COST ESTIMATION AND ECONOMICS

Marshall and Shift index in 1992 for equipments is 943.1

Cost estimation based on the equipment

Cost of the bare columns is 3*11000£.

Saddles cost 720£/m^3.

Total cost of the packing ,for the 3 columns 3*315£.

Cost of the reactor is 16000£.

There are five heat exchangers, reboilers and condensers, of shell and tube type. The approximate cost of the each exchanger is 3000£.

The cost of one DPHE is 1500£.

Therefore the total cost of the equipment = 66445£.

Taking 1£ = Rs 63.

Total cost of the equipment = Rs 66445*63*1048/943.1.

= Rs $4.65115*10^6$.

ESTIMATION OF DIRECT COST

COMPONENTS	COSTS
Purchased equipment cost (E)	Rs $4.65115*10^6$
Purchased equipment installation (39% of E)	Rs $1.8139*10^6$
Instrumentation (installed cost), 28%E	Rs $1.3023*10^6$
Piping installed, 31%E	Rs $1.4418*10^6$
Electrical installation, 10%E	Rs $0.465115*10^6$
Yard improvement, 10%E	Rs $0.465115*10^6$
Service facility, 55%E	Rs $2.55813*10^6$
Land , 6%E	Rs $0.279069*10^6$
TOTAL DIRECT COST (D)	Rs $13.999*10^6$

ESTIMATION OF INDIRECT COST

1. Engg and supervision (32% E) = Rs $1.48836*10^6$
2. Construction + contractor fees (25% direct cost)

   = Rs $3.4997*10^6$

Therefore total indirect cost (I) = Rs $4.988118*10^6$

DIRECT AND INDIRECT COST (TOTAL) = Rs $18.9871*10^6$

Contingence (10%D+I) = Rs $1.89871*10^6$

Fixed capital investment (FCI) ,

contingence + D + I = Rs $20.88801*10^6$

Working Capital: (10-20% of Fixed-capital investment)

Consider the Working Capital = 15% of Fixed-capital investment

i.e., Working capital = 15% of $20.88801*10^6 = 0.15 \times 20.88801*10^6$

$= \text{Rs } 3.13320*10^6$

Total Capital Investment (TCI):

Total capital investment

= Fixed capital investment + Working capital

$= \text{Rs } 24.02121*10^6$

i.e., Total capital investment $= \text{Rs } 24.02121*10^6$

Estimation of Total Product cost:

I. Manufacturing Cost = Direct production cost + Fixed charges + Plant overhead cost.

A. Fixed Charges: (10-20% total product cost)

i. Depreciation: (depends on life period, salvage value and method of calculation-about 13% of FCI for machinery and equipment and 2-3% for Building Value for Buildings)

Consider depreciation = 13% of FCI for machinery and equipment and 3% for Building Value for Buildings)

i.e., Depreciation = Rs. 2.71541×10^6

ii. Local Taxes: (1-4% of fixed capital investment)

Consider the local taxes = 3% of fixed capital investment

i.e. Local Taxes = $0.03 \times 20.88801*10^6$

= Rs. 0.6266×10^6

iii. Insurances: (0.4-1% of fixed capital investment)

Consider the Insurance = 0.7% of fixed capital investment

i.e. Insurance = 0.007× Rs 20.88801*10^6

= Rs. 0.14621607×10^6

iv. Rent: (8-12% of value of rented land and buildings)

Consider rent = 10% of value of rented land and buildings

Rent = Rs. 0.1302322x10^6

Thus, Fixed Charges = Rs. 3.61844×10^6

B. Direct Production Cost: (about 60% of total product cost)

Now we have Fixed charges = 10-20% of total product charges – (given)

Consider the Fixed charges = 15% of total product cost

- ⇨ Total product charge = fixed charges/15%
- ⇨ Total product charge = 3.61844×10^6/15%
- ⇨ Total product charge = 3.61844×10^6/0.15
- ⇨ Total product charge(TPC) = Rs. 24.1229×10^6

i. Raw Materials: (10-50% of total product cost)

Consider the cost of raw materials = 25% of total product cost

- ⇨ Raw material cost = 25% of 24.1229×10^6
- ⇨ Raw material cost = Rs. 6.03073×10^6

ii. Operating Labour (OL): (10-20% of total product cost)

Consider the cost of operating labour = 12% of total product cost

- ⇨ operating labour cost = 12% of 24.1229×10^6
- ⇨ Operating labour cost = Rs 2.89478×10^6

iii. Direct Supervisory and Clerical Labour (DS & CL):

