



Ministry of Higher Education and Scientific Research

Al-Mustaqbal University College

Chemical Engineering and Petroleum Industries Department

# Chemical Engineering Economics

## Fourth Stage

### Lecture No.2

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The term **depreciation** refers to an accounting method used to allocate the cost of a tangible or physical asset over its useful life. Depreciation represents how much of an asset's value has been used. It allows companies to earn revenue from the assets they own by paying for them over a certain period of time.

Because companies don't have to account for them entirely in the year the assets are purchased, the immediate cost of ownership is significantly reduced. Not accounting for depreciation can greatly affect a company's profits. Companies can also depreciate long-term assets for both tax and accounting purposes.

### **Gross profit (depreciation not included)**

The product sales revenue minus the total product cost gives the gross profit, also called gross earnings. Gross profit is expressed both with and without depreciation included as follows:

**Gross Profit = Revenue – Production Cost or (COGS)**

$$g_j = s_j - C_{oj}$$

where  $g_j$  is gross profit, depreciation *not* included,  $j$  in year.

### **Gross profit (depreciation included)**

$$G_j = s_j - C_{oj} - d_j$$

where  $G_j$  is gross profit, depreciation included, in year  $j$ .

**Annual revenue** is the total amount of money a company makes during a given 12-month period from the sale of products, services, assets or capital.

$$\text{Annual sales revenue, } \$/\text{yr} = \sum (\text{sales of product, kg/yr})(\text{product sales price, } \$/\text{kg})$$

**Cash Flow**

The flow of funds for an overall industrial operation based on a corporate treasury (the funds or revenue) serving as a reservoir and source of capital.

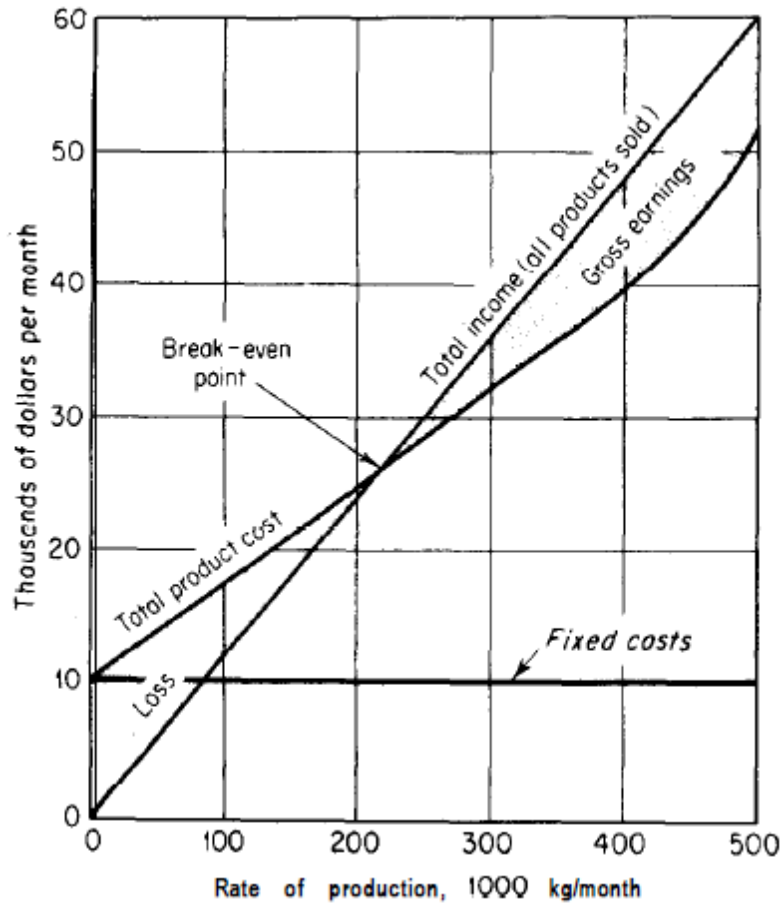
*Inputs* to the capital reservoir normally are in the form of loans, stock issues, bond sales, and other capital sources, and the cash flow from project operations. *Outputs* from the capital reservoir are in the form of capital investments in projects, dividends to stockholders, repayment of debts, and other investments.

Operating profit is gross profit minus all other fixed and variable expenses associated with operating the business, such as rent, utilities, and payroll.

**Break-Even Point**

As shown in Fig. (1) below, the corresponding volume of production on the X-axis is known as the breakeven sales quantity. At the intersection point, the total cost is equal to the total revenue. This point is also called the no-loss or no-gain situation. For any production quantity which is less than the break-even quantity, the total cost is more than the total revenue. Hence, the firm will be making loss. For any production quantity which is more than the break-even quantity, the total revenue will be more than the total cost. Hence, the firm will be making profit.

**Break-Even point (units) = Fixed Costs ÷ (Sales price per unit – Variable costs per unit)**



**Figure 1:** Breakeven chart for chemical processing plant.

**Example:**

The annual variable production costs for a plant operating at 70 percent capacity are \$280,000. The sum of the annual fixed charges, overhead costs, and general expenses is \$200,000, and may be considered not to change with production rate. The total annual sales are \$560,000, and the product sells for \$4/kg. What is the breakeven point in kilograms of product per year? What are the gross annual profit G<sub>j</sub> (depreciation included) and net annual profit for this plant at 100 percent capacity if the income tax rate is 35 percent of gross profit?

**■ Solution**

The breakeven point occurs when the total annual product cost equals the total annual sales. The total annual product cost is the sum of the fixed charges (depreciation included), overhead and general expenses, and the variable production costs.

Total annual sales = (No. kg of product) (selling price per kg)

$$560,000 = (\text{No. kg of product}) (\$4/\text{kg})$$

$$\text{No. kg of product} = 560,000 / (\$4/\text{kg}) = 140,000 \text{ kg}$$

$$\text{Direct production cost/kg} = \$280,000 / 140,000 \text{ kg} = \$2/\text{kg}$$

$$\text{the kg/yr needed for a breakeven point} = \$200,000 \div [(\$4) (\text{kg/yr}) - (\$2)(\text{kg/yr})] = 100,000 \text{ kg/yr}$$

$$\text{Since the annual capacity} = 140,000 / (0.70) = 200,000 \text{ kg}$$

**So, the breakeven point is 100,000 / 200,000 = 50% of capacity**

**The gross annual profit = total annual sales — total annual costs.**

**Gross Profit = Revenue – Production Cost or (COGS)**

So at 100 percent capacity

$$G_j = (\$4/\text{kg}) (200,000) - [\$200,000 + (200,000 \text{ kg}) (\$2/\text{kg})]$$

$$= \$200,000$$

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**Net Profit = Gross Profit – Taxes,  $Np_j = G_j (1-\Phi) = G_j - G_j\Phi$**

**and the annual net profit = \$200,000 - (0.35) (\$200,000), so**

**$NP_j = \$130,000$**

**Home Work:**

1. If the cost of a fan is 5.30 dollar and sold at 7.90 dollars. Find the gross profit?
2. If the cost of a toy is 6.70 dollar and sold at 10.00 dollar. Find the gross profit?
3. The fixed costs at Company X are \$1 million annually. The main product has revenue of \$8.90 per unit and \$4.50 variable cost. (a) Determine the breakeven quantity per year, and (b) Annual profit if 200000 units are sold.