual fixed costs}}{\text{Annual sales} - \text{Annual variables costs}} = = \frac{262{,}500{,}000 \text{ x } 42{,}645{,}000}{262{,}500{,}000 - 162{,}429{,}000}$$

BEP (Sales) = 16,257,249 Birr

B. BEP production

To determine BEP production volume, divided BEP sales by the unit selling price (USP)

BEP production = 16,257,249/2,500 = 6,503

C. $$\text{BEP percentage} = \frac{\text{Annual fixed costs x 100\%}}{\text{Annual sales} - \text{Annual variables costs}}$$

$$= \frac{42{,}645{,}000 \text{ x } 100\%}{262{,}500{,}000 - 162{,}429{,}000}$$

= 43%

5.6.2 Return on investment

Return on investment = Net profit /Total capital requirement

= 37,327,000/220,416,000

= 17%

The return on owners' investment (ROOI)

= Annual net profit /owners' investment

= 37,327,000/66,124,800

= 56%

5.7 Project benefits

For financial analysis and evaluation of the given project, the current raw materials price, and packing materials buying price and final packed calcium carbonate price at the project gate has been taken as a basis. Consequently, based on the recent market survey, price has been indicated in sales revenue table.

As it has been stated earlier the project is envisaged to reach full capacity operation four years after commencement of production activities which are assumed to begin with 70% of the estimated total capacity.

Thus, according to the computation in Annex Table 16 and Annex Table 18, the net income and cash flow statements analysis revealed that at full capacity operation the project will generate a total income (gross revenue) amounting to 375 million Birr per annum. The Net Income Statement shows a steady growth of gross profit starting from 57.42 million Birr in year 1 reaching the peak of 126 million Birr in year 10. In its 10 years of manufacturing activities, the project is expected to generate

a total net profit of 667million Birr and contribute 359 million Birr to the government treasury in form of 35% income tax.

According to the current investment Law, machinery and equipment are anticipated to be imported duty- free. The liquidity position of the project is very strong. The corresponding Annex Table 16 of "Cash Flow Statement" shows the positive cumulative cash balance of Birr 619million and the project will not face any cash shortage throughout its production life.

The computation of the pay-back period as depicted in Annex table 23 indicates that the project will be able to reimburse itself from its net cash-income within four years after commencement of production activities, the period which is considered to be very good for the project of this nature.

In Annex Table 24 of the Benefit-cost ratio and Net present value (NPV) have been calculated at 17% discount factor (D.F) for 10 years of the project activity. Accordingly, the project has NPV of 359 million Birr at 17%D.F. and the benefit-cost ratio of 1.29 at 17% D.F. These results are most appreciable, especially, when related to the external capital borrowing interest rate which ranges from 8.50% to 18.5 % for newly establishing projects.

Break-even point (BEP) have been undertaken the project under study when implemented will have BEP at about 43% operation of the estimated full capacity

In addition to this, finally, summary of financial efficiency tests have been conducted in Annex table 22, Accordingly, all efficiency ratios indicated positive trends and consequently, it can be inferred that the project can operate in the frame work of free market mechanism on commercially and financially viable basis and is remunerative.

ANNEXES

NNEX II

CALCULATION OF ANNUAL PRODUCTION COSTS

Table 14 Annual total production costs"000"

Period	Start-up			Full capacity						
Capacity utilization	70 %	80 %	90 %	100 %	100 %					
Project Year	1	2	3	4	5	6	7	8	9	10
Cost category										
I. Material inputs including packing materials	147,000	168,000	189,000	210,000	210,000	210,000	210,000	210,000	210,000	210,000
II. Labor	4,865	4,865	4,865	4,865	4,865	4,865	4,865	4,865	4,865	4,865
III. Utility	4,709	5,169	5,629	6,090	6,090	6,090	6,090	6,090	6,090	6,090
IV. Repair and Maintenance (1 % of fixed costs) and spare parts (0.5 % of fixed costs)	2,845	2,845	2,845	2,845	2,845	2,845	2,845	2,845	2,845	2,845
VI Direct overheads	6,086	6,086	6,086	6,086	6,086	6,086	6,086	6,086	6,086	6,086
A. Direct Production costs	165,505	186,965	208,425	229,886	229,886	229,886	229,886	229,886	229,886	229,886
VII. Administration over head	108	108	108	108	108	108	108	108	108	108
VIII. Marketing and Promotional expense 3 % of sales revenue	7,875	9,000	10,125	11,250	11,250	11,250	11,250	11,190	11,250	11,250
B. Operating costs	173,488	196,073	218,658	241,244	241,244	241,244	241,244	241,184	241,244	241,244
Interest	17,743	16,707	15,552	14,264	12,829	11,228	9,443	7,452	5,233	2,759
Depreciation	13,843	13,843	13,843	13,843	13,343	13,243	10,383	4,655	4,655	4,655
C. Total production costs	205,074	226,623	248,053	269,351	267,416	265,715	261,070	253,291	251,132	248,658

