ANNUAL EQUIVALENT METHOD

6.1 INTRODUCTION

In the annual equivalent method of comparison, first the annual equivalent cost or the revenue of each alternative will be computed. Then the alternative with the maximum annual equivalent revenue in the case of revenue-based comparison or with the minimum annual equivalent cost in the case of cost-based comparison will be selected as the best alternative.

EXAMPLE 6.2 A company is planning to purchase an advanced machine centre. Three original manufacturers have responded to its tender whose particulars are tabulated as follows:

Manufacturer	*Down payment* (Rs.)	*Yearly equal installment* (Rs.)	*No. of installments*
1	5,00,000	2,00,000	15
2	4,00,000	3,00,000	15
3	6,00,000	1,50,000	15

Determine the best alternative based on the annual equivalent method by assuming $i = 20\%$, compounded annually.

Solution *Alternative 1*

Down payment, P = Rs. 5,00,000

Yearly equal installment, A = Rs. 2,00,000

n = 15 years

i = 20%, compounded annually

The cash flow diagram for manufacturer 1 is shown in Fig. 6.4.

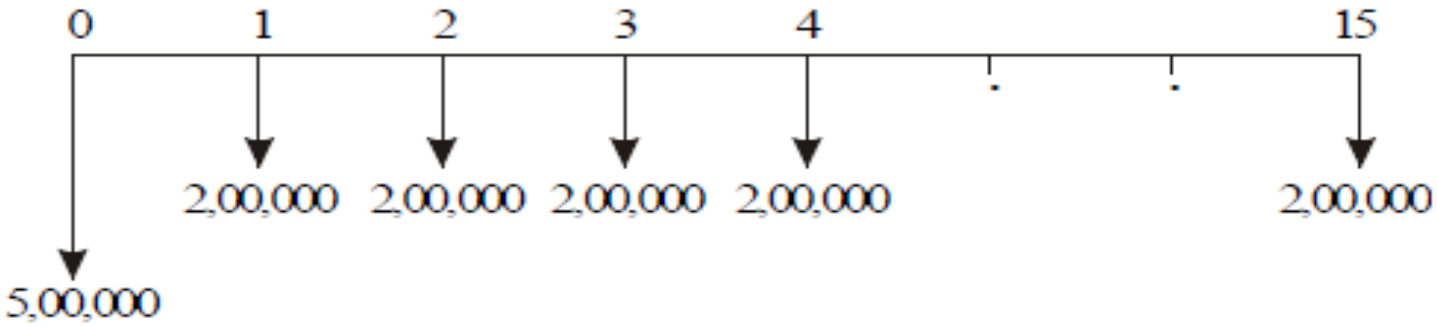

Fig. 6.4 Cash flow diagram for manufacturer 1.

The annual equivalent cost expression of the above cash flow diagram is

$$AE_1(20\%) = 5{,}00{,}000(A/P,\ 20\%,\ 15) + 2{,}00{,}000$$
$$= 5{,}00{,}000(0.2139) + 2{,}00{,}000$$
$$= 3{,}06{,}950$$

Alternative 2

Alternative 2

Down payment, P = Rs. 4,00,000
Yearly equal installment, A = Rs. 3,00,000
n = 15 years
i = 20%, compounded annually

The cash flow diagram for the manufacturer 2 is shown in Fig. 6.5.

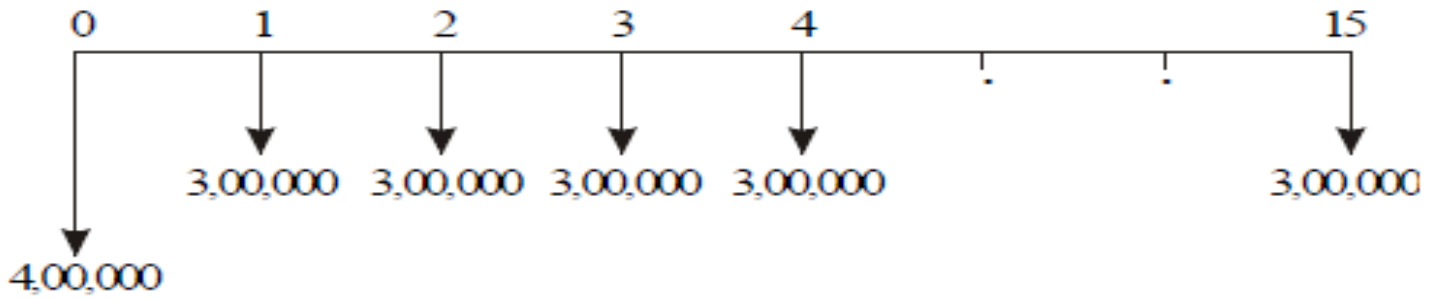

Fig. 6.5 Cash flow diagram for manufacturer 2.