(10-25% of OL)

Consider the cost for Direct supervisory and clerical labour= 12% of OL

⇨ Direct supervisory and clerical labour cost

$= 12\% \text{ of } 2.89478\times10^6$

$= 0.34736\times10^6$

iv. Utilities: (10-20% of total product cost)

Consider the cost of Utilities = 12% of total product cost

⇨ Utilities cost = 12% of 24.1229×10^6

$= 0.12\times 24.1229\times10^6$

⇨ Utilities cost = Rs. 2.89464×10^6

v. Maintenance and repairs (M & R):

(2-10% of fixed capital investment)

Consider the maintenance and repair cost

= 5% of fixed capital investment

i.e. Maintenance and repair cost = $0.05\times20.88801\times10^6$

= Rs. 1.0444×10^6

vi. Operating Supplies: (10-20% of M & R or 0.5-1% of FCI)

Consider the cost of Operating supplies = 15% of M & R

Operating supplies cost = 15% of 1.0444×10^6

Operating supplies cost = Rs. 0.15666×10^6

vii. Laboratory Charges: (10-20% of OL)

Consider the Laboratory charges = 15% of OL

⇨ Laboratory charges = 15% of 2.89478×10^6

⇨ Laboratory charges = Rs. 0.434212×10^6

viii. Patent and Royalties: (0-6% of total product cost)

Consider the cost of Patent and royalties = 4% of total product cost

⇨ Patent and Royalties = 4% of 24.1229×10^6

⇨ Patent and Royalties cost = Rs. 0.964919×10^6

Thus, Direct Production Cost = Rs. 14.7676×10^6

C. Plant overhead Costs (50-70% of Operating labour, supervision, and maintenance or 5-15% of total product cost); includes for the following: general plant upkeep and overhead, payroll overhead, packaging, medical services, safety and protection, restaurants, recreation, salvage, laboratories, and storage facilities.

Consider the plant overhead cost = 60% of OL, DS & CL, and M & R

Plant overhead cost

$= 60\% \text{ of } ((2.8947\times10^6) + (0.3473\times10^6) + (1.04441\times10^6))$

Plant overhead cost = Rs. 2.5719×10^6

Thus, Manufacture cost = Direct production cost + Fixed charges + Plant overhead costs.

Manufacture cost = Rs. 20.9580×10^6

II. General Expenses = Administrative costs + distribution and selling costs + research and development costs

Administrative costs:(2-6% of total product cost)

Consider the Administrative costs = 5% of total product cost

⇨ Administrative costs = Rs. 1.206145×10^6

A. Distribution and Selling costs: (2-20% of total product cost); includes costs for sales offices, salesmen, shipping, and advertising.

Consider the Distribution and selling costs = 15% of total product cost

Distribution and selling costs = 15% of 2.41229×10^7

⇨ Distribution and Selling costs = Rs. 3.6184×10^6

C. Research and Development costs: (about 5% of total product cost)

Consider the Research and development costs = 5% of total product cost

Research and Development costs = 5% of 2.41229×10^7

Research and Development costs = Rs. 1.2010×10^6

D. Financing (interest): (0-10% of total capital investment)

Consider interest = 5% of total capital investment

i.e. interest = 5% of 2.40212×10^7

Interest = Rs. 1.20106×10^6

Thus, General Expenses = Rs. 7.23178×10^6

III. Total Product cost = Manufacture cost + General Expenses

Total product cost = Rs. 28.1897×10^6

V. Gross Earnings/Income:

Wholesale Selling Price of carbitol per ton = £ 70

Hence Wholesale Selling Price of carbitol per ton. = 63 ×70 = Rs. 4400

Total Income = Selling price × Quantity of product manufactured

= 4400 × (25 T/day) × (330 days/year)

Total Income = Rs. 36.3×10^6

Gross income = Total Income – Total Product Cost

= $36.3\times10^6 - 24.122\times10^6$

Gross Income = Rs. 12.1771×10^6

Let the Tax rate be 45% (common)

Taxes = 45% of Gross income

= 45% of 12.1771×10^6

Taxes = Rs. 5.4796×10^6

Net Profit = Gross income - Taxes = Gross income× (1- Tax rate)

Net profit = $(12.1771\times10^6) - (5.4796\times10^6)$

= Rs. 6.6974×10^6

Rate of Return:

Rate of return = Net profit×100/Total Capital Investment

Rate of Return = $6.6974\times10^6\times100/ (24.02121\times10^6)$

Rate of Return = 27.881%