

269. PROFILE ON SILVER RECOVERY

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I. SUMMARY

This profile envisages the establishment of a plant for the recovery of silver with a capacity of 50 kg per annum.

The present demand for the proposed product is estimated at 340 kg per annum. The demand is expected to reach at 882 kg by the year 2017.

The plant will create employment opportunities for 8 persons.

The total investment requirement is estimated at Birr 1.8 million, out of which Birr 60,455 is required for plant and machinery.

The project is financially viable with an internal rate of return (IRR) of 15% and a net present value (NPV) of Birr 3.16 million, discounted at 8.5%.

II. PRODUCT DESCRIPTION AND APPLICATION

Silver is shining white metal used for ornaments, coins, utensils, etc. It is substantially present in the black and white film developing solution, commonly known as hypo solution. Generally the hypo solution is available from the x-ray film units of hospitals and photographic industries. Silver is available in this solution as double complex and the concentration of silver in this solution is as high as 8 to 10 grams per litre.

Every photographic film has a thin coating of silver over it. During image formation, silver is changed from image portion of the film into hypo solution called "fixing solution". By repeating the process again and again, the silver concentration becomes very high and the fixing solution stops working, and then rejected. This waste solution is used as basic raw material for recovery of silver.

Being a precious metal, silver has number of applications in addition to its use in ornaments. It is used for silver paints, silver batteries (as watch batteries), silver catalyst; brazing alloys (silver-copper), mirrors, dental amalgam, silver nitrates as antiseptics etc.

III. MARKET STUDY AND PLANT CAPACITY

A. MARKET STUDY

1. Past supply and present demand

Silver (Ag), is one of the precious metals having a wide range of applications. It conducts heat and electricity better than any other metal. Silver has been known and valued as an ornamental and coinage metal since ancient times. With the exception of gold, silver is the most malleable and ductile of all metals. It is harder than gold but softer than copper. In addition to its ornamental value it is used for silver paints, silver batteries (watch battery), brazing alloys, mirrors, dental amalgam etc.

Due to its wide applications and limited supply it is highly demanded all over the world. Despite its wide application and wide market, Ethiopia does not produce the product for certain reasons. As a result the countries requirement for silver nitrate is met through import. The amount of silver nitrate imported during the past 7 years is presented in Table 3.1

Table 3.1
IMPORT OF SILVER NITRATE (K.G)

Year	Import
2000	276
2001	56
2002	82
2003	530
2004	72
2005	249
2006	511

Source :-Customs Authority.

The import data provided in Table 3.1 is highly erratic ranging from 72kg to 530 kg. However, Ethiopia was importing about 340 kg of silver nitrate per annum for the past recent four years. Hence, this could be taken as the present effective demand for the domestic market.

2. Projected Demand

The domestic demand for silver nitrate is influenced by income rise and development of silver nitrate users as an intermediate input. Although the product has a wide export market it is considered in this study assuming that the hypo solution to be collected from hospitals and photographic industries in the region doesn't allow supplying to the world market. Hence, by taking the estimated current effective demand as a base a 10% annual average growth rate is applied to project the future demand (see Table 3.2)

Table 3.2
PROJECTED DEMAND FOR SILVER NITRATE (KG.)

Year	Projected Demand
2008	374
2009	411
2010	453
2011	498
2012	548
2013	602
2014	663
2015	729
2016	802
2017	882

It has to be noted that if the hypes solution (from which silver nitrate is to be extracted) is available the market in the international market is very wide.

3. Pricing and Distribution

Taking the average CIF price of the recent two years and allowing a 40% for duty and other charges an ex- factory price of Birr 74 per kg. is recommended.

The product can be sold directly to the end users.

B. PLANT CAPACITY AND PRODUCTION PROGRAMME

1. Plant Capacity

The annual production capacity of the plant, working 8 hours a day (single shift), and 300 days per annum is recommended to be 50 kg of silver taking into consideration the existing demand and the availability of the hypo solution . However, production can be increased by introducing additional shifts of operation as far the hypo solution is available.

2. Production Programme

The production programme is scheduled in such a way that the plant operates at 75% and 85% of the installed capacity during the first and second year, respectively, and at full capacity on the third year and thereafter. The production programme is set by deducting Sundays and public holidays in a year and assuming that repair and maintenance works will be carried out during off-production hours.

IV. MATERIALS AND INPUTS

A. RAW MATERIALS

Hypo solution is the major raw material required for recovery of silver from the waste hypo solution. A minimum quantity of silver estimation paper is also required. The annual cost of these raw materials is Birr 32,450 out of which Birr 24,000 will be required in foreign currency.

