PROJECT PROFILE ON PHOSPHORIC ACID PRODUCTION

JUNE 27, 2022

ADDIS ABEBA CITY ADMINISTRATION INVESTMENT COMMISSION

A.A

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I. Executive summary

This project profile is prepared to assess the viability of running PHOSPHORIC ACID 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 Phosphoric acid 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 only one private Phosphoric acid manufacturing factory. According to the latest data sourced from Ethiopian investment commission (EIC) no one is registered to involve in production of phosphoric acid and related products.

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 factory at full capacity operation can produce 600,000 liters, 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 321.32 million. Out of the total investment capital, the owners will cover Birr 96.40million (30 %) while the remaining balances amounting to Birr 224.92million (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 38 million in the first year to Birr 50 million at the end of the 10th year of operation. At the end of the 10th year of operation period the cumulative cash balance reaches Birr 548.44million. 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 271.48 million Birr at 17%D.F. and the benefit-cost ratio of 1.69 at 17% D.F.

Therefore, from the aforementioned overall market technical and financial analysis we can conclude that the phosphoric acid production business is a viable and worthwhile.

1. BACKGROUND INFORMATION

1.1 Introduction

This document was undertaken to show phosphoric acid production 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.

Presently, in spite of high demand and its crucial importance, phosphoric acids are in short supply and also significant amounts are imported from abroad. This causes freight transportation costs from the supplier to the Djibouti Port to the users to be high and in some cases inefficient and unreliable.

The provision of adequate phosphoric acid is fundamental importance to Ethiopia's present and future demand of many industries. In Ethiopia, the demand for phosphoric acid is expected to increase considerably in the next few decades as a result of increased population growth, urbanization and increasing income levels. Thus, identifying potential of local phosphoric acid production is crucial in a country like Ethiopia.

1.2 Product Description and Application

Phosphoric acid, also known as orthophosphoric acid, is a triprotic acid that exists as a dense liquid. It is an irritant or corrosive to the skin, eyes, and other mucous membranes of both humans and laboratory animals. Its salts, though, exhibit a significantly lower irritancy potential. Moderate toxicity has been observed in mice when exposed via the inhalation route.

Phosphoric acid is an important chemical, which finds a multitude of uses in industries, agriculture, and even in many homes. It is a component of fertilizers, detergents, and many household cleaning products. Dilute solutions have a pleasing acid taste; thus, it's also used as a food additive, lending acidic properties to soft drinks and other prepared foods, and in water treatment products. It is also used in rust proofing, engraving, and metal coating and is an intermediate or reagent in many manufacturing processes. Taking advantage of its ability to lower blood pH, phosphoric acid has been used therapeutically to treat lead poisoning.

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 Phosphoric acid

2.2.1 Local Supply

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

2.2.2 Import

As shown in table 1, import of phosphoric acid has been growing from year to year with minor fluctuations. The yearly average level of import which was about 337 tons during the period 2012-2014 has increased to a yearly average of 514 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 492 tons. The annual average import growth rate of the last 10 years was 8.4%.

In terms of value, the country was on the average spending 20.275 million Birr during the period 2012-2014. The expenditure for importing phosphoric acid has increased to annual average of Birr 23.776 million and Birr 26.777 million during the period 2015-2018 and during the recent two years (2020 & 2021) respectively. The huge increase for the demand of phosphoric acid is believed to be due to the establishment of a number of end user industries, mainly in the chemical sub-sector.

In estimating the current effective demand for phosphoric acid, it is considered as reasonable to assume that the present demand for the product would be the average of the imported quantity of the recent two years i.e. year 2020 and 2021. Accordingly, the present (year 2022) effective demand for phosphoric acid is estimated at 492 tons.

Table 1: Import phosphoric acid from 2012 to 2021

Year	Quantity (Tons)	Value (`000 Birr)
2012	303	20,448
2013	311	21,591
2014	398	18,786
2015	337	14,423
2016	362	21,788
2017	1,212	52,648
2018	144	6,246
2019	-	-
2020	304	14,651
2021	680	38,903

Sources: Ethiopian Revenue and customs Authority, compiled by consultant

2.3 Demand Projection

The future demand for phosphoric acid depends mainly on the growth of the chemical and allied industries, which are using it to produce paints and as filler in different chemical and rubber products. During the past ten years, the annual average growth of demand has been more than 8.4 % per annum. As per the data of the Ethiopian Investment commission 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 8.4 % annual growth rate, erratic growth from year to year, and future prospects of the industrial sector, demand for phosphoric acid is acid is assumed conservatively to grow by 10% per annum.

