

# CH0401 Process Engineering Economics

## Chapter 2 – Balance Sheet and Cost Accounting

### Lecture 2g

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- 1 Capital requirements for process plants
- 2 Balance Sheets
- 3 Earnings, process and returns (Income statements)
- 4 Economic production, break even analysis charts**
- 5 Cost accounting - pre construction cost estimation - allocation of cost.

## Problems Break Even analysis

Normally break-even analysis is performed in two ways one is by analytical equations and two is by graphical technique. Further the analytical calculations are sub divided into two ways they are (1) break even for the number of units (or volume) of production and (2) break even for the volume of sales.

Equations used

$$\text{B. E.P (in Volume of Output)} = \frac{\text{Fixed Cost Per Annum (} F \text{)}}{\text{Contribution per unit (} C \text{)}}$$

$$\text{Contribution per Unit} = \text{Selling price per unit (} S \text{)} - \text{Variable cost per unit (} V \text{)}$$

$$\text{B.E.P (in Volume of Output)} = \frac{\text{Fixed Cost Per Annum (} F \text{)}}{\text{Selling price per unit (} S \text{)} - \text{Variable cost per unit (} V \text{)}}$$

$$\text{B. E.P (in Volume of Sales)} = \frac{(F)}{(S) - (V)} \times (S)$$

(or)

$$\text{B. E.P (in Volume of Sales)} = \frac{(F)}{(1) - \left(\frac{V}{S}\right)}$$

$$\text{Contribution in terms of volume of sales} = Es \left[ 1 - \frac{V}{S} \right]$$

Profit = Contribution – Fixed Cost per Annum

$$\text{Turn over for a stated profit, } T_{ps} = \frac{F + Ps}{1 - \frac{V}{S}}$$

## Nomenclature

$F$  – fixed cost per annum

$S$  – selling price per unit

$V$  – variable cost per unit

$Es$  – estimated Sales

$Ps$  – Specified profit or targeted profit

**Example problem** A factory manufacturing fans and blowers has the capacity to produce 250 fans per annum. The variable cost of the fan is ₹1400 which is sold for ₹ 5000. The total fixed costs are ₹120000 per annum. Calculate B.E.P for out put and Sales.

## Solution

$$\text{Contribution per Unit (C)} = (S) - (V) = 5000 - 1400 = \mathbf{₹3600}$$

$$\text{B. E.P (in Volume of Output)} = \frac{(F)}{(C)} = \frac{120000}{5000-1400} = \mathbf{33.33 \text{ Units}}$$

$$\text{B.E.P (in Volume of Sales)} = \frac{(F)}{(C)} \times (S) = \frac{120000}{3600} \times 5000 = \mathbf{₹1,66,666.67}$$

**Example problem** The fixed cost in the manufacture of a processed food product for the year 2012 -2013 is \$4,00,000. The variable costs per product is 430. The estimated sales for the year is valued at \$18, 00,000. Each product sells at \$180. For the given data

- (a) Find the break-even point in sales
- (b) If \$14,00,000 will be the likely sales turnover made for the next budget period, calculate the contribution and profit.
- (c) If a profit target of \$8,00,000 has been targeted, estimate the turnover required.

## Solution

$$(a) \text{ B. E.P (in Volume of Sales)} = \frac{(F)}{(1) - \left(\frac{V}{S}\right)} = \frac{(4,00,000)}{(1) - \left(\frac{30}{180}\right)} = \mathbf{₹4,80,000}$$

$$(b) \text{ Contribution in of sales} = Es \left[1 - \frac{V}{S}\right] = 18,00,000 \left[1 - \frac{30}{180}\right] = \mathbf{₹15,00,000}$$

$$(c) \text{ Profit} = (C) - (F) = \mathbf{₹11,00,000}$$

$$(d) \text{ Turn over for a stated profit, } T_{ps} = \frac{F+Ps}{1 - \frac{V}{S}} = \frac{400000+800000}{1 - \frac{30}{80}} = \mathbf{₹19,20,000}$$

**Example problem (Graphical Technique)** The fixed costs to produce a product for the year 2012- 2013 is \$80,000. The estimated sales for the period was valued at \$200,000. The variable cost per unit made is \$4. If each unit sold at \$20 and the number of units involved coincides with the expected volume of output,

- (a) construct a break – even chart
- (b) determine the expected units of production to seek the profit
- (c) identify the profit earned at a turnover of \$160,000



## Solution

*Given:* Fixed Cost per Annum,  $F$  = \$80,000

Variable Cost per Unit,  $V$  = \$4

Selling price per unit,  $S$  = \$20

Estimated Sales per Annum,  $Es$  = \$200,000

- Required:*
- (a) Break-Even Chart or Economic Production Chart
  - (b) B.E.P from Chart
  - (c) Expected number of units to be produced to seek profit
  - (d) Profit earned at a specified turnover