B. UTILITIES

The total installed electric power of the plant (automatic machine for silver recovery) is 0.5 kw. Annual consumption of electric power for a single shift operation of the plant is 1200 kwh, and total estimated cost of electricity is Birr 1,096. The water consumption of the plant is very minimal and the cost to be incurred is negligible.

V. TECHNOLOGY AND ENGINEERING

A. TECHNOLOGY

1. Production Process

The process of silver extraction from the waste hypo solution involves the operations briefly stated below.

The concentration of silver in the solution is checked in grams per litre with the help of silver estimation papers within 15 seconds. For the recovery of silver the use of an automatic machine based on electrochemical process is found to be economical.

The waste hypo solution is fed to the machine. A 500 grams/day capacity machine has a maximum tank capacity of 75 litres and electric load of 300 watts. The silver is recovered and collected after specified time period. Silver extracted through this process is directly marketable.

2. Source of Technology

The technology is readily available in Far East countries.

B. ENGINEERING**1. Machinery and Equipment**

Major plant machinery and equipment required for silver extraction are the silver extraction plant, packing & sealing machine, and storage tanks for hypo (PVC), (1,000 litres). The total cost of machinery and equipment is estimated at Birr 60,455 out of which Birr 45,341 will be required in foreign currency.

2. Building and Civil Works

Total land requirement of the plant is estimated to be 150 sq. metres. The value of land as per regions lease rate is estimated at Birr 120 per annum. Total requirement for built-up area is estimated at 75 sq. metres. Cost of building at the rate of Birr 2,500 per metre square is estimated at Birr 187,500.

3. Proposed Location

The envisaged plant shall be located in Awassa town, the regional capital considering the availability of raw material and the market for the product.

VI. MANPOWER AND ENGINEERING REQUIREMENT**A. MANPOWER REQUIREMENT**

The plant requires minimum number of manpower and therefore it is assumed that all the manpower would be employed in the first year of operation. Total manpower requirement of the plant is estimated to be 8 persons. Table 6.1 depicts details of the manpower requirement and the related cost estimates.

B. TRAINING REQUIREMENT

The project does not need a special training as such and no training costs would be incurred by the plant.

Table 6.1
MANPOWER REQUIREMENT AND LABOUR COST

Sr. No	Position	Req. No.	Salary (Birr)	
			Monthly	Annual
1	Manager	1	1,500	18,000
2	Accountant/typist	1	800	9,600
3	Sales clerk	1	500	6,000
4	Driver	1	350	4,200
5	Watchman	2	400	4,800
6	Operator	1	500	6,000
7	Production Worker	1	200	2,400
Sub Total		8	4250	51,000
Employees' Benefit (25% of Basic Salary)			1,062.5	12,750
Total			5,312.50	63,750

VII. FINANCIAL ANALYSIS

The financial analysis of the silver recovery 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	5 years
Bank interest	8%
Discount cash flow	8.5%
Accounts receivable	30 days
Raw material local	30days
Work in progress	5 days
Finished products	30 days
Cash in hand	5 days

A. TOTAL INITIAL INVESTMENT COST

The total investment cost of the project including working capital is estimated at Birr 14.18 million, of which 19 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	28.0
2	Building and Civil Work	3,450.0
3	Plant Machinery and Equipment	6,500.0
4	Office Furniture and Equipment	125.0
5	Vehicle	450.0
6	Pre-production Expenditure*	823.1
7	Working Capital	2,808.5
	Total Investment cost	14,184.7
	Foreign Share	19

** N.B Pre-production expenditure includes interest during construction (Birr 673.11 thousand) training (Birr 50 thousand) and Birr 100 thousand costs of registration, licensing and formation of the company including legal fees, commissioning expenses, etc.*

B. PRODUCTION COST

The annual production cost at full operation capacity is estimated at Birr 19.76 million (see Table 7.2). The material and utility cost accounts for 88.93 per cent, while repair and maintenance take 0.66 per cent of the production cost.

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

Items	Cost	%
Raw Material and Inputs	15,661.00	79.25
Utilities	1912.49	9.68
Maintenance and repair	130	0.66
Labour direct	282.53	1.43
Factory overheads	94.18	0.48
Administration Costs	188.35	0.95
Total Operating Costs	18,268.55	92.45
Depreciation	955	4.83
Cost of Finance	537.01	2.72
Total Production Cost	19,760.56	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.

$$\text{BE} = \frac{\text{Fixed Cost}}{\text{Sales} - \text{Variable Cost}} = 30 \%$$

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 15 % and the net present value at 8.5% discount rate is Birr 3.16 million.

D. ECONOMIC BENEFITS

The project can create employment for 8 persons. In addition to supply of the domestic needs, the project will generate Birr 3.97 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.