

55. PROFILE ON PRODUCTION OF ACETONE

TABLE OF CONTENTS

	<u>PAGE</u>
I. SUMMARY	55-3
II. PRODUCT DESCRIPTION & APPLICATION	55-3
III. MARKET STUDY AND PLANT CAPACITY	55-4
A. MARKET STUDY	55-4
B. PLANT CAPACITY & PRODUCTION PROGRAMME	55-6
IV. MATERIALS AND INPUTS	55-7
A. RAW MATERIALS	55-7
B. UTILITIES	55-8
V. TECHNOLOGY & ENGINEERING	55-8
A. TECHNOLOGY	55-8
B. ENGINEERING	55-9
VI. MANPOWER & TRAINING REQUIREMENT	55-10
A. MANPOWER REQUIREMENT	55-10
B. TRAINING REQUIREMENT	55-11
VII. FINANCIAL ANALYSIS	55-11
A. TOTAL INITIAL INVESTMENT COST	55-11
B. PRODUCTION COST	55-12
C. FINANCIAL EVALUATION	55-13
D. ECONOMIC BENEFITS	55-14

I. SUMMARY

This profile envisages the establishment of a plant for the production of acetone with a capacity of 100 tonnes per annum.

The present demand for the proposed product is estimated at 70 tonnes per annum. The demand is expected to reach at 137.7 tonnes by the year 2017.

The plant will create employment opportunities for 20 persons.

The total investment requirement is estimated at Birr 6.17 million, out of which Birr 2.84 million is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 14 % and a net present value (NPV) of Birr 1.71 million, discounted at 8.5%.

II. PRODUCT DESCRIPTION AND APPLICATION

Acetone is a colorless volatile and inflammable liquid with a mildly pungent and aromatic odor. It is miscible in all proportions with water and organic solvents such as diethyl ether, methanol, ethyl alcohol and esters.

This product is used for the following purposes:-

- As a solvent for cellulose acetate, nitro-cellulose, celluloid, chlorinated rubber, etc.;
- As a carrier for acetylene;
- as a raw-material for the chemical synthesis of a wide range of products, such as ketene, methyl methacrylate, bisphenol A, methyl isobutyle ketone, etc, in chemicals, explosives and lacquer industries.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past Supply and Present Demand

The country's requirement for acetone is totally met through import. Data obtained from the Ethiopian Customs Authority with regard to import of acetone for the period covering 1997 - 2004 is given in Table 3.1.

Table 3.1
IMPORT OF ACETONE

Year	Quantity (Tonnes)	Value (Birr)
1997	41.6	1,155,509
1998	90.6	666,919
1999	52.7	313,882
2000	24.7	203,718
2001	154.3	876,904
2002	34.0	350,414
2003	34.3	438,912
2004	57.7	563,321
2005	47.5	658,413
2006	84.2	1,023,102

Source: - Ethiopian Customs Authority

As can be seen from Table 3.1 there were years in which import figures were unusually high. This situation was clearly identified in the years 1998, 2001 and 2006 when their respective

import figures were much higher than the imports in the following years. In 1998, the import figure was about 90.6 tonnes while in the following years, i.e., 1999 and 2000 the import figure dropped to 52.7 tonnes and 24.7 tonnes respectively. Similarly, import figure in the year 2001 was about 154 tonnes while in the following four consecutive years, i.e., from 2002 - 2005 import ranges from only 34 tonnes to about 58 tonnes. This probably indicates that the high imports in some years were used as buffer stocks for the following years. Hence, some portion of the imports were distributed among the subsequent years in which recorded import figures were found to be comparatively low.

By looking to the above argument, the present effective demand is estimated using the following methodology.

- The average import figures in the recent past six years, i.e., 2001- 2006 is taken as an effective demand for the year 2007

- Since the product is directly related with the growth of the manufacturing sector, an annual average growth rate of 7% (which is recorded by the industrial sector in the past) is applied to arrive at the current (year 2007) demand.