The total demand projection worked based on the above assumptions are presented in table 2.

Table 2: Projected demand for phosphoric acid from 2023 to 2032

Year	Phosphoric Acid (tons)
2023	541
2024	595
2025	655
2026	720
2027	792
2028	871
2029	959
2030	1,054
2031	1,160
2032	1,276

The demand projection, executed in table 2 reveals that the demand for Phosphoric Acid will grow from 541 tons in the year 2023 to 792 tons and 1,276 tons by the year 2027 and year 2032, respectively.

3. Production Technology and engineering

3.1 Technology

Phosphoric acid (H_3PO_4) can be produced by 3 main commercial methods: wet process, thermal process and dry kiln process. Wet process is by far the most common route and the acid can be used in phosphate fertilizers production (DAP, MAP, SPA). Thermal process phosphoric acid is of a much higher purity and is used in the manufacture of high grade chemicals, pharmaceuticals, detergents, food products, beverages, and other non-fertilizer products. The last method, using a rotary kiln, is a promising alternative because of its reduced environmental footprint and potential cost saving.

(a) Thermal process

Raw materials for phosphoric acid production by the thermal process are elemental phosphorus, air, and water. Thermal process of producing phosphoric acid involves 3 major steps which are combustion, hydration, and demisting (Inorganic Chemical Industry, 1995). At combustion stage, the elemental phosphorus in liquid form is oxidized in ambient air by burn it in a combustion chamber at a very high temperatures of 1650 to 2760°C to form phosphorus pentoxide.

Next is hydration process. The phosphorus pentoxide produced by combustion is then hydrated with dilute phosphoric acid or water to produce strong phosphoric acid liquid. Last process is demisting that were done using a high-pressure drop demister. It will remove the phosphoric acid mist from the combustion gas stream before release to the atmosphere.

(b) Dry Kiln

For dry kiln process, it is an improved process from thermal process. For thermal process, it used electrical arc furnace to burn the phosphorus. But for the improved method, it used rotary kiln which also known as dry kiln to burn the phosphorus using direct-fired to the reactor (Shaw, 2002). The burning of phosphorus will further be produced carbon monoxide as co-product and will continue to be burnt out throughout the process continuously. This reaction will generate heat of combustion which most of it will be used to replace the electrical energy that usually used in conventional method. By using heat of combustion to generate energy, this method had proved that it would be much energy saving than the conventional thermal process.

(c) Wet process

Wet process is the most common way of producing phosphoric acid. In a wet process facility, phosphoric acid is produced by reacting concentrated (93%) sulfuric acid (H_2SO_4) with naturally occurring fluorapatite which is the phosphate rock $3Ca_3(PO_4)_2.CaF_2$ (The Essential Chemical Industry, 2017) . The phosphate rock is dried, crushed, and then continuously fed into the reactor along with sulfuric acid. The reaction combines calcium from the phosphate rock with sulfate, forming calcium sulfate ($CaSO_4$), commonly referred to as gypsum. This results in phosphoric acid and calcium sulfate (gypsum) plus other insoluble impurities. Water is added and the gypsum is removed by filtration along with other insoluble materials (e.g. silica). Fluoride, as H_2SiF_6, is removed at a further stage by evaporation.

Below (figure 1) is the process flow to produce phosphoric acid (wet processing plant).

