CH0401 Process Engineering Economics

Chapter 2 – Balance Sheet and Cost Accounting

Lecture 2

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Process Engineering Economics

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.

Process Engineering Economics

1. **Capital requirements for process plants**
2. Balance Sheets
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Capital Requirement for a Process Plant

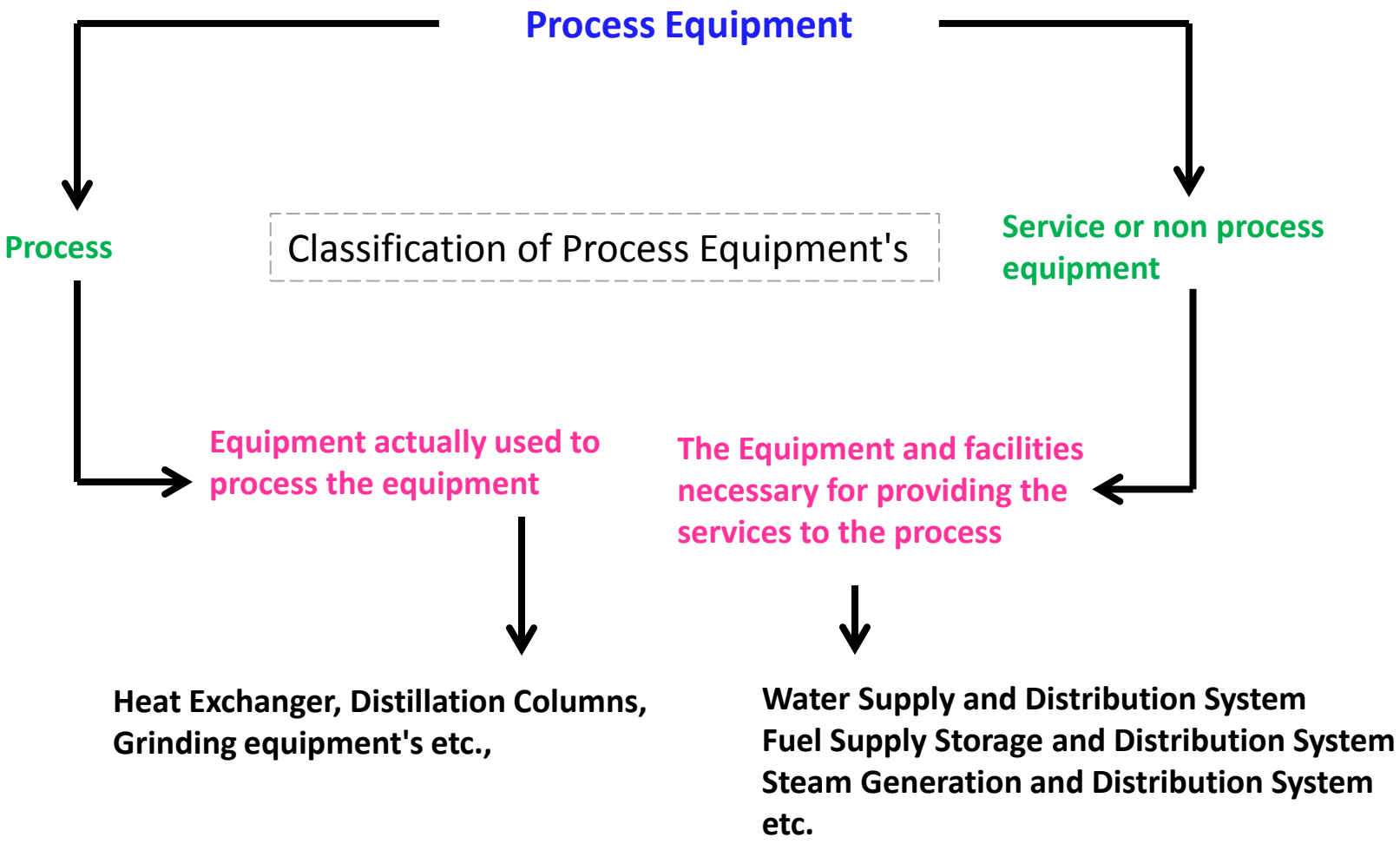
The capital required for building and equipment in the process industries varies with *type of operation*, the *size of the plant* and the *time* at which the investment is made

Other factors that are operating to control the amount of investment in a proposed venture are *the world economic condition* and change in *market supply and demand for the product* for which the company is interested.