Accordingly, current effective demand is estimated at 70 tonnes.

2. Projected Demand

Acetone is used as a solvent in the production of paint, varnish, lacquer, cellulose acetate, potassium iodide and permanganate. It is also used to clean dry parts of precision equipments, delusterant for cellulose acetate fibre and specification testing of vulcanized rubber products. This clearly indicates that demand for acetone is directly related with the development of the industrial sector. Taking this in consideration, annual average growth of 7% is applied to forecast the future demand. The forecasted demand up to the year 2017 is given in Table 3.2.

Table 3.2
PROJECTED DEMAND FOR ACETONE (TONNES)

Year	Projected Demand
2008	74.9
2009	80.2
2010	85.8
2011	91.8
2012	98.2
2013	105.1
2014	112.4
2015	120.3
2016	128.7
2017	137.7

3. Pricing and Distribution

Taking the recent three years average price of import, an ex-factory price of Birr 25,000 per tonne is recommend. The product can be sold directly to the end-users, i.e., mainly to the chemical industries.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

The capacity of the recommended plant is 100 tonnes of acetone per year for 300 working days.

2. Production Programme

Production programme of the envisaged plant is set as follows.

- ✓ 75% of plant capacity during the 1st year,
- ✓ 85% of plant capacity during the 2nd year, and
- ✓ 100% of plant capacity starting from the third year.

The production programme is set considering Sundays and public holidays and assuming that maintenance works will be carried out during off-working hours.

IV. MATERIALS AND INPUTS

A. RAW MATERIALS

Propylene or ISO-propyl alcohol is the only raw material used for manufacturing of acetone in the presence of a catalyst. Packaging materials are required for delivering this product. The annual materials requirement and cost of the plant is given in Table 4.1.

Table 4.1
ANNUAL CONSUMPTION OF RAW MATERIALS AND COST

Description	Unit of meas.	Qty.	Cost in '000 Birr		
			F.C	L.C	T.C
Propylene	tonnes	120	918	162	1080
Catalyst (silver or copper)	"	0.5	17	3	20
Water	m ³	80	-	0.26	0.26
Packaging	Barrel	625	-	188	188
Total			935	353.26	1288.26

B. UTILITIES

Utilities required for manufacturing acetone include electric power, potable and cooling water, and steam (see Table 4.2).

Table 4.2
ANNUAL CONSUMPTION OF UTILITIES AND COST

Description	Unit of Measure	Qty.	Cost in '000 Birr
Electricity	kWh	33,100	16
Furnace oil	m ³	140	757
Water	m ³	15,040	83
Total			856

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

Acetone is produced by the catalytic dehydration of iso-propyl alcohol. Propylene and water are pre-heated and fed to a catalytic reactor, where isopropanol is formed. Aqueous isopropanol is separated from water and small amounts of other light and heavy ends in a series of 3 to 6 distillation columns. It is then vaporized and dehydrogenated in a fixed bed catalyst reactor. Purification is carried out using conventional fractional techniques.

2. Source of Technology

The technical data and information are compiled from UNIDO document "How to Start Manufacturing Industries, Vol II."

B. ENGINEERING

1. Machinery and Equipment

The list of production machinery and equipment required for the plant is provided in Table 5.1. The total cost of plant machinery and equipment is estimated at Birr 2,841.2 thousand, out of which Birr 2,367.7 thousand will be required in foreign currency.

Table 5.1
LIST OF MACHINERY AND EQUIPMENT REQUIRED

Sr. No	Description	Qty. (No)
1	Vaporizer	
2	Reactor	1
3	Cooler	1
4	Scrubber	1
5	Acetone fractionating column	1
6	Water fractionating column	1
7	Storage tanks	1
8	Boiler	1
9	Handling facility	(sets)
10	Laboratory equipment	(sets/LS)

2. Land, Building and Civil Works

The built-up area of the plant will be 600 sq.meters. The total area will be 2,000 sq.meters. The plant will have production buildings, stores, office buildings and other civil structures. The total cost of buildings and civil works shall be Birr 1,500,000. The annual leased land rent shall be Birr 700 per annum.