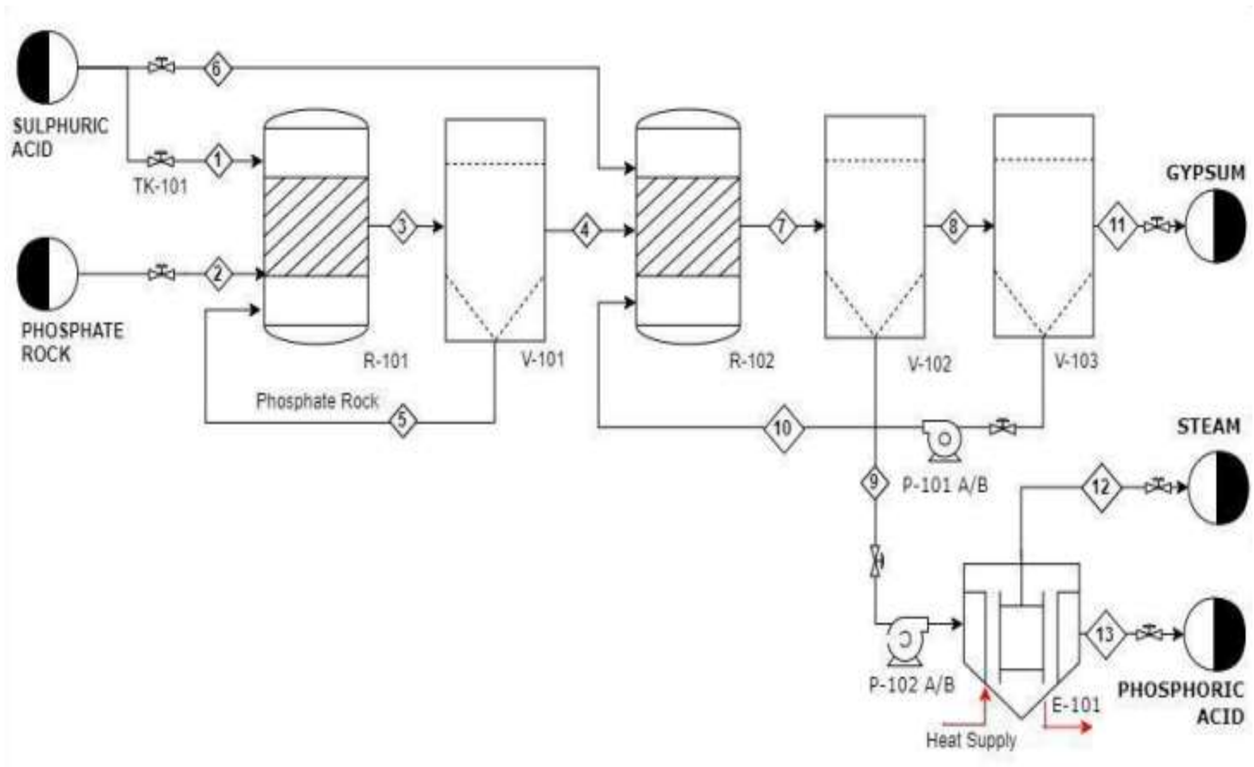

Figure 1: Process flow diagram of phosphoric acid production (wet process plant)

Key

Reactor 1 (R-101): Continuous Stirred Tank Reactor (CSTR) or Agitated Tank Reactor is preferred to perform the reaction due to its ability to improved controllability and mixing and much easier to adjust the parameters compared to other reactors.

Filter (V-101): Pan filter is used to separate between two major components, which is calcium phosphate and phosphate rock. This step is taken into consideration due to phosphate rock availability in the product stream. Recycling phosphate rock is essential to utilize the component into its full extent thus reducing the demand for reactant required for the reaction process.

Reactor 2 (R-102): Continuous Stirred Tank Reactor (CSTR) or Agitated Tank Reactor is used to perform the reaction due to its ability to improved controllability and mixing and much easier to adjust the parameters compared to other reactors.

Separator 1 (V-102): Separator is used to separate between two major components, which is slurry of gypsum and calcium phosphate and phosphoric acid. Gypsum and calcium phosphate will emerge to the top product stream and eases the process flow in producing the desired phosphoric acid.

Separator 2 (V-103): Separator is used to separate between two major components, which is gypsum and calcium phosphate. The reason being is gypsum yield a highly profitable byproduct and calcium phosphate is needed to be recycled back to the CSTR reactor in order to produce the phosphoric acid.

Evaporator (E-101): Evaporator is conducted mainly to reduce the moisture content in the product stream (mixture of phosphoric acid and water). This is to boost the purity of product produced, reaching the desired demand of the market.

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 phosphoric acid. Potential environmental and social impacts due to the production of phosphoric acid 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. Social responsibility cost estimated to be 1% of fixed investment costs.

3.1.2 Plant capacity

In determining the plant capacity of the Phosphoric Acid 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 Phosphoric Acid raises from 541 tons to 1,276 tons from years 2023 to 2032.

Hence, based on the demand gap and the minimum economic of scale for Phosphoric Acid production, a plant with a capacity of 600 ton of Phosphoric Acid per annum is proposed

3.1.3 Production program

It is assumed that the Phosphoric Acid plant will start at 70% in the first year and will grow by 10% each year considering the market penetration traits and consumer perception for local products. The production program of the envisaged plant is given in table 3.

