

# Depreciation

**Book : *Plant Design and Economics for Chemical Engineers*, M.S. Peters and K. D. Timmerhaus  
Chapter 9 (4<sup>th</sup> Edition)**

- In any business operation, analysis of costs and profits shows that physical assets decrease in value with age
- This decrease in value may be due to physical deterioration, technological advances, economic changes or other factors
- The economic function of depreciation can be used as a means of distributing the original expense for a physical asset over the period during which the asset is in use

***Depreciation is defined as the reduction in value of a property or asset with time***

Depreciation is of two types –      ***Physical depreciation***  
    ***Functional depreciation***

# Types of depreciation

**Physical depreciation** is the term given to the measure of the decrease in value due to changes in the physical aspects of the property.

- Physical depreciation may be due to wear and tear, corrosion, accidents, deterioration due to age or the elements
- The serviceability of the property is reduced because of physical changes for this type of depreciation

**Functional depreciation** is the reduction in value of the asset due to all other causes apart from physical changes

- These causes may be
  - (a) availability of newer or advanced technology which may render the equipment obsolete. Even though the property has suffered no physical change, its economic serviceability is reduced because it is inferior to improved types of similar assets that are now available through advancements in technology,
  - (b) decrease in demand for services as the market is saturated (other options available)
  - (c) shifts in population
  - (d) change in government policy
  - (e) closing down of an enterprise (industry)

- Since depreciation can be considered to be a decrease in the value of the property with time, it can immediately be considered from a cost point of view
- Depreciation is an unusual charge in that it is paid into the corporate treasury, and has a significant effect on the corporate cash flow

If a piece of equipment was bought for Rs. 52,000 and the equipment after 10 years is worn out and is worth only Rs. 2000, the decrease in the value over a 10 year period is Rs. 50,000. This is essentially the cost incurred for the use of the equipment. The depreciation cost is spread over the period of 10 years and part of this cost is charged every year as depreciation.

Thus, total cost due to depreciation is the original or new value of a property minus the value of the same property at the end of the depreciation period.

The depreciation costs per year is included as an operating cost (manufacturing cost) incurred during the year

## Depreciable Investments

- All property with a useful life greater than one year which is used in the industry or business is depreciable
- Fixed capital investment, not including land, is *depreciable*
- Working capital and start up costs are *not depreciable*
- Inventories held for sale are *not depreciable*
- Costs for maintenance and repairs are direct operating expenses and thus are *not depreciable*

## Depreciation and Income Tax

- When money is invested in buying an asset, then it is entirely reasonable that invested principal should be recovered by the investor and project revenues may be charged to pay that principal
- Depreciation is charged as an expense and then paid to the corporation
- Depreciation as a cost permits realistic evaluation of the profits earned by the company. Income tax is charged on the gross profit minus depreciation ( $s_j - c_{oj} - d_j$ ) to get the net profit after taxes  
[ $s_j$  = sales revenue;  $c_{oj}$  = total product cost,  $d_j$  = depreciation]
- The taxable income is reduced by subtracting  $d_j$ . This is later added to the cash flow (net profit after taxes) to get the net cash flow from the project  $[(s_j - c_{oj} - d_j)(1 - \phi) + d_j = (s_j - c_{oj})(1 - \phi) + d_j \phi]$
- Depreciation in reality is a 'non-cash' charge, i.e., no money was actually paid when expenses were incurred. It is subtracted and added to the income statement. Depreciation reduces net income on the income statement, but it does not reduce the cash account on the balance sheet

# Amortization

- This is a term very similar to depreciation and sometimes is used interchangeably with it. It essentially means spreading of payments over multiple periods.
- Amortization refers to allocating the cost of an 'intangible asset' over a period of time. The cost of acquisition of an intangible asset minus the residual value is the amortization value which is spread out over its useful economic lives
- Intangible assets include assets that do not have a physical existence such as patent, copyright, franchise, trademark and software
- Depreciation is the corresponding concept for tangible assets.
- Methodologies for allocating amortization to each accounting period are generally the same as that of depreciation

## Terms associated with depreciation

- **Depreciable capital** : This is the difference between the original value of the asset at the start of service life period completely installed and ready for use minus the salvage value of the asset at the end of service life
- **Service Life (Recovery Period)**: This is the period over which the use of property is economically feasible. Recovery period is the period over which depreciation is charged. Both physical and functional depreciation are taken into consideration in determining service life, and the term is synonymous with *economic* or *useful* life. The estimated life of various types of equipment are usually listed by the government.

For eg., service life of chemical and allied product manufacturing – 11 yrs

service life of electrical equipment – 12 yrs

service life of electronic equipment – 8 yrs

service life of petroleum refining – 16 yrs

- **Salvage value**: This is the net amount of money obtained from the sale of the used property at the end of the service life over and above any charges involved in removal and sale. The term salvage value implies that the asset can give some type of further service and is worth more than merely the junk value. Since finding the accurate salvage value a priori (before hand) is not easy, tax regulations often limit the salvage value to 10% or less of initial value of the property



## Terms associated with depreciation

- **Scrap value (Junk value)** : When the equipment is not fit to render the service it is supposed to give, then the price that is obtained by selling the equipment at the end of its service life is called the scrap value
- **Present value** : The present value of an asset can be defined as the value of the asset in its condition at the time of valuation. There are different types of present values:
  - **Book value** : The difference between the original cost of a property (or asset), and the total amount of depreciation charged up to that point is defined as the *book value (or unamortized cost)*. It represents the worth of the property as shown on the owner's accounting records.
  - **Market value** : The price that could be obtained for an asset if it were placed on sale in the open market is designated as the *market value*.
  - **Current value**: The value of the asset in its condition at the time of valuation is the *current value*
  - **Replacement value**: The cost necessary to replace an existing property at any given time with one at least equally capable of rendering the same service is known as the *replacement value*.