CH0401 Process Engineering Economics

Lecture 3b

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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

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Annual Cost Method

Problem 1. A company has received alternate bids on a filtration step in their operations is as follows:

Plan A uses a **plate and frame filter** press costing $10,000 with an annual labor costs of $18,600 per year and with all other annual direct costs at about 8% of the total investment cost when operating under optimum conditions.

Plan B uses a **continuous filter** costing $30,000 with $11,000 per year annual labor costs and with all other annual direct costs at about 10% of investment cost. Money is worth 10 percent, and the service life is taken as 10 years with the salvage value of $600 for the plate and frame and $1,000 for the continuous filter.

Which installation would be the most economical with respect to annual cost?

Annual Cost Method

Total annual cost for the service = Capital recovery + labor costs + other direct costs

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

Process Engineering Economics – *Annual Cost*

Plan A	Plan B
We know, $P = R\left(\frac{(1+i)^n - 1}{i(1+i)^n}\right)$ (1) $R = P\left(\frac{i(1+i)^n}{(1+i)^n - 1}\right)$ (2) $R = (P-L)\times\left(\frac{i(1+i)^n}{(1+i)^n - 1}\right) + L\times i$ (3) now taking i =0.1, n = 10 years, L = \$600, P=\$10,000 from the problem statement we have, $R = (10{,}000 - 600)\times\left(\frac{0.1(1+0.1)^{10}}{(1+0.1)^{10} - 1}\right) + 600\times 0.1$ $R = (9{,}400)\times(0.1627) + 60 = 1589.8$ $R = \$1589$	We know, $P = R\left(\frac{(1+i)^n - 1}{i(1+i)^n}\right)$ (1) $R = P\left(\frac{i(1+i)^n}{(1+i)^n - 1}\right)$ (2) $R = (P-L)\times\left(\frac{i(1+i)^n}{(1+i)^n - 1}\right) + L\times i$ (3) now taking i =0.1, n = 10 years, L = \$1,000, P=\$30,000 from the problem statement we have, $R = (30{,}000 - 1{,}000)\times\left(\frac{0.1(1+0.1)^{10}}{(1+0.1)^{10} - 1}\right) + 1000\times 0.1$ $R = (29{,}000)\times(0.1627) + 1000\times 0.1 = 4280$ $R = \$4820$
$R = \$1589$	$R = \$4820$

Therefore, the total annual cost for the service are

Items	**Plan A** (Plate and frame filter press)	**Plan B** (Continuous filter)
A. Capital investment	\$10,000	\$30,000
B. Capital recovery, *R*	\$ 1,590	\$ 4,820
C. Labor cost	\$18,600	\$11,000
D. Other direct costs	\$ 800 (8% of total investment i.e. $10{,}000 \times \frac{8}{100}$)	\$ 3,000 (% of total investment i.e. $30{,}000 \times \frac{10}{100}$)
Total annual costs (B+C+D)	**\$20,990**	**\$18,820**

From the above table we can see that total annual cost with a potential saving (20,990 - 18,820) of \$2,170 is available for the continuous filtration. Hence continuous filter (Plan B) is recommended as the most economical installation.

Process Engineering Economics – ***References***

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