Table 3: Phosphoric acid production program

Year of Production	**1st Year**	**2nd Year**	**3rd Year**	**4th-10th Year**
Capacity utilization (%)	70	80	90	100
Phosphoric Acid (liters)	420,000	480,000	540,000	600,000

3.1.4 Materials and inputs

Raw and Auxiliary Materials

The principal raw materials for the production of Phosphoric Acid are phosphate rock and sulphuric acid. A number of analyses on production costs for different producing mines and potential mines and deposits have been made. The most significant factors altering the cost situation for recovery and processing of phosphate rock and thus the profitability would be; accessibility of the ore, degree of beneficiation required, capital investment, operating costs and, availability and cost of other resources. This raw material is a sedimentary rock dominantly composed of carbonate minerals, particularly carbonates of calcium and magnesium. The most significant factors altering the cost situation for recovery and processing of phosphate rock and thus the profitability would be; accessibility of the ore, degree of beneficiation required, capital investment, operating costs and, availability and cost of other resources.

The total annual cost of raw material at full capacity is estimated at Birr 79.89 million which is locally available. The annual requirement of this raw material is shown in table 4.

Table 4: Raw materials requirement and cost to produce 1000kg of phosphoric acid (100%)

Sr.No.	Description	Unit	Quantity	Unit costs	Total cost (`in Birr)
1	Phosphate Rock	kg	1,635	4.50	7,357.50
2	Sulphuric Acid	kg	1,360	80	108,800.00
3	Packing material,25liter plastic drum	Pcs	40	50	2,000.00
4	Others	LS		LS	15,000.00
	Total				**133,157.50**

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 5. A total area ready for the processing plant is 10,000 m^2 out of which 5,670 m^2 is to be covered by building while uncovered area of 4,330m^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 113.10 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 5 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	5,670 M^2		93,100,000.00

Table 6 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 7 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 a wet process phosphoric acid production plant is the Continuous Stirred Tank Reactor (CSTR) or Agitated Tank Reactor. The total cost of machinery and equipment is estimated at about Birr 158.49 million, which is required in foreign currency. Lists of required machinery and equipment are shown in table 8.

Table 8: Lists of required machinery and equipment

S/N	Description	UOM	Number of Equipment	Unit Cost of Equipment(Birr)	Total Cost of the Equipment(Birr)
1	Sulfuric acid tank	pcs	1	982,855.81	982,855.81
2	Continuous Stirred Tank Reactor (CSTR)	“	2	27,502,410.88	55,004,821.76
3	Pan filter	“	1	28,358,302.93	28,358,302.93
4	Separator	“	2	28,358,302.93	56,716,605.86
5	Evaporator	“	1	13,439,395.27	13,439,395.27
6	Pumps	“	2	1,994,457.04	3,988,914.08
				Total	158,490,895.70

3.2.3. Lists of machinery suppliers

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969 West Wen Yi Road Yu Hang District, Hangzhou 311121 Zhejiang Province, China Tel: (+86) 571-8502-2088 Fax (Mainland China): (+86) 571-8656-1717 Fax (Hong Kong, Macao and Taiwan regions of China and Overseas): (+86) 571-8376-8429

ASIA CHEMICAL

TEL: +86-571-87228886

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Email: asiachem@yatai.cn

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	10	4,000.00	480,000.00
Ass. Operator	6	3,000.00	216,000.00
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	2	2,500.00	60,000.00
Sub total	44		3,517,200.00

5. Financial Analysis

5.1General

The financial analysis evaluation of phosphoric acid manufacturing project are 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 9 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	158,490,895.70	
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				170,990,895.70	
	Fixed capital investment costs				302,940,895.70	
8	pre-operational expenses				2,000,000.00	
	Working capital				16,383,000.00	
	TOTAL INVESTMENT COSTS				321,323,895.70	

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. See Annex table 16 detail annual working capital calculation.

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 13 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 phosphate rock, Sulphuric acid 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 79.89 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 10 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 11 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 12 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	158,490,895.70	15 % of original value	23,774	23,774	23,774	23,774
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			30,829	30,829	30,829	30,829

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.