**Solution** *Identify the following*

Total Cost per annum = Fixed Cost per annum + Variable Cost per annum

Variable Cost per annum = No. of units produced per annum  $\times$  Variable cost per unit

Number of units produced/annum = Estimated sales per annum / Selling price per unit

Number of units produced /annum = 200,000/20 = 10,000 units/annum

Variable Cost per annum = 10,000  $\times$  4 = \$40,00

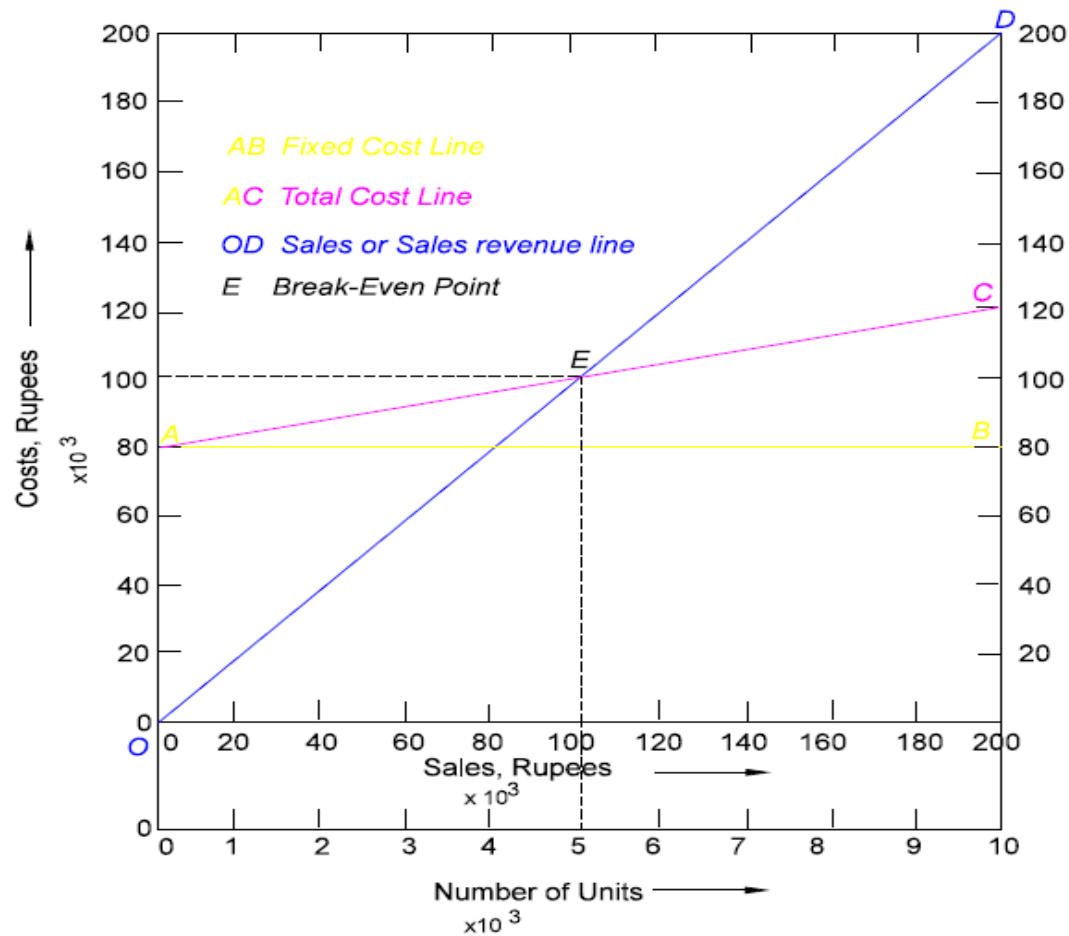
Total Cost per annum = \$80,000 + \$40,000 = \$120,000

## Solution

### (a) Break-Even Chart or Economic Production Chart

- I. Draw the fixed cost line AB at \$8,000 on the graph as shown in slide no. 12
- II. Specify the points (200,000 and 120,000) and draw the total cost line AC above the fixed cost line
- III. Sales revenue (or income) is zero at 0 units of production and it is \$200,000 at 10,000 units. Therefore draw the sales revenue line (OD)
- IV. In the chart, point E represents the break-even point. It is at 5000 units of product or \$100,000 volume of sales.

# Process Engineering Economics – *Break – Even Chart*



## Solution

(b) Break-Even point from the chart is found to be **5000 units of product or \$100,000 volume of sales.**

(c) More than **5000 units** should be produced to seek profit

(d) Turn over for a stated profit,  $T_{ps} = \frac{F+P_s}{1-\frac{V}{S}}$

$$160,000 = \frac{80,000+P_s}{1-\frac{4}{20}}$$

$$160,000 \times 0.8 = 80,000+P_s$$

$$P_s = \mathbf{\$48,000}$$

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