3. Proposed Location

The envisaged plant shall be located in Aleta wondo town in Aleta woreda.

VI. MANPOWER TRAINING REQUIREMENT

A. MANPOWER REQUIREMENT

The total manpower requirement of the plant will be 20. The monthly and annual salaries and wages are summarized in Table 6.1.

Table 6.1
MANPOWER REQUIREMENT AND LABOUR COST (BIRR)

Sr. No	Description	No of Persons	Monthly Salary	Annual Salary
1	Manager	1	3,000	36,000
2	Secretary	1	700	8,400
3	Administration + Finance head	1	2,000	24,000
4	Sales & purchase head	1	2,000	24,000
5	Store keeper	1	800	9,600
6	Production supervisor	1	2,000	24,000
7	Technical foreman	1	1,500	18,000
8	Operators	6	4,800	57,600
9	Mechanic and Electrician	2	2,400	28,800
10	Messenger, guard and cleaner	5	1,250	15,000
	Total	20	20,450	245,400

B. TRAINING REQUIREMENT

On-the-Job training is shall be carried out during plant erection and commissioning. Therefore, the cost of training is estimated at Birr 25,000.

VII. FINANCIAL ANALYSIS

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

Construction period	1 year
Source of finance	30 % equity
	70 % loan
Tax holidays	3 years
Bank interest	8%
Discount cash flow	8.5%
Accounts receivable	30 days
Raw material local	30 days
Raw material, import	90 days
Work in progress	5 days
Finished products	30 days
Cash in hand	5 days
Accounts payable	30 days

A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at Birr 6.17 million, of which 27 per cent will be required in foreign currency.

The major breakdown of the total initial investment cost is shown in Table 7.1.

Table 7.1
INITIAL INVESTMENT COST

Sr. No.	Cost Items	Total Cost (‘000 Birr)
1	Land lease value	700.0
2	Building and Civil Work	1,500.0
3	Plant Machinery and Equipment	2,841.2
4	Office Furniture and Equipment	100.0
5	Vehicle	250.0
6	Pre-production Expenditure*	440.9
7	Working Capital	342.0
	Total Investment cost	6,174.2
	Foreign Share	27

* *N.B Pre-production expenditure includes interest during construction (Birr 290.91 thousand) training (Birr 25 thousand) and Birr 125 thousand costs of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

B. PRODUCTION COST

The annual production cost at full operation capacity is estimated at Birr 3.29 million (see Table 7.2). The material and utility cost accounts for 65.16 per cent, while repair and maintenance take 3.45 per cent of the production cost.

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

Items	Cost	%
Raw Material and Inputs	1,288.26	39.15
Utilities	856	26.01
Maintenance and repair	113.65	3.45
Labour direct	147.24	4.47
Factory overheads	49.08	1.49
Administration Costs	98.16	2.98
Total Operating Costs	2,552.39	77.57
Depreciation	484.12	14.71
Cost of Finance	254.09	7.72
Total Production Cost	3,290.60	100

C. FINANCIAL EVALUATION**1. Profitability**

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

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

2. Break-even Analysis

The break-even point of the project including cost of finance when it starts to operate at full capacity (year 3) is estimated by using income statement projection.

$$\text{BE} = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 24 \%$$

3. Pay Back Period

The investment cost and income statement projection are used to project the pay-back period. The project's initial investment will be fully recovered within 6 years.

4. Internal Rate of Return and Net Present Value

Based on the cash flow statement, the calculated IRR of the project is 14 % and the net present value at 8.5% discount rate is Birr 1.71 million.

D. ECONOMIC BENEFITS

The project can create employment for 20 persons. In addition to supply of the domestic needs, the project will generate Birr 1.2 million in terms of tax revenue. The establishment of such factory will have a foreign exchange saving effect to the country by substituting the current imports.