The annual equivalent cost expression of the above cash flow diagram is

$$AE_2(20\%) = 4{,}00{,}000(A/P, 20\%, 15) + 3{,}00{,}000$$
$$= 4{,}00{,}000(0.2139) + 3{,}00{,}000$$
$$= \text{Rs. } 3{,}85{,}560.$$

Alternative 3

Down payment, P = Rs. 6,00,000
Yearly equal installment, A = Rs. 1,50,000
n = 15 years
i = 20%, compounded annually

The cash flow diagram for manufacturer 3 is shown in Fig. 6.6.

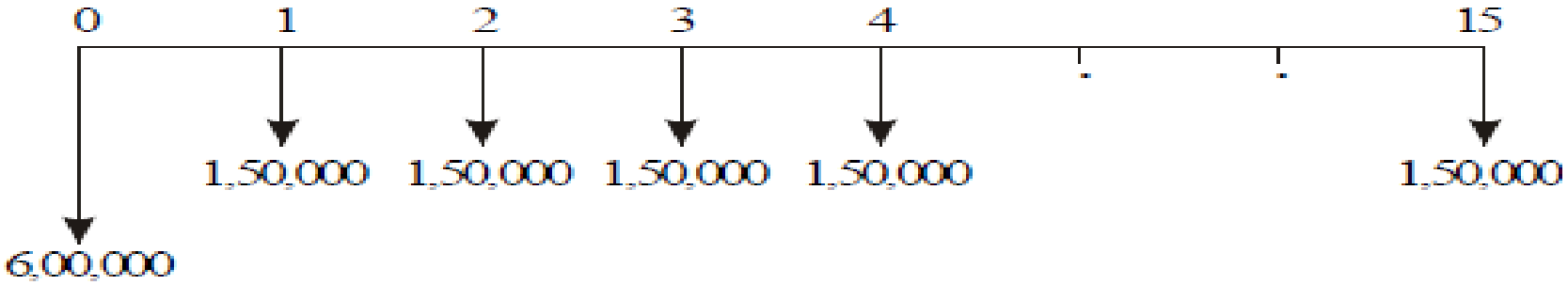

Fig. 6.6 Cash flow diagram for manufacturer 3.

The annual equivalent cost expression of the above cash flow diagram is

$$AE_3(20\%) = 6,00,000(A/P, 20\%, 15) + 1,50,000$$
$$= 6,00,000(0.2139) + 1,50,000$$
$$= \text{Rs. } 2,78,340.$$

The annual equivalent cost of manufacturer 3 is less than that of manufacturer 1 and manufacturer 2. Therefore, the company should buy the advanced machine centre from manufacturer 3.

EXAMPLE 6.3 A company invests in one of the two mutually exclusive alternatives. The life of both alternatives is estimated to be 5 years with the following investments, annual returns and salvage values.

	Alternative	
	A	B
Investment (Rs.)	– 1,50,000	– 1,75,000
Annual equal return (Rs.)	+ 60,000	+ 70,000
Salvage value (Rs.)	+ 15,000	+ 35,000

Determine the best alternative based on the annual equivalent method by assuming $i = 25\%$.

Solution Alternative A

Initial investment, P = Rs. 1,50,000
Annual equal return, A = Rs. 60,000
Salvage value at the end of machine life, S = Rs. 15,000
Life = 5 years
Interest rate, i = 25%, compounded annually

The cash flow diagram for alternative A is shown in Fig. 6.7.

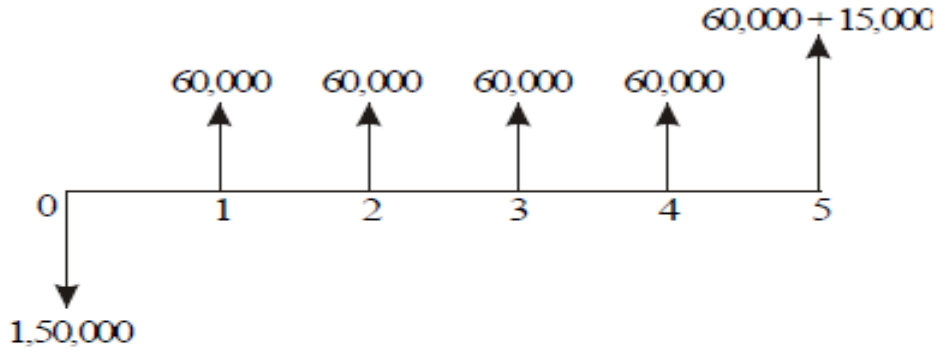

Fig. 6.7 Cash flow diagram for alternative A.

