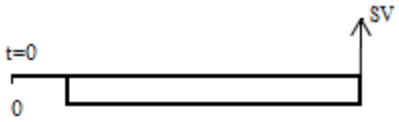
Replacement Analysis

- Two approaches are commonly used in replacement analyses: Cash Flow Approach(insider viewpoint) and Opportunity cost approach (outsider viewpoint)

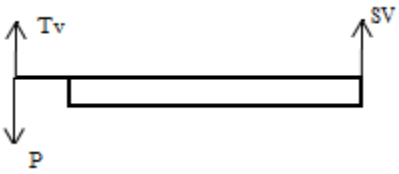
a. Cash Flow Approach(insider viewpoint)

1. Defender (Old machine)

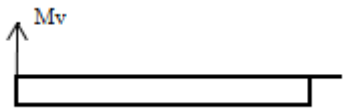


"Hint: the value at t=0 equal to zero if does not have maintenance"

2. Challenger (New machine)

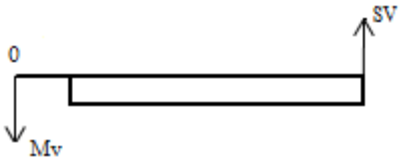


3. Lease

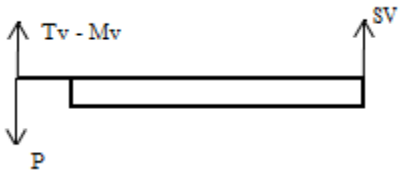


b. Opportunity cost approach (outsider viewpoint)

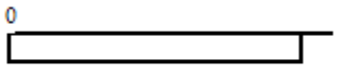
1. Defender (Old machine)



2. Challenger (New machine)



3. Lease



- **Steps to compare between alternatives**

  1. Calculate the EUAC for each alternatives by (present or annual or Future worth)
  2. Select the minimized value of EUAC.

- **Notes**
  1. Tv ="Trade value "and Mv = "Market value"
  2. **book value** neglected.
  3. **Sunk cost** neglected.
  4. **Salvage value** used in old & new machine but neglected in lease machine.
  5. If not given in equation Trade value used Tv=Mv.

Ex.1

Apricot computers are considering replacing its material handling system and either purchasing or leasing a new system. The old system has an annual operating and maintenance cost of $32000, remaining life of 8 years, and an estimated salvage value of $5000 at that time.

A new system can be purchased for $250,000 it will be worth $25,000 in 8 year; and it will annual operating and maintenance cost of $18000/year . it a new system is purchased, the old system can be traded in for $20,000.

Leasing a new system will cost $26,000/year, payable at beginning of the year, plus operating costs of $9000/year, payable at the end of the year. If the system is leased, the old system will be sold for $10,000

MARR is 15%.compare the annual worth of keeping the old system, buying a new system, and leasing a new system based upon a planning horizon of 8 years.

a. Use the insider viewpoint approach.
b. Use the outsider viewpoint approach.

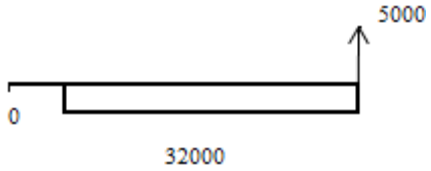
Solution

Old	New	Lease
O&M=$ 32,000/year Sv=$ 5000 n=8 Mv=10,000	P_0=$250,000 O&M=18,000/year Tv=20,000 n=8	26,000 beginning of the year O&M=9000/year Mv=10,000 n=8