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

Annual sales = 168,000,000Birr

Unit selling price = 400Birr/liter

BEP (sales) = $= \frac{\text{Annual sales x Annual fixed costs}}{\text{Annual sales} - \text{Annual variables costs}}$ = $= \frac{168{,}000{,}000 \text{ x } 66{,}407{,}000}{168{,}000{,}000 - 70{,}220{,}000}$

BEP (Sales) = <u>114,096,707 Birr</u>

B. BEP production

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

BEP production = 114,096,707/400 = 285,242

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

$$= \frac{66{,}407{,}000\text{x } 100\%}{168{,}000{,}000 - 70{,}220{,}000}$$

= 68%

5.6.2 Return on investment

Return on investment = Net profit /Total capital requirement

= 20,392,000/321,323,896

= 6.3%

The return on owners' investment (ROOI)

= Annual net profit /owners' investment

= 20,392,000/96,397,168

= 21%

5.7 Project benefits

For financial analysis and evaluation of the given project, the current raw price, and packing materials buying price and final packed processed veterinary drug price at the project gate has been taken as a basis. Consequently, based on the recent market survey, price has been indicated in table 4.

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 240 million Birr per annum. The Net Income Statement shows a steady growth of gross profit starting from 20.40 million Birr in year 1 reaching the peak of 80.52 million Birr in year 10. In its 10 years of manufacturing activities, the project is expected to generate a total net profit of 553million Birr and contribute 296 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 18 of "Cash Flow Statement" shows the positive cumulative cash balance of Birr 548million 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 three 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 271million Birr at 17%D.F. and the benefit-cost ratio of 1.69 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 68% 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 I

CALCULATION OF ANNUAL PRODUCTION COSTS

Table 13 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	55,927	63,916	71,905	79,895	79,895	79,895	79,895	79,895	79,895	79,895
II. Labor	3,517	3,517	3,517	3,517	3,517	3,517	3,517	3,517	3,517	3,517
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 and spare parts (1.5 % of fixed costs)	4,544	4,544	4,544	4,544	4,544	4,544	4,544	4,544	4,544	4,544
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	74,783	83,232	91,681	100,132	100,132	100,132	100,132	100,132	100,132	100,132
VII. Administration over head	108	108	108	108	108	108	108	108	108	108
VIII. Marketing and Promotional expense 3 % of sales revenue	5,040	5,760	6,480	7,200	7,200	7,200	7,200	7,200	7,200	7,200
B. Operating costs	79,931	89,100	98,269	107,440	107,440	107,440	107,440	107,440	107,440	107,440
Interest	25,867	24,356	22,672	20,796	18,702	16,368	13,766	10,864	7,629	4,022
Depreciation	30,829	30,829	30,829	30,829	30,329	30,229	21,713	4,655	4,655	4,655
C. Total production costs	136,627	144,285	151,770	159,065	156,471	154,037	142,919	122,959	119,724	116,117

ANNEX II
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

ii. Working capital requirement

Table 14 Calculation of working capital

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	7,993	8,910	9,827	10,744	10,744	10,744	10,744	10,744	10,744	10,744
B. Inventory												
1. Material inputs	26	10	5,593	6,392	7,191	7,990	7,990	7,990	7,990	7,990	7,990	7,990
2. Spare parts	90	4	1,136	1,136	1,136	1,136	1,136	1,136	1,136	1,136	1,136	1,136
3. Work under process	2	130	575	640	705	770	770	770	770	770	770	770
4. Product ready for delivery	8	32.5	2,409	2,669	2,929	3,189	3,189	3,189	3,189	3,189	3,189	3,189
C. Cash on hand	90	4	4,741	4,856	4,971	5,086	5,086	5,086	5,086	5,086	5,086	5,086
D. Current assets			22,447	24,603	26,759	28,915	28,915	28,915	28,915	28,915	28,915	28,915
II. Current liabilities A. A/p	26	10	6,064	6,909	7,753	8,599	8,599	8,599	8,599	8,599	8,599	8,599
III. Working capital												
A. Net working capital			16,383	17,694	19,005	20,316	20,316	20,316	20,316	20,316	20,316	20,316
B. Increasing in working capital			16,383	1,311	1,311	1,311	0	0	0	0	0	0

ANNEX III

PROJECTED SALES REVENUE

Table 15 projected sales revenue'000'

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
Phosphoric acid	Will be packed in 25 liter plastic drum	pcs	24,000	10,000	168,000	192,000	216,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
GRAND TOTAL					168,000	192,000	216,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000

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	168,000	192,000	216,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
Less total production costs	136,627	144,285	151,770	159,065	156,471	154,037	142,919	122,959	119,724	116,117
Gross profit	31,373	47,715	64,230	80,935	83,529	85,963	97,081	117,041	120,276	123,883
Tax	10,981	16,700	22,481	28,327	29,235	30,087	33,978	40,964	42,097	43,359
Net profit	20,392	31,015	41,750	52,608	54,294	55,876	63,103	76,077	78,179	80,524
Accumulated undistributed profit	20,392	51,407	93,157	145,764	200,058	255,934	319,037	395,114	473,293	553,817

