

## COST ESTIMATION AND ECONOMIC ANALYSIS

A preliminary economic analysis is performed for the overall plan. Due to lack of recent data, different cost estimates are done based on cost indices and capacity factors. However, the present analysis will give a fair idea about the profitability of the plant. The byproducts DEG and TEG are assumed to have no sale value as they have not been purified. However, an additional distillation step may be added if one of the higher glycols is to be recovered.

### A. Equipment and Installation Costs

EQUIPMENT	COST IN \$
Refrigeration Unit	7000
Hold Tank	2000
Pumps	1330X3
Heat Exchanger HE-1	11800
Heat Exchanger HE-2	1950
Heat Exchanger HE-3	7300
Condenser	3500
Reboiler	2210
Reactor	2000
Evaporator Unit (Triple Effect)	75000
Distillation Column	30000
Trays	300X26
Steam Ejector	1500

Purchased Equipment cost (PEC) = 1,56,050\$ = 78,02,500 Rs

#### **Other Costs(OC)**

Installation Costs = 47% PEC = 3667175 Rs

Instrumentation Costs = 18% PEC = 1404450 Rs

Piping Costs = 66%PEC = 5149650 Rs  
Electrical Costs = 11%PEC = 858275 Rs  
Building Costs = 18%PEC = 1404450 Rs  
Yard Improvement = 10%PEC = 780250 Rs  
Service Facility = 70%PEC = 5461750 Rs  
Land = 6%PEC = 468150 Rs

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Total Cost = 1,91,94,150 Rs

**(B) Direct Plant Cost (DPC) = A + OC = 2,69,96,650 Rs**

Engineering supervision = 33%PEC = 2574825 Rs

Construction Expenses = 41%PEC = 3199025 Rs

**(C) Total Direct and Indirect Plant Costs**

DI = 3,27,70,500 Rs

I. Contractor's fee = 5%DI = 1638525 Rs

II. Contingency fee = 10%DI = 3277050 Rs

**Fixed Capital Investment (FCI) = 3,76,86,075 Rs**

**Working Capital (WC) = 86%PEC = 6710150 Rs**

**Total Capital Investment (TCI) = FCI + WC**

= 4,43,96,225 Rs

**Manufacturing Cost Estimation**

**A) Direct Production Cost**

1) Raw Material Cost

Ethylene oxide: Rs 30/kg X 1.0148 X 3600 X 24 X 365 = 96,00,81,984 Rs/yr

Water (Pure) = Rs 1/kg X 0.4 X 3600 X 24 X 365 = 1,26,14,400 Rs/yr

Total raw material cost = 97,26,96,384 Rs/yr

Let the total production cost be Rs. Z/yr

2) Operating Labor = 0.1Z/yr

3) Direct Supervision and clerical labor = 0.01Z/yr

4) Maintenance and repair cost (Assuming a 10yr life) =  $0.02(\text{FCI}/10) = 75372/\text{yr}$

5) Utilities = 0.1Z/yr

6) Operating supplies =  $0.01(\text{FCI}/10) = 37686/\text{yr}$

7) Patents and Royalties = 0.03Z/yr

8) Laboratory Charges = 0.01Z/yr

## **B) Fixed Charges**

i). Depreciation:

Assuming a 10 year life for equipment and machines,

Depreciation = Total Equipment Cost / 10 =  $15214875/10 = 1521488$  Rs/yr

Assuming a 50 year life for buildings,

Depreciation = Cost of Buildings/50 =  $1404450/50 = 28089/\text{yr}$

Total Depreciation = 1549577 Rs/yr

C) **Plant overhead costs** = 0.05Z/yr

## II. General Expenses

a) Administration Cost = 0.02Z/yr

b) Distribution and Selling Cost = 0.05Z/yr

c) Research and Development cost = 0.02Z/yr

## III. Total Production Cost (TPC)

TPC = MC + GE

$Z = 0.01Z + 0.01Z + 75372 + 0.1Z + 37686 + 0.03Z + 0.01Z + 1549577 + 0.05Z + 0.02Z + 0.05Z$   
 $+ 0.02Z + 972696384$

$Z = (974359019)/(0.7) = 1,39,19,41,456$  Rs/yr

Selling Price = Rs 38.5/kg (Fiber grade glycol)

Total Selling Price/yr =  $38.5 \times 100 \times 1000 \times 365 = 1,40,52,50,000$  Rs/yr

Gross Earning = 1,33,08,544 Rs/yr

### **Rate of Return**

Let tax rate be 45% (common)

Net profit =  $13308544(1-0.45) = 73,19,699$  Rs/yr

Rate of Return =  $(7319699 \times 100) / 44396225 = 16.5\%$

### **Break Even Point**

Let N TPA be the break even production rate.

Raw material Cost/(ton product) =  $972696384 / (100 \times 365) = 26649$  Rs / (Ton Product)

Fixed Cost =  $1549577 + 0.05Z + 0.02Z + 0.05Z + 0.02Z = 196421381$  Rs/yr

At break even production,

Fixed charges + Direct Production Cost = Selling Cost

$26649 + 196421381 = 38.5 \times 100 \times N$

$N = 16574.2$  TPA = 45.5 TPD

Hence, the break even production rate is 45.5 TPD or 45.5% of the considered plant capacity.