EUAC=Aw

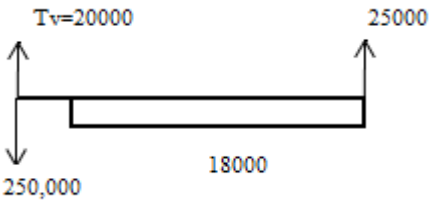
a. Insider viewpoint

Old machine



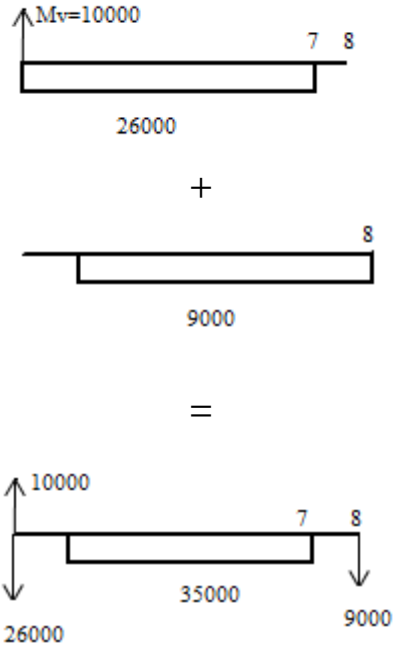
A_w= $ 31630.6

Challenger (New machine)



A_w=$67434.27

Lease

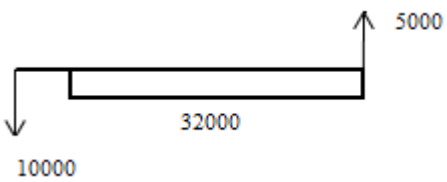


A_w= $ 36671.50

Keep old system

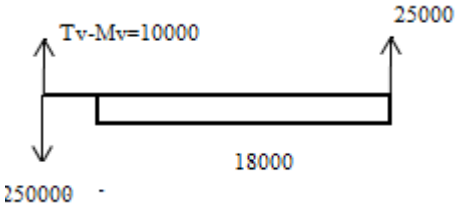
b. outsider viewpoint

Old machine



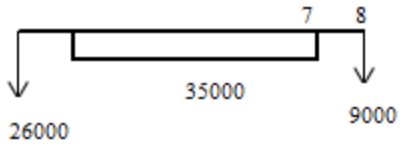
A_w= $ 33864.25

Challenger (New machine)



A_w=$ 169662.77

Lease



A_w=$38900

Keep old system

Ex.2 (problem4/533)

The continer corporation of american is considering replacing an automatic painting machine purchased 9 year ago for $ 700,000.it has a market value today of 40,000. The unit costs $350,000 annually to opreate and maintance. A new unit can purshaserd for $ 800,000 and will have annual O&M costs of $120,000. If the old unit is retained, it will have no salvage value at the end of its remaining life of 10 years. The new unit, if purchased, will have a salvage value of 100,000 in 10 years. Using an EUAC measure and a MARR of 20 percent, perform a before- tax analysis to see if the automatic painting machine should be replaced if it is taken as a trade-in for its market value of $ 40,000.

a. Use the cash flow approach (insider viewpoint approach)
b. Use the Opportunity cost approach (outsider viewpoint approach)

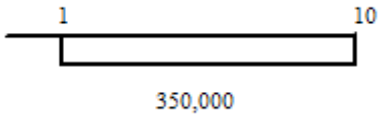
Solution

EUAC=Aw

Old	**New**
Mv=40,000	P_0=800,000
O&M=350,000/year	O&M=12000/year
n=10	Sv= 100,000
Sv=0	n=10