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

Table 17 Debt services schedule and computation'000'

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										
2. Outstanding balance at end of year	224,925	211,796	197,155	180,831	162,630	142,334	119,706	94,475	66,342	34,975
a. First year loan	224,925	211,796	197,155	180,831	162,630	142,334	119,706	94,475	66,342	34,975
Total										
A. Debt service										
1. First year Loan										
a. Interest	25,867	24,356	22,672	20,796	18,702	16,368	13,766	10,864	7,629	4,022
b. Repayment of principal	13,131	14,641	16,324	18,202	20,295	22,629	25,231	28,132	31,367	34,975

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	495,388	194,156	218,155	242,157	240,000	240,000	240,000	240,000	240,000	240,000
1. Financial resource (total)	327,388	2,156	2,155	2,157						
2. Sales revenue	168,000	192,000	216,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
B. Cash – outflow	457,298	146,953	161,902	176,921	175,672	176,524	180,415	187,400	188,533	189,796
1. Total assets schedule including replacement	327,388	2,156	2,156	2,156						
2. Operating costs	79,931	89,100	98,269	107,440	107,440	107,440	107,440	107,440	107,440	107,440
3. Debt service (total)										
a. Interest	25,867	24,356	22,672	20,796	18,702	16,368	13,766	10,864	7,629	4,022
b. Repayment	13,131	14,641	16,324	18,202	20,295	22,629	25,231	28,132	31,367	34,975
4. Tax	10,981	16,700	22,481	28,327	29,235	30,087	33,978	40,964	42,097	43,359
C. Surplus (Deficit)	38,090	47,203	56,253	65,236	64,328	63,476	59,585	52,600	51,467	50,204
D. Cumulative cash balance	38,090	85,293	141,546	206,782	271,110	334,586	394,171	446,771	498,238	548,442

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	302,941											
b. Replacement												
2. Pre-operational capital expenditure	2,000											
3. Working capital increase	16,383	1,311	1,311	1,311								
Total investment costs	321,324	1,311	1,311	1,311								

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	302,941											
❖ Cost of land												
d. Replacement												
2. Pre-operational capital expenditure	2,000											
3. Current assets increase	22,447	2,156	2,156	2,156								
Total assets	327,388	2,156	2,156	2,156								

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	96,397	1,311	1,311	1,311							
2. Loan capital	224,927										
3. Current liabilities	6,064	845	844	846							
Total finance	327,388	2,156	2,155	2,157							

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 %										
Gross profit : Revenue	19%	25%	30%	34%	35%	36%	40%	49%	50%	52%
Net profit : Revenue	12%	16%	19%	22%	23%	23%	26%	32%	33%	34%
Net profit : initial investment	6%	10%	13%	16%	17%	17%	19%	23%	24%	25%
Net profit : Equity	21%	32%	42%	52%	54%	56%	63%	76%	78%	80%
Gross profit : Initial investment	10%	15%	20%	25%	26%	26%	30%	36%	37%	38%
Operating costs : Revenue	48%	46%	45%	45%	45%	45%	45%	45%	45%	45%

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	20,392	30,829	51,221	321,324	-270,103
2	31,015	30,829	61,844	1,311	-209,570
3	41,750	30,829	72,579	1,311	-138,302
4	52,608	30,829	83,437	1,311	-56,176
5	54,294	30,329	84,623	0.00	+28,447

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	168,000	0.854701	143,590	321,324	79,931	401,255	342,953
2	192,000	0.730514	140,259	1,311	89,100	90,411	66,047
3	216,000	0.624371	134,864	1,311	98,269	99,580	62,175
4	240,000	0.53365	128,076	1,311	107,440	108,751	58,035
5	240,000	0.456111	109,467		107,440	107,440	49,005
6	240,000	0.389839	93,561		107,440	107,440	41,884
7	240,000	0.333195	79,967		107,440	107,440	35,798
8	240,000	0.284782	68,348		107,440	107,440	30,597
9	240,000	0.243404	58,417		107,440	107,440	26,151
10	240,000	0.208037	49,929		107,440	107,440	22,351
Total			1,006,477				734,997

A. Benefit- cost ratio at 17% D = 1.69
B. NPV at 17% D.F. = 271,480,000 Birr