Replacement Study

Fundamental Issue

Over time, company assets need to be replaced due to:

- Reduced performance
- Altered requirements
- Obsolescence

A replacement study answers the question of when, not if, to replace.

A replacement study is an application of the AW method of comparing unequal-life alternatives.

Replacement Study

Definitions

Defender – currently installed asset

Challenger – the "best" alternative to replace the defender

AW – primary economic measure of comparison between defender and challenger.

Economic Service Life (ESL) – the number of years at which the lowest AW of cost for an alternative occurs

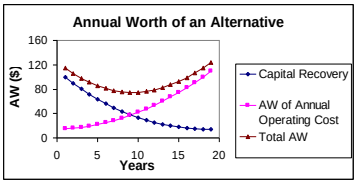
Defender First Cost – the current market value of the defender

Challenger First Cost – the cost of replacing the defender with the challenger

Replacement Study

Economic Service Life (ESL)

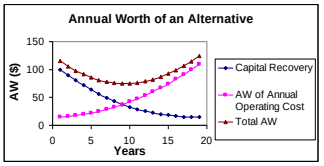
– the number of years at which the lowest AW of cost for an alternative occurs



- The AW of the annual operating costs tends to increase as the asset ages
- The capital recovery cost tends to decrease as the capital cost is spread over more years

Replacement Study

Economic Service Life (ESL)



Total AW = -capital recovery – AW of annual operating costs

Total AW $= -P(A/P,i,k) + S_k(A/F,i,k) - \left[\sum_{j=1}^{k} AOC_j(P/F,i,j)\right](A/P,i,k)$

Where P = initial investment or current market value

S_k = salvage value or market value after k years

AOC_j = annual operating cost for year j

Replacement Study

Economic Service Life (ESL) - Example

A manufacturing process is being considered for replacement. The current market value is $13,000. What is the economic service life of this defender if the interest rate is 10% per year?

Year j	MV_j	AOC_j	Capital Recovery	AW of AOC	Total AW_k		
1	9000	-2500	-5300	-2500	-7800		
2	8000	-2700	-3681	-2595	-6276		
3	6000	-3000	-3415	-2717	-6132	**ESL = 3**	
4	2000	-3500	-3670	-2886	-6556		
5	0	-4500	-3429	-3150	-6579		
CR(1) =							
CR(2) =							
AOC(1) =							
AOC(2) =							
AOC(3) =							

Replacement Study

Performing the Study

Two types of study:

- No study period specified
- Study period specified

No study period specified:

1. Perform ESL analysis on defender and on challenger.
2. If $AW_C < AW_D$, then replace defender with challenger and end study.

   Else, go to step 3.
3. Keep defender for a year, then obtain new market values and estimated AOCs for defender and best challenger. Go to step 1.

Performing the Study – Example

i = 10%		Challenger	
Challenger Year k	Market Value	AOC	Total AW if owned k years
0	$ 50,000	-	
1	$ 40,000	$ (5,000)	$ (20,000)
2	$ 32,000	$ (7,000)	$ (19,524)
3	$ 25,600	$ (9,000)	$ (19,245)
4	$ 20,480	$ (11,000)	$ (19,123)
5	$ 16,384	$ (13,000)	$ (19,126)
		Defender	
Defender Year k	Market Value	AOC	Total AW if owned k years
0	$ 15,000	-	
1	$ 12,000	$ (20,000)	$ (24,500)
2	$ 9,600	$ (8,000)	$ (18,357)
3	$ 7,680	$ (12,000)	$ (17,307)

Because $AW_D < AW_C$: -$17,307 < -$19,123, keep defender for another year.

Replacement Study

Performing the Study – Example (one year later)

However, one year later $AW_D > AW_C$:

-$20,819 > -$19,123, therefore replace defender with challenger.

i = 10%		Challenger	
Challenger Year k	Market Value	AOC	Total AW if owned k years
0	$ 50,000	-	
1	$ 40,000	$ (5,000)	$ (20,000)
2	$ 32,000	$ (7,000)	$ (19,524)
3	$ 25,600	$ (9,000)	$ (19,245)
4	$ 20,480	$ (11,000)	$ (19,123)
5	$ 16,384	$ (13,000)	$ (19,126)
		Defender - 1 Year Later	
Defender Year k	Market Value	AOC	Total AW if owned k years
0	$ 12,000	-	
1	$ 2,000	$ (12,000)	$ (23,200)
2	$ -	$ (16,000)	$ (20,819)