Chapter - 5

Replacement Analysis

[12 marks]

Replacement Analysis

- Replacement Analysis is carried out when there is a need to replace the current owned equipments or any assets.
- Concept of replacement analysis refers to the selection of similar but new assets to replace the existing assets to meet the current & future requirements more economically.

Reasons for replacement:

a. Deterration: Loss of value due to aging
b. ~~Obsolence~~ Obsolesene: Outdated or No longer used
c. Depletion: Gradual loss of market value.
d. Physical Impairments: Wear & Tear due to chemical changes
e. Inadequacy: Lacking the quality

Approaches for comparing defender and challenger:

a. Cash flow approach

⇒ Treat the proceed from ~~sells~~ sales of old machine as a down payment towards purchasing new machine

b. Use ~~NPP~~ NPW (Net Present Worth) or (A.E.C.) to analyze

(2) Cash flow approach

From the data given below decide whether the replacement is justified or not.

Take MARR = 12%

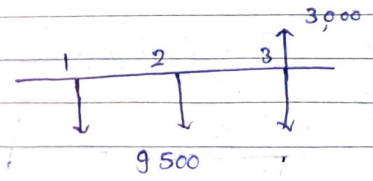
Use Cash flow approach.

$AEC_D > AEC_C$; Replacement is Justified.

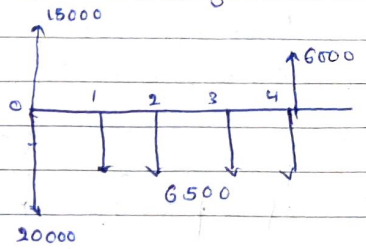
Defender		Challenger	
Market Price	Rs 15,000	Initial Cost	Rs 20,000
Remaining Useful life	3 years	Useful life	4 year
Salvage Value	3000	Salvage value	6000
Operating & Maintaining Cost	9,500	Operating & Maintaing Cost	6,500

Solution:

For defender :



For Challenger:



$$A.E.C._D = -\{-9500 + 3000\left(\frac{A}{F}, i\%, n\right)\}$$

$$= -\{-9500 + 3000\left[\frac{i}{(1+i)^n - 1}\right]\}$$

$$= -\{-9500 + 3000\left[\frac{0.12}{1.12^3 - 1}\right]\}$$

$$= +8610.95$$

$$A.E.C._C = -\{-6500 + 6000\left(\frac{A}{F}, i\%, n\right) + -5000\left(\frac{A}{P}, i\%, n\right)$$

$$= -\{-6500 + 6000\left[\frac{i}{(1+i)^n - 1}\right] - 5000\left(\frac{(1+i)^n \times i}{(1+i)^n - 1}\right)$$

$$= -6890.76$$

$AEC_D > AEC_C$. So, replacement is justified. //

(b) Opportunity cost approach

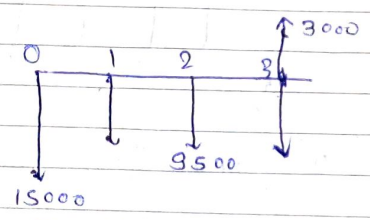
⇒ Treat the proceed from the sales of old machine as the investment required to keep the old machine.

Q. MARR = 12%

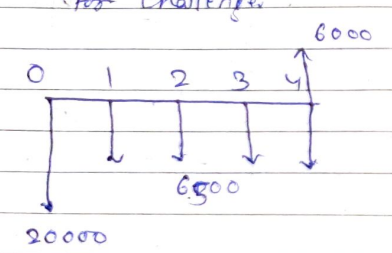
Defender	Challenger
M.P. = Rs. 15,000	Initial Cost = Rs. 25,000
Remaining Useful life = 3 years	Useful life = 4 years
S.V = Rs. 3000	S.V = Rs. 6000
O&MC = Rs. 9500	O&C = Rs. 6500

Use opportunity cost approach.

Solution:



For Defender



$$(A.E.C)_D = 9500 - 3000\left(\frac{i}{(1+i)^n-1}\right) + 15000\left(\frac{(1+i)^n \times i}{(1+i)^n-1}\right)$$

$$= 14856.187$$

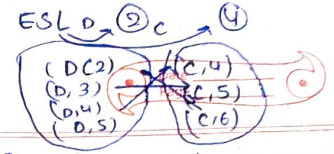
$$(A.E.C)_C = 6500 + 20000\left(\frac{(1+i)^n \times i}{(1+i)^n-1}\right) - 6000\left(\frac{i}{(1+i)^n-1}\right)$$

$$= 11829.28$$

Since, $A.E.C._D > A.E.C._C$, Replacement is justified.

ESL: Economic Service Life

Minimum AEC.



V. Imp

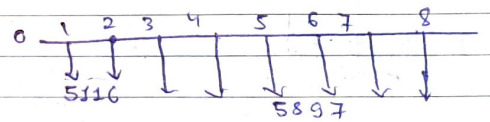
Q. For the data given below, what is the most economical replacement scenario / strategies? Take 8 years planning horizon.