ANNEX IV
CALCULATION OF WORKING CAPITAL REQUIREMENTS

I. Minimum requirement of current assets and liabilities
   A. Accounts receivable: 26 days at total production costs minus depreciation and interest
   B. Inventory
      1. Material inputs: 26 days
      2. Spare parts : 90 days
      3. Work under process: two days at direct costs
      4. Product ready for delivery: 8 days at direct costs plus administration overheads
   C. Cash on hand : 360 days
   D. Accounts payable 26 days for material inputs and utilities

Cost category	Minimum Days of coverage	Coeff-icient of turnover	Project year									
			Start up			Full capacity						
			1	2	3	4	5	6	7	8	9	10
I. Current asset												
A. A/R	26	10	17,349	19,607	21,866	24,124	24,124	24,124	24,124	24,118	24,124	24,124
B. Inventory												
1. Material inputs	26	10	14,700	16,800	18,900	21,000	21,000	21,000	21,000	21,000	21,000	21,000
2. Spare parts	90	4	711	711	711	711	711	711	711	711	711	711
3. Work under process	2	130	1,273	1,438	1,603	1,768	1,768	1,768	1,768	1,768	1,768	1,768
4. Product ready for delivery	8	32.5	5,200	5,861	6,521	7,181	7,181	7,181	7,181	7,181	7,181	7,181
C. Cash on hand	90	4	4,653	4,768	4,883	4,999	4,999	4,999	4,999	4,999	4,999	4,999
D. Current assets			43,887	49,186	54,485	59,784	59,784	59,784	59,784	59,778	59,784	59,784
II. Current liabilities A. A/p	26	10	15,171	17,317	19,463	21,609	21,609	21,609	21,609	21,609	21,609	21,609
III. Working capital												
A. Net working capital			28,716	31,869	35,022	38,175	38,175	38,175	38,175	38,169	38,175	38,175
B. Increasing in working capital			28,716	3,153	3,153	3,153	0	0	0	0	0	0

ii. Working capital requirement

Table 15 Calculation of working capital

ANNEX V

PROJECTED SALES REVENUE

Period					Start up			Full capacity						
Capacity utilization		U/m	Quantity at full capacity	Unit price	70 %	80 %	90 %	100 %						
Item description	Product mix													
Project year					1	2	3	4	5	6	7	8	9	10
	Precipitated calcium carbonate	ton	15,000	25,000	262,500	300,000	337,500	375,000	375,000	375,000	375,000	373,000	375,000	375,000
GRAND TOTAL					262,500	300,000	337,500	375,000	375,000	375,000	375,000	373,000	375,000	375,000

ANNEX VI

PROJECTED NET INCOME STATMENT

Table 16 Projected Net income statement "000"

Period	Start up			Full capacity						
Capacity utilization	70 %	80 %	90 %	100 %						
Project year	1	2	3	4	5	6	7	8	9	10
Item description										
Product sales revenue	262,500	300,000	337,500	375,000	375,000	375,000	375,000	373,000	375,000	375,000
Less total production costs	205,074	226,623	248,053	269,351	267,416	265,715	261,070	253,291	251,132	248,658
Gross profit	57,426	73,377	89,447	105,649	107,584	109,285	113,930	119,709	123,868	126,342
Tax	20,099	25,682	31,306	36,977	37,654	38,250	39,876	41,898	43,354	44,220
Net profit	37,327	47,695	58,141	68,672	69,930	71,035	74,055	77,811	80,514	82,122
Accumulated undistributed profit	37,327	85,022	143,163	211,834	281,764	352,799	426,854	504,665	585,179	667,301

ANNEX VII
DEBT SERVICE SCHEDULE AND COMPUTATION
PAYMENT OF EQUAL ANNUAL INSTALLMENTS

Table 17 Debt services schedule and computation

Item description	Project year									
	1	2	3	4	5	6	7	8	9	10
A. Investment and working capital										
1. Investment										
2. Increment working capital										
Total										
B. Loan receipts and balances										
1. Loan receipts	154,291	145,284	135,241	124,043	111,557	97,636	82,113	64,806	45,508	23,991
2. Outstanding balance at end of year										
a. First year loan	154,291	145,284	135,241	124,043	111,557	97,636	82,113	64,806	45,508	23,991
Total										
A. Debt service										
1. First year Loan										
a. Interest	17,743	16,707	15,552	14,264	12,829	11,228	9,443	7,452	5,233	2,759
b. Repayment of principal	9,007	10,042	11,197	12,485	13,921	15,522	17,307	19,297	21,517	23,991

