

# Cost Estimation

# TYPES OF COSTS

## Capital Costs

- Fixed equipment
- Working capital

## Operating Costs

- Direct costs
- Fixed costs
- General costs

Evaluating rough cost estimates for both using the same approach:

Use historical data to develop correlations and apply corrections for unique factors in specific situations.

# HOW ACCURATE DO YOU WANT IT TO BE?

**We must balance the needed accuracy with the cost to perform.  
(Peters and Timmerhaus, Pg 160-162)**

Name	Accuracy	Application	Process detail
Order of magnitude	-30 to +50%	Screen investments	Block flow diagram
Study	-15 to +30%	Finalize major choices	PFD + rough design of major equipment
Definitive	-5 to +15%	Control costs	P&I Drawing, detailed M&E balances, equipment specifications

**No shortcut: A flowsheet simulation (e.g., ABACUSS) is required when developing a definitive cost estimation. The information is required for accurate estimates of both capital and manufacturing costs.**

# ESTIMATION OF CAPITAL COSTS

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- **A couple of very rough methods (initial screening)**
  - **Turnover Ratio**
  - **Lang's Factor**
- **Bare Module method**
  - **The primary method used in process industry**
  - **First calculate the cost of individual equipment**
    - Specific equipment type
    - Material of construction
    - Operating pressure
  - **Estimate other indirect costs with appropriate factors**

# TURNOVER RATIO

- Values of 0.2 to 8.0; usually 1.0 to 1.25 in process industries

$$TR = \frac{(\text{gross annual sales})}{(\text{fixed capital})}$$

We can use this to estimate the fixed capital costs for a plant making a known quantity for sales.

# LANG'S FACTOR

$$LF = \frac{(\text{Total capital cost})}{(\text{Delivered cost of major equipment})}$$

We use this as a guideline for the ratio of major equipment to total capital costs.



# OPERATING COSTS

**These are incurred with every unit of production and do not include capital items.**

- **Direct** - Materials, labor, utilities, supplies, waste treatment, etc.  
**Fixed (indirect)** - Land taxes, insurance, plant administration, etc.
- **General expenses** - Corporation, sales&marketing, R&D, etc.

# HINTS FOR ESTIMATION OF OPERATING COSTS

**Do not use standard inflation for energy or raw materials costs.**

*– These can change rapidly + and - due to international incidents.*

**Account for all shifts and overhead when estimating labor costs**

*–Overhead is about 40% of salary*

**Personnel do not scale with production when equipment size can be increased.**

# REQUIREMENT OF PROJECT

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- Categorized cost estimation
  - Equipments (Assuming no other capital costs)
    - Rental or purchase?
    - Piece-wise calculation
  - Raw materials
  - Utilities
    - Heating/Cooling/Pressure & Vacuum Supply
  - Waste treatment
    - Wastes in various phases
- Target?
  - Cost per money
  - Campaign time