The annual equivalent revenue expression of the above cash flow diagram is as follows:

$$AE_A(25\%) = -1,50,000(A/P, 25\%, 5) + 60,000 + 15,000(A/F, 25\%, 5)$$
$$= -1,50,000(0.3718) + 60,000 + 15,000(0.1218)$$
$$= \text{Rs. } 6,057$$

Initial investment, P = Rs. 1,75,000
Annual equal return, A = Rs. 70,000
Salvage value at the end of machine life, S = Rs. 35,000
Life = 5 years
Interest rate, i = 25%, compounded annually

The cash flow diagram for alternative B is shown in Fig. 6.8.

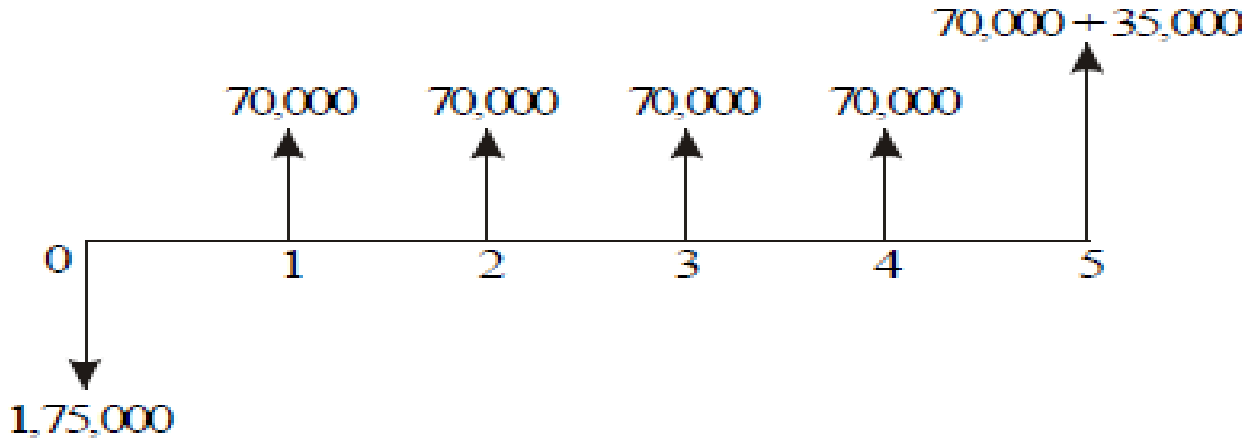

Fig. 6.8 Cash flow diagram for alternative B.

The annual equivalent revenue expression of the above cash flow diagram is

$$AE_B(25\%) = -1,75,000(A/P, 25\%, 5) + 70,000 + 35,000(A/F, 25\%, 5)$$
$$= -1,75,000(0.3718) + 70,000 + 35,000(0.1218)$$
$$= \text{Rs. } 9,198$$

The annual equivalent net return of alternative B is more than that of alternative A. Thus, the company should select alternative B.

EXAMPLE 6.5 Two possible routes for laying a power line are under study. Data on the routes are as follows:

		Around the lake	*Under the lake*
Length		15 km	5 km
First cost	(Rs.)	1,50,000/km	7,50,000/km
Useful life	(years)	15	15
Maintenance cost	(Rs.)	6,000/km/yr	12,000/km/yr
Salvage value	(Rs.)	90,000/km	1,50,000/km
Yearly power loss	(Rs.)	15,000/km	15,000/km

If 15% interest is used, should the power line be routed around the lake or under the lake?

Solution Alternative 1—Around the lake

First cost = 1,50,000 × 15 = Rs. 22,50,000

Maintenance cost/yr = 6,000 × 15 = Rs. 90,000

Power loss/yr = 15,000 × 15 = Rs. 2,25,000

Maintenance cost and power loss/yr = Rs. 90,000 + Rs. 2,25,000
= Rs. 3,15,000

Salvage value = 90,000 × 15 = Rs. 13,50,000

The cash flow diagram for this alternative is shown in Fig. 6.11.

