CH0401 Process Engineering Economics

Lecture 3c

Balasubramanian S

Department of Chemical Engineering
SRM University

Process Engineering Economics

1. **Economics of Selecting Alternatives**
2. Annual cost method
3. Present worth method
4. Replacement – Rate-of-return method
5. Payout time method

Process Engineering Economics

1. Economics of Selecting Alternatives
2. Annual cost method
3. Present worth method
4. Replacement – Rate-of-return method
5. Payout time method

Process Engineering Economics – *Present Worth*

Present Worth Method

Total present worth = (Present worth of annual cost – Present worth of salvage)
+ (Present worth of initial cost)

Problem 2. The same filter installation as in problem 1 will be considered with the same labor costs. Which plan has the lowest equivalent capital requirement? Take annual costs for plan A and B as $19,400 and $14,000 respectively, excluding capital recovery. The table given below shows the data taken from problem no. 1

Process Engineering Economics – *Present Worth*

Present Worth Method

Solution

Data

Items	**Plan A** (Plate and frame filter press)	**Plan B** (Continuous filter)
Cost of filter	$10,000	$30,000
Labor cost	$18,600	$11,000
Annual direct cost	8% of investment	10% of investment
Money worth	10%	10%
Service life	10 years	10 years
Salvage Value	$600	$1,000
Annual costs, *R*	**$19,400**	**$14,000**

Process Engineering Economics – *Present Worth*

Solution

Plan A

We know,

$$P = R\left(\frac{(1+i)^n - 1}{i(1+i)^n}\right) \qquad (1)$$

Therefore, the present worth of annual cost, P is calculated as follows

$$P = 19{,}400 \times \left(\frac{(1+0.1)^{10} - 1}{0.1(1+0.1)^{10}}\right)$$

$$P = 19{,}400 \times 6.145 = 1{,}19{,}213$$

$$P = \$119{,}213$$

Present worth of salvage is given by

$$F = P(1+i)^n$$

$$P = \frac{F}{(1+i)^n}$$

$$P = \frac{600}{(1+0.1)^{10}} = \frac{600}{2.594} = 231.3$$

$$P = \$231.3$$

Plan B

We know,

$$P = R\left(\frac{(1+i)^n - 1}{i(1+i)^n}\right) \qquad (1)$$

Therefore, the present worth of annual cost, P is calculated as follows

$$P = 14{,}000 \times \left(\frac{(1+0.1)^{10} - 1}{0.1(1+0.1)^{10}}\right)$$

$$P = 14{,}000 \times (6.144) = 86{,}030$$

$$P = \$86{,}030$$

Present worth of salvage is given by

$$F = P(1+i)^n$$

$$P = \frac{F}{(1+i)^n}$$

$$P = \frac{1000}{(1+0.1)^{10}} = \frac{1000}{2.594} = 385.5$$

$$P = \$385.5$$

Process Engineering Economics – *Present Worth*

Solution

Particulars	**Plan A** (Plate and frame filter press)	**Plan B** (Continuous filter)
(i) Present worth of annual cost	$119,213.0	$86,030.0
(ii) Present worth of salvage	$ 231.3	$ 385.5
(iii) Present worth of initial cost	$ 10,000.0	$30,000.0
Total present worth = (i – ii) + (iii)	**$128,982**	**$115,645**

Thus, it is seen that in comparing the two alternatives, the equivalent capital involved at the present time on an economic basis is $13,337 less for plan B. Since Plan B is recommended.

Process Engineering Economics – ***References***

- Herbert E. Schweyer. (1955) ***Process Engineering Economics***, Mc Graw Hill
- Max S. Peters, Kaus D. Timmerhaus, Ronald E. West. (2004) ***Plant Design and Economics for Chemical Engineers***, 5th Ed., Mc Graw Hill
- Max Kurtz. (1920) ***Engineering Economics for Professional Engineers' Examinations***, 3rd Ed., Mc Graw Hill
- Frederic C. Jelen, James H. Black. (1985) ***Cost and Optimization Engineering***, International Student edition, Mc Graw Hill
- Grant L. E, Grant Ireson. W, Leavenworth S. R. (1982) ***Principles of Engineering Economy***, 7th Ed., John Wiley and Sons.