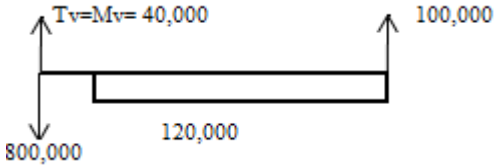
a. Insider

Old



A_w= $ -350,000

New

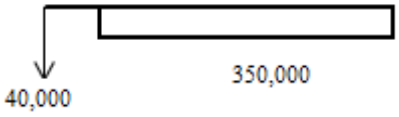


A_w= -120,000 -760000(A/P20,10) + 100,000(A/F20,10)
=$ - 297,423.20

Replace with new painting machine

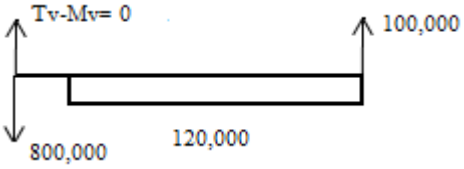
b. Outsider

Old



A_w=-350,000-40,000(A/P20,10)
= - $359,540.80

New



A_w=-120,000-800,000(A/P20,10)+100,000(A/F20,10)
= $- 306,964.00

Replace with new painting machine

Ex.3

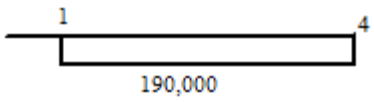
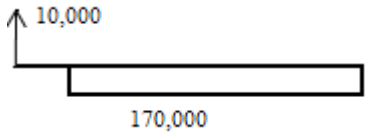
A currently owned shredder used in a refuse-powered electrical generating plant has a percent net realizable value of $200,000 and is expected to a have a market value of $10,000 after 4 years. Operating and maintenance disbursements are $ 190,000 per year. An equivalent shredder can be leased for $ 200 per day plus $80 per hour of actual use as determined by an hour meter, with both components assumed to be paid at year end. Actual use is expected to be $ 1500 hours and 250 days per year. Using a 4-year planning horizon before-tax analysis, and a MARR of 15% percent. Determine The preferred alternative using the annual cost criterion.

a. Use the cash flow approach (insider viewpoint approach)
b. Use the Opportunity cost approach (outsider viewpoint approach)

Solution

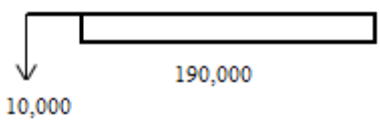
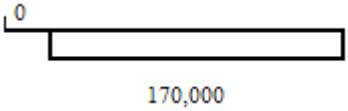
Old	Lease
P_0=$200,000	**250(200)+1500(8)=170,000/year**
Mv=$1000	**Mv=10,000**
n=4	**n=4**
O&M=100,000/yr	

Insider

Old	**Leased**
	
A_w=-$ 190,000	**A_w= -170,000 + 10,000(A/P15,4) =$ -166,497.3**

Leased equivalent shredder

Outsider

Old	**Leased**
	
A_w= -190,000-10,000(A/P15,4) = $-193,502.7	**A_w=-$170,000**

Leased equivalent shredder

Optimum Replacement

EUAC=Capital Recovery Cost + Operation and Maintenance

Ex.1

EOY	0	1	2	3	4	5	6	7
S.V(SR)	10000	6800	5620	4137	3133	2340	1597	1358
O&M(SR)	-	1000	1600	2200	2800	3400	4000	4600

1. If MARR=10%, Find optimum Replacement.

Solution

EUAC=Capital Recovery Cost + Operation and Maintenance

CR= (P-F) (A/P I,n)+Fi

CR_1= (10,000-6800)(A/P10,1)+6800(0.1)= SR 4200

CR_2 = (10,000-5620)(A/P10,2) +5620(0.1)=SR 3085.915

CR_3=SR 2771.22

CR_4=2479.88

CR_5=SR 2254.72

CR_6=SR 2089.01

CR_7=SR 1910.85

$EUAC_1$=4200+1000=SR 5200

$EUAC_{2=}$3085.915+1000+600(A/G10,2)=SR 4371.635

$EUAC_3$=2771.22+1000+600(A/G10,3)=SR 4333.18

$EUAC_4$=SR 4308.6

$EUAC_5$=SR 4340.78

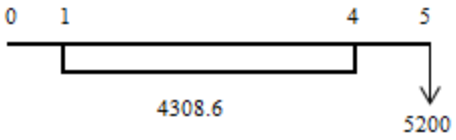
$EUAC_6$=SR 4423.17

$EUAC_7$=SR 4483.81

The optimum replacement interval at n=4

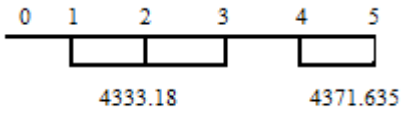
2. **Find optimum replacement interval for 5 year planning horizon**.

Solution



P_w =4308.6(P/A 10,4) +5200(P/A10,5)

P_w= SR 16886.51



P_w=4333.18(P/A10,3) + 4371.635(P/A10,2)(P/F 10,3)

P_W=SR 16476.27

The optimum replacement interval for planning Horizon at n=3