ANNEX VIII
CASH-FLOW STATEMENT
FOR
FINANCIAL PLANING

Table 18 Projected Cash flow statement

Period	Start up			Full capacity						
Capacity utilization	70%	80%	90%	100%						
Project year	1	2	3	4	5	6	7	8	9	10
Item description										
A. Cash - inflow	498,087	305,299	342,799	380,299	375,000	375,000	375,000	373,000	375,000	375,000
1. Financial resource (total)	235,587	5,299	5,299	5,299						
2. Sales revenue	262,500	300,000	337,500	375,000	375,000	375,000	375,000	373,000	375,000	375,000
B. Cash – outflow	455,924	253,803	282,012	310,269	305,648	306,244	307,870	309,831	311,348	312,214
1. Total assets schedule including replacement	235,587	5,299	5,299	5,299						
2. Operating costs	173,488	196,073	218,658	241,244	241,244	241,244	241,244	241,184	241,244	241,244
3. Debt service (total)										
a. Interest	17,743	16,707	15,552	14,264	12,829	11,228	9,443	7,452	5,233	2,759
b. Repayment	9,007	10,042	11,197	12,485	13,921	15,522	17,307	19,297	21,517	23,991
4. Tax	20,099	25,682	31,306	36,977	37,654	38,250	39,876	41,898	43,354	44,220
C. Surplus (Deficit)	42,163	51,496	60,787	70,030	69,352	68,756	67,130	63,169	63,652	62,786
D. Cumulative cash balance	42,163	93,659	154,446	224,476	293,828	362,584	429,714	492,883	556,535	619,321

ANNEX XII
TOTAL INVESTMENT COSTS

Table 19 Total investment costs"000"

Period	Start up			Full capacity								
Project year	1	2	3	4	5	6	7	8	9	10	11	
Investment Category												
1. Fixed investment costs												
a. Initial fixed investment costs	189,700											
b. Replacement												
2. Pre-operational capital expenditure	2,000											
3. Working capital increase	28,716	3,153	3,153	3,153								
Total investment costs	220,416	3,153	3,153	3,153								

ANNEX XIII
TOTAL ASSETS

Table 20 Total Assets

Period	Start up			Full capacity								
Project year	1	2	3	4	5	6	7	8	9	10	11	12
Investment Category												
1. Fixed investment costs												
c. Initial fixed investment costs	189,700											
❖ Cost of land												
d. Replacement												
2. Pre-operational capital expenditure	2,000											
3. Current assets increase	43,887	5,299	5,299	5,299								
Total assets	235,587	5,299	5,299	5,299								

ANNEX XIV
SOURCES OF FINANCE

Table 21 Sources of finance

Period	Start up			Full capacity							
Project year	1	2	3	4	5	6	7	8	9	10	Total
Sources of finance											
1. Equity capital	66,125	3,153	3,153	3,153							
2. Loan capital	154,291										
3. Current liabilities	15,171	2,146	2,146	2,146							
Total finance	235,587	5,299	5,299	5,299							

ANNEX XI
SUMMARY OF FINANCIAL EFFECIENCY TESTS

Table 22 Summary of financial efficiency tests

	Project year									
Project year	1	2	3	4	5	6	7	8	9	10
Capacity utilization	70%	80%	90%	100%						
Financial ratio in %										
1. Gross profit : Revenue	22%	24%	27%	28%	29%	29%	30%	32%	33%	34%
2. Net profit : Revenue	14%	16%	17%	18%	19%	19%	20%	21%	21%	22%
3. Net profit : initial investment	17%	21%	26%	30%	30%	31%	32%	34%	35%	36%
4. Net profit : Equity	56%	69%	80%	91%	93%	94%	98%	103%	107%	109%
5. Gross profit : Initial investment	26%	33%	39%	46%	47%	48%	50%	52%	54%	55%
6. Operating costs : Revenue	66%	65%	65%	64%	64%	64%	64%	65%	64%	64%

ANNEX XV

CALCULATIONS OF PAYBACK PERIOD

Table 23 Calculation of payback period"000"

Year	Amount Paid Back			Total investment	End of year
	Net Profit	Depreciation	Total		
1	37,327	13,843	51,170	220,416	-169,246
2	47,695	13,843	61,538	3,153	-110,861
3	58,141	13,843	71,984	3,153	-42,030
4	68,672	13,843	82,515	3,153	+37,332

ANNEX XVI
CALCULATIONS OF NET PRESENT VALUE AT 17% D.F.

Table 24 Calculation of NPV at 17% D.F.

Project year	Gross Revenue	$1/(1+i)^n$ At 17%	Present value at 17%	Project costs			
				Total investment	Operating costs	Total	Present value at 17%
1	262,500	0.854701	224,359	220,416	173,488	393,904	336,670
2	300,000	0.730514	219,154	3,153	196,073	199,226	145,537
3	337,500	0.624371	210,725	3,153	218,658	221,811	138,492
4	375,000	0.53365	200,119	3,153	241,244	244,397	130,422
5	375,000	0.456111	171,042		241,244	241,244	110,034
6	375,000	0.389839	146,190		241,244	241,244	94,046
7	375,000	0.333195	124,948		241,244	241,244	80,381
8	375,000	0.284782	106,793		241,244	241,244	68,702
9	375,000	0.243404	91,277		241,244	241,244	58,720
10	375,000	0.208037	78,014		241,244	241,244	50,188
Total			1,572,620				1,213,193

A. Benefit- cost ratio At 17% D.F. = 1.29

B. NPV At 17% D.F. = 359,427,000 Birr