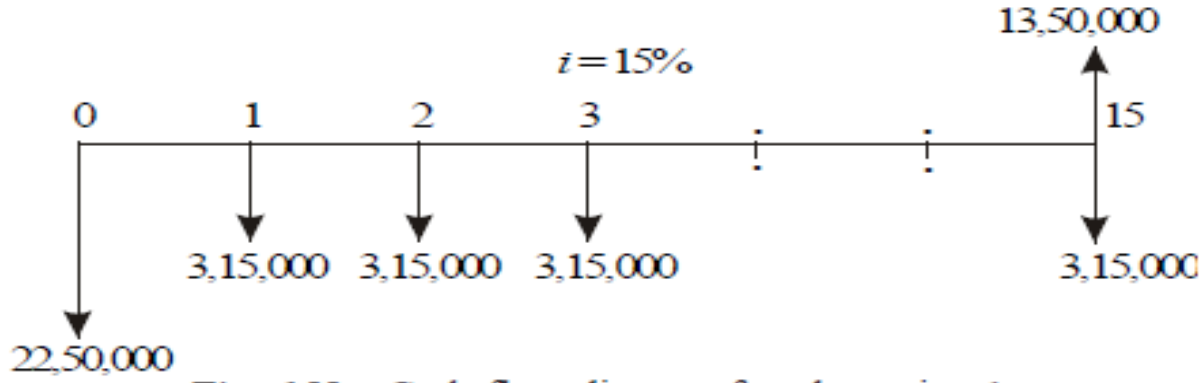

Fig. 6.11 Cash flow diagram for alternative 1.

The annual equivalent cost expression of the above cash flow diagram is

$$AE_1(15\%) = 22,50,000(A/P, 15\%, 15) + 3,15,000 - 13,50,000(A/F, 15\%, 15)$$
$$= 22,50,000(0.1710) + 3,15,000 - 13,50,000(0.0210)$$
$$= \text{Rs. } 6,71,400$$

First cost = 7,50,000 × 5 = Rs. 37,50,000
Maintenance cost/yr = 12,000 × 5 = Rs. 60,000
Power loss/yr = 15,000 × 5 = Rs. 75,000
Maintenance cost and power loss/yr = Rs. 60,000 + Rs. 75,000
= Rs. 1,35,000
Salvage value = 1,50,000 × 5 = Rs. 7,50,000

The cash flow diagram for this alternative is shown in Fig. 6.12.

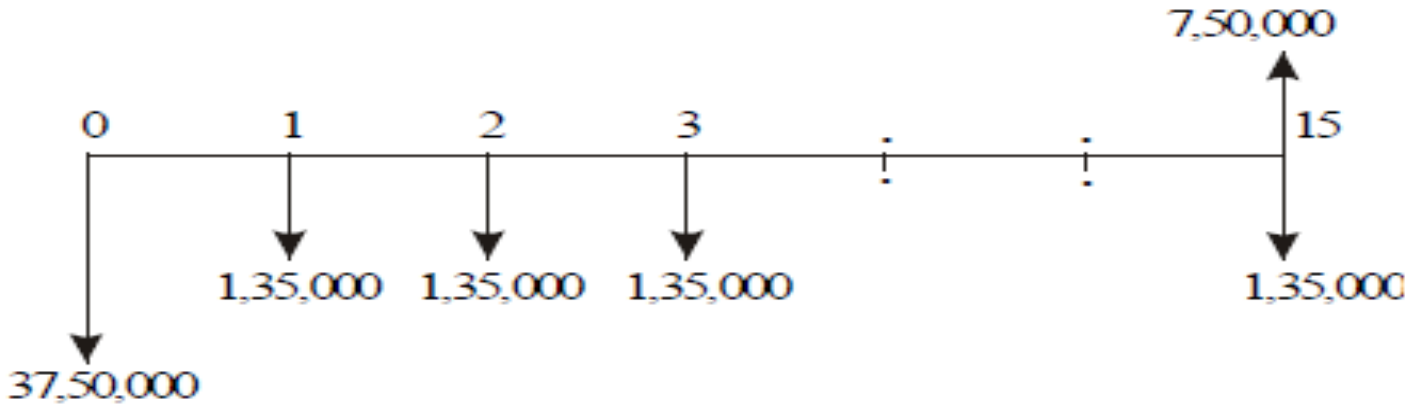

Fig. 6.12 Cash flow diagram for alternative 2.

The annual equivalent cost expression of the above cash flow diagram is

$$AE_2(15\%) = 37,50,000(A/P, 15\%, 15) + 1,35,000 - 7,50,000(A/F, 15\%, 15)$$
$$= 37,50,000(0.1710) + 1,35,000 - 7,50,000(0.0210)$$
$$= \text{Rs. } 7,60,500$$

The annual equivalent cost of alternative 1 is less than that of alternative 2. Therefore, select the route around the lake for laying the power line.