Non-Discounted Profitability Criteria:

Cash flows and profit in these equations refer to the after tax values

Payback Period (PBP) = Time required after start-up to recover the FCI_L. This may be estimated by:

$$PBP = \frac{FCI_L}{Average\ Cash\ Flow}$$

Rough estimate, use only relevant years for best estimate

Interpolation reminder: $Y = Y1 + (Y2 - Y1)\frac{(X - X1)}{(X2 - X1)}$ Preferred method of PBP

Cumulative Cash Position (CCP) = Worth of project at the end of the project life

Cumulative Cash Ratio (CCR):

$$\text{CCR} = \frac{Sum\ of\ all\ Positive\ Cash\ Flows}{Sum\ of\ all\ Negative\ Cash\ Flows}$$

Rate of Return on Investment (ROI):

$$ROI = \frac{Average\ Annual\ Net\ Profit}{Fixed\ Capital\ Investment\ (FCI_L)}$$

Discounted Profitability Criteria:

Discount all cash flows to time zero using:

$$(P/F, i, n): \qquad P = F_n(1 + i)^{-n}$$

Net Present Value (NPV):

$$\text{NPV} = \text{Cumulative discounted cash position at the end of the project}$$

Present Value Ratio (PVR): >1 is profitable

$$PVR = \frac{Present\ Value\ of\ all\ Positive\ Cash\ Flows}{Present\ Value\ of\ all\ Negative\ Cash\ Flows}$$

Discounted Payback Period (DPBP):

DPBP = Time required, after start-up, to recover the fixed capital investment, FCI_L, required for the project, with all cash flows discounted back to time zero.

Discounted Cash Flow Rate of Return, *DCFROR* (Also called Internal Rate of Return, IRR, in other books)

DCFROR = interest or discount rate for which the NPV of the project is equal to zero.

$$\text{Income Tax} = (\text{R} - COM_d - \text{d}_k) \cdot t$$

$$\text{After Tax Net Profit} = (\text{R} - COM_d - \text{d}_k) \cdot (1 - t)$$

$$\text{After Tax Cash Flow} = (\text{R} - COM_d - \text{d}_k) \cdot (1 - t) + d_k$$

Comparing Equipment Alternatives:

n_{eq} is equipment life, P is equipment cost

YOC is yearly operating costs of equipment

Net Present Value method is only good if the equipment life is the same for all equipment:

$$NPV = -capital - YOC\left(\frac{(1+i)^{n_{eq}}-1}{i(1+i)^{n_{eq}}}\right)$$

The Capitalized Cost (CC) method is calculating the cost to purchase and replace this equipment forever. It is only good if YOC is the same:

$$CC = P\left[\frac{(1+i)^{n_{eq}}}{(1+i)^{n_{eq}}-1}\right]$$

The Equivalent Capitalized Cost (ECC) method may be used for different equipment lives or YOC:

$$ECC = \frac{P(1+i)^{n_{eq}}}{(1+i)^{n_{eq}}-1} + \frac{YOC}{i}$$

The Equivalent Annual Operating Cost (EAOC) may also be used for different equipment lives or YOC:

$$EAOC = P\left[\frac{i(1+i)^{n_{eq}}}{(1+i)^{n_{eq}}-1}\right] + YOC$$

The common denominator method may also be used – if 2 equipment lives, n and m, are different, analyze over n*m years. Compare NPV for each option.

Retrofitting Projects:

These are non-discounted methods for comparing projects:

$$ROROII = \frac{Incremental\ Yearly\ Savings}{Incremental\ Investment}$$

$$IPBP = \frac{Incremental\ Investment}{Incremental\ Yearly\ Savings}$$

These are discounted methods for comparing projects:
PC=Project Cost, YS=Yearly Savings
Incremental Net Present Value (INPV):

$$INPV = -PC + YS\left[\frac{(1+i)^{n}-1}{i(1+i)^{n}}\right]$$

Equivalent Annual Operating Cost (EAOC, for retrofit comparison):

$$EAOC = PC\left[\frac{i(1+i)^{n}}{(1+i)^{n}-1}\right] - YS$$

A negative value for EAOC represents a good investment (positive savings).

$$Profit\ Margin = \sum(Revenue\ from\ Products) - \sum(Cost\ of\ Raw\ Materials)$$

Profit margin must be greater than 0 for profit. This is useful in initial screening of projects.