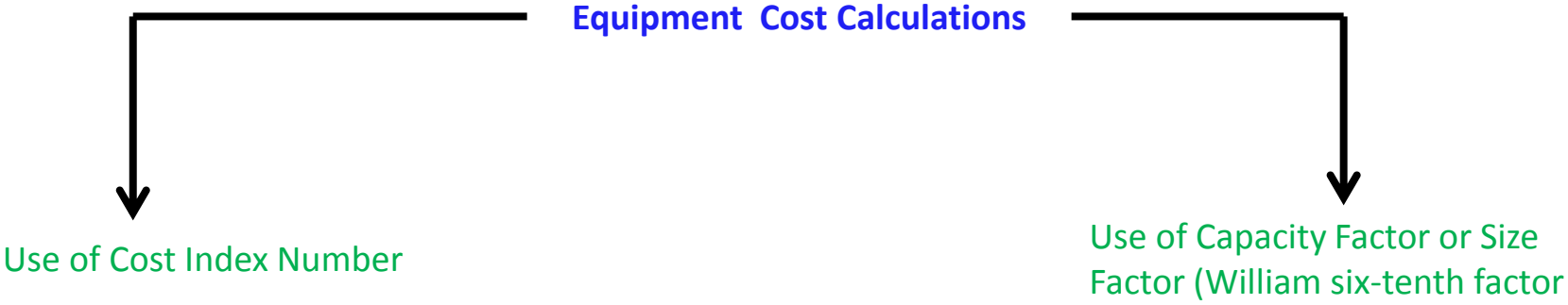
Capital Requirement for a Process Plant

Many of these factors (world economic condition, market supply and demand) are *irreducible and requires consideration* by the management before a decision is made to proceed with the venture, but once the decision is made it is the engineer who must select the detail equipment items and determine their costs

Process Engineering Economics – ***Capital Requirements***



Methods for calculating the equipment cost



Cost Index

A cost index may be defined as *a dimensionless number which permits comparison of costs at various dates over a period of time from present back to any date in the past for which data are available*

Typical cost indices used are

- ENR Construction Cost Index http://enr.construction.com/economics/
- Material Cost Index
- Process Equipment Cost Index
- Marshal and Swift Index http://www.marshallswift.com
- Chemical Engineering Process Plant Index http://www.che.com/pci/

Problems based on cost index

An index value for a given point in time showing the cost at that time relative to a certain base time. If the cost at some time in the past is known, the equivalent cost at the present time can be determined by multiplying the original cost by the ratio of the present index value to the index value applicable when the original cost was obtained.

Problems based on cost index

Formulas Used

$$\frac{C_1}{C_2} = \frac{I_1}{I_2}$$

Where C_1 and C_2 are the Cost ratio; I_1 and I_2 are the index values

(or)

$$\text{Present Cost} = \text{Original Cost} \times \left(\frac{\text{Index value at present time}}{\text{Index value at time original cost was obtained}} \right)$$

Problems based on cost index

Example Problem A pump and motor installation costs $1300 in 1946. What is the estimated cost for similar installation in 1954? The relative cost index for 1946 compared to 1954 is indicated by the relative process equipment cost index for two years which were 123 and 182

Data Available

S. No.	Year	Cost , $	Cost Index
1	1946	1300	123
2	1954	?	182

Solution

$$\frac{C_1}{C_2} = \frac{I_1}{I_2}$$

$$C_2 = C_1 \times \frac{I_2}{I_1}$$

$$C_2 = 1300 \times \frac{182}{123} = \$1923.58$$

(or)

$$\text{Present Cost} = \text{Original Cost} \times \left(\frac{\text{Index value at present time}}{\text{Index value at time original cost was obtained}} \right)$$

$$\text{Present Cost} = 1300 \times \frac{182}{123}$$

$$\text{Present Cost} = \$1923.58$$

Problems based on Capacity Factor

Formulas Used

$$\frac{C_1}{C_2} = \left(\frac{S_1}{S_2}\right)^a$$

Where C_1 and C_2 are the Cost ratio;

S_1 and S_2 are the Size Factor/Capacity factor or William Six-Tenth factor;

a = 6/10 or 0.6 (exponent factor)

Problems based on Capacity Factor

Example Problem The Purchased cost of a 400 ft^2 heat exchanger was $9000 in 1979, when the cost index was 561. Estimate the cost of similar heat exchanger having 1000 ft^2 in 1980 when the index was 688.

Data Available

S. No.	Year	Cost , $	Cost Index	Capacity or Size
1	1979	9000	561	400 ft^2
2	1954	?	688	1000 ft^2

Problems based on Capacity Factor

Solution

$$\frac{C_1}{C_2} = \frac{I_1}{I_2}$$

$$C_2 = C_1 \times \frac{I_2}{I_1}$$

$$C_2 = 9000 \times \frac{688}{561} = \$11037.43$$

$$\frac{C_1}{C_2} = \left(\frac{S_1}{S_2}\right)^a = C_1 = C_2 \times \left(\frac{S_1}{S_2}\right)^a$$

$$C_1 = 11037.43 \times \left(\frac{1000}{400}\right)^{0.6} = \$19126.35$$

Process Engineering Economics – ***References***

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