Year	Defender (D)	Challenger (C)
1.	5190	7500
2.	5116	6151
3.	5500	5847
4.	5961	5826
5.	6434	5897

AEC = 15%

Combinations: 1. (D,2) (C,6)
2. (D,3) (C,5)
3. (D,4), (C,4)

1. (D,2), (C,6) (C,6) = latest value i.e. (C,5



$$PW = -5116\left(\frac{P}{A}, i\%, n\right) - 781\left(\frac{P}{A}, i\%, n\right)\left(\frac{P}{F}, i\%, n\right)$$

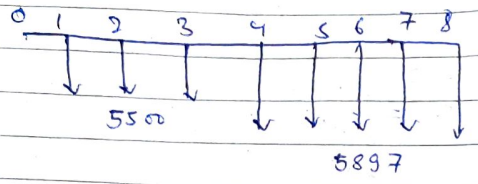
$$= -5116\left(\frac{(1+i)^n - 1}{(1+i)^n \times i}\right) - 781\left(\frac{(1+i)^n - 1}{(1+i)^n \times i}\right)(1+i)^{-n}$$

$$= -5116\left(\frac{1.15^8 - 1}{1.15^8 \times 0.15}\right) - 781\left(\frac{1.15^6 - 1}{1.15^6 \times 0.15}\right) \times 1.15^{-2}$$

$$= -25192.05$$

Cost

2. (D,3) , (C,5)

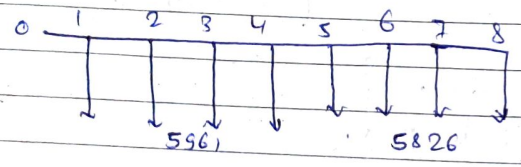


$PW = -\{-5500\left(\frac{P}{A}, i\%, n\right) - 397\left(\frac{P}{A}, i\%, n\right)\left(\frac{P}{F}, i\%, n\right)\}$

$= \{5500\left(\frac{1.15^8 - 1}{1.15^8 \times 0.15}\right) - 397\left(\frac{1.15^5 - 1}{1.15^5 \times 0.15}\right)(1.15)^{-3}\}$

$= +25555.29$

(3) (D,4) , (C,4)



$PW = \{-5961\left(\frac{1.15^8 - 1}{1.15^8 \times 0.15}\right) + 135\left(\frac{1.15^4 - 1}{1.15^4 \times 0.15}\right)(1.15)^{-4}\}$

$= 26528.55$

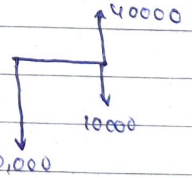
Since, first combination has lower cost. So, selecting first combination.

Find economic service life from the data:
Initial cost : Rs. 50,000
Operating cost : Rs. 10,000 for the 1st year that increases by 15% thereafter.
Salvage value decreases each year 20% from the previous value.
Useful life = 7 years
MARR = 15% per year.

Soln

Year	O & M Cost	Salvage value	AEC
1.	10000	0.8×50000 = 40000	27500
2.	11500	32000	26569
3.	13225	25600	25952
4.	15208.75	20480	25594
5.	17490.0625	16384	25456
6.	20113.57	13107.2	25500
7.	23130.60	10485.76	

For n=1

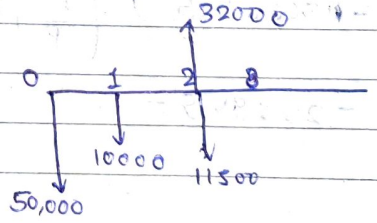


$A.E.C_1 = 50000 - 30000(\quad$

$= -50000\left(A/P, i\%, n\right) + 30000$

$= -27500$

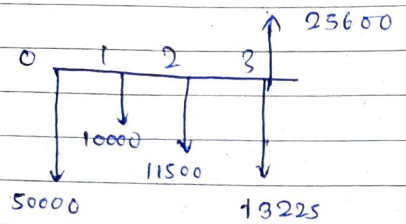
For n=2,



$A.E.C_2 = -50000\left(\frac{A}{P}, i\%, n\right) - 10000 + (32000 - 1500)\left(\frac{A}{F}, i\%, n\right)$

$= -26569.76$

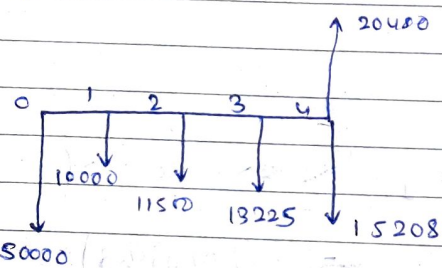
For $n = 3$



$A.E.C_3 = -50000\left(\frac{A}{P}, i\%, n\right) - 10000 + \left(25600 - 3225 - 1500(1.15)\right)\left(\frac{A}{F}, i\%, n\right)$

$= -26103.31 \quad -25952.12$

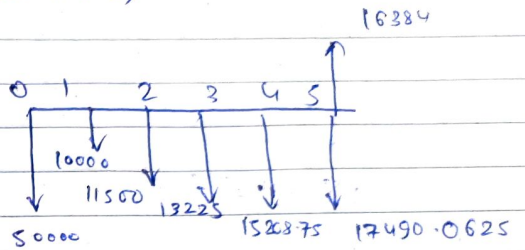
For $n = 4$.



$A.E.C_4 = -50000\left(\frac{A}{P}, i\%, n\right) - 10000 + (20480 - 5208.75 - 3225 \times 1.15 - 11500 \times 1.15^2)\left(\frac{A}{F}, i\%, n\right)$

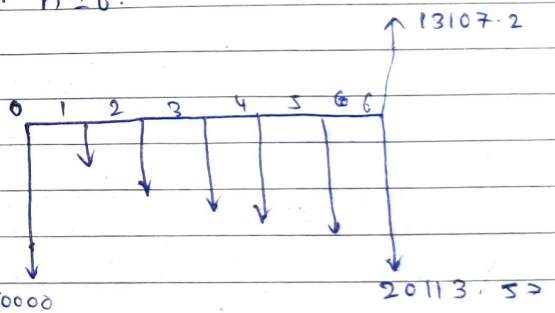
$= -28243.48 \quad -25594.97$

For $n = 5$,



$A.E.C_5 = -25456.017$

For $n = 6$.



$A.E.C_6 = -25500.79$

$AE.C_6 > A.E.C_5$.

So, ESL = 5 years.

Define ESL