

Chapter 4.11: Financial Management**Short type questions**

1.	What's the need for performing financial analysis of an energy saving proposal? Ans. Plant managements invest in capital which will yield the greatest return. In order to make a decision about any course of action, management needs to appraise all costs involved in appropriate manner in a project and determine the potential returns.
2.	What are the financial issues associated with capital investment in energy saving project? Ans. The financial issues associated with capital investment in energy saving projects are from discounted cash-flow techniques like 1: NPV : Net present value 2: IRR : Internal rate of return
3.	What are fixed and variable costs? Give an example of a diesel generator installation. Ans. Variable costs are those which vary directly with the output of plant or production-such as fuel costs. Fixed costs are those which are not dependent on plant or production output such as interest on capital, site rent or insurance. For example, capital cost & annual maintenance costs or fixed costs. Considering a DG installation, the fixed costs are manpower, interest on capital and depreciation costs. The variable costs are Fuel & lubricating oil costs.
4.	What are two types of interest charges? Take the example of a boiler installation involving Rs 5.0 lakh investment @ 10% interest per annum with a repayment period of 5 years and compute the total repayment value for both simple interest method. Ans. The two ways of calculating interest are simple & compound interest. The total repayment value with simple interest = Rs $(5.0 + (10/100 \times 5.0 \times 5))$ = Rs 7.5 lakh The total repayment value with compound interest = Rs. $5.0 \times (1 + 10/100)^5$ = Rs. 8.05 lakh
5.	What is profitability index? Give an example of motor having a capital investment of Rs 1.0 lakh with discounted net savings of Rs. 1.2 lakh? Ans. The technique used to evaluate the financial viability of projects is the profitability index. THIS IS GIVEN BY RATIO of Sum of discounted net savings and Capital costs $= 1.2 / 1.0 \times 100 = 120\%$
6.	Explain the term "depreciation" Ans. This is the reduction in value of plant assets over life. It is not a real cash-flow but only a paper expense allocation and does not directly affect the life cost. But it is a real expense in terms of tax-calculations.

7.	What is the objective of carrying out sensitivity analysis? Ans. It is an assessment of risk involved in cash flows Like, Capital cost, energy cost savings, maintenance cost, etc. The take into account various factors like process changes, change in government policies like depreciation, interest, technology changes etc. To make the project feasible, sensitivity analysis is recommended which has a direct affect on cash flows.
8.	Give formula for calculating the simple payback period. Calculate the same for an application involving flat-belt installation (replacing V belts drive) costing Rs 12,000 with an annual energy saving potential of Rs 12,000/-. The annual expenses could be reckoned as Rs 4000. Ans. Simple pay back period: $\frac{\text{Capital or first cost}}{\text{Yearly benefits} - \text{yearly costs}}$: $\frac{12000}{12000 - 4000} = 1.5 \text{ years}$
9.	What are the factors affecting financial analysis while computing NPV and IRR. Ans. Though NPV and IRR are basic principles adopted with the financial analysis of a project, they do not allow for the following considerations. • The capital value of plant and equipment generally depreciates over time. • General inflation reduces the value of savings as time progresses. The capital depreciation of an item of equipment can be considered in terms of its salvage value.
10.	Briefly explain simple pay back period and its advantage / disadvantage. Ans. Simple pay back period is the time required to recover the initial investment (first cost) considering only net annual savings. Simple pay back period: $\frac{\text{Capital or first cost}}{\text{Yearly benefits} - \text{yearly costs}}$ Following calculation of simple pay back period has some benefits as below. • Easy to calculate • It is interpreted in tangible terms (in years) • It does not require any assumptions about the project in terms of timing, life time or interest rates. The severe disadvantages of simple pay back calculations are: • It takes no account of any savings after the pay back period • It takes no account of the residual value in the capital asset. • It takes no account of the time value of money

Long type questions

1.	What are two types of discounted cash-flow methods? Briefly explain the terminology. Ans. The financial issues associated with capital investment in energy saving projects from discounted cash-flow techniques are: 1: NPV: Net present value 2. IRR: Internal rate of return NPV - This is the discounted present value of future cash—flows. The NPV calculates the present value of all the yearly cash flows incurred or accrued through out the life cycle of the project. Higher the NPV value, more attractive is the proposed project. IRR- The discount rate, which achieves a net present value (NPV) equal to zero is known as the internal rate of return.
2.	List the factors need to be considered in calculating annual cash flows and cite an example of an industrial utility case for each. Ans. Factors that need to be considered in calculating annual cash flows are Taxes, Depreciation and intermittent cash-expenses. Taxes, using the marginal tax rate applied to positive (i.e. increasing taxes) or negative (i.e. decreasing taxes) cash flows. The government policy regarding variations off taxes on electricity or fuel could be an example for an industrial facility with captive power plant generating in-house power. Asset depreciation, the depreciation of plant assets over their life. For example, if Rs.10,00,000 asset is depreciated at 20% and the marginal tax rate is 40%, the depreciation would be Rs. 200,000 and the tax cash flow would be Rs. 80,000 and it is this latter amount that would show up in the costing calculation. Intermittent cash flow which occur sporadically rather than annually during the life of the project. Relining a furnace once every five years would be an example.

Numerical type questions

1. The energy and demand savings analysis for retrofit LED exit signs is given in table below.

Retrofit cost	Energy & demand savings	Maintenance savings
Rs. 32,500	6000 kWh/month & Rs.3800/year as demand charges	Annual maintenance savings will be Rs. 2000/-.

The key data is given below:

- Energy savings are based on Rs3.00/kWh
- No changes in energy rates for 10 years
- LED exit signs have 10 year life period
 - a) Estimate savings in maintenance costs at the end of life of LED signs.
 - b) Prepare cash-flow analysis for the upgrade option.
 - c) Calculate NPV against 12% interest rate.

Ans. The cash flow detail for ten year duration is given below.

Year	Retrofit cost	Cost of Energy & demand savings-Computed	Maintenance savings
0	32500	0	0
1	0	21800	+2000
2	0	21800	+2000
3	0	21800	+2000
4	0	21800	+2000
5	0	21800	+2000
6	0	21800	+2000
7	0	21800	+2000
8	0	21800	+2000
9	0	21800	+2000
10	0	21800	+2000

- a) The estimated savings in maintenance saving at the end of life of LED signs is Rs 20,000/-
- b) The net cash-flow for the upgrade option is Rs 2,05,500/-
- c) The net-present value against 12% interest rate is given below.

NPV is given by
$$: \frac{A \times [(1+i)^n]}{[i \times (1+i)^n]}$$

NPV is given by
$$: \frac{23800 \times [(1+0.12)^{10} - 1]}{[0.12 \times (1+0.12)^{10}]} = \text{Rs. 1,34,472/-}$$

2. A proposed project for cooling tower optimisation requires an initial capital investment of Rs.20,000. The cash flow generated by the project are shown in the table below:

Year	Cash flow, (Rs.)
0	-20,000.00
1	+8,000.00
2	+8,000.00
3	+8,000.00
4	+6,000.00
5	+6,000.00
6	+6,000.00

Calculate the gross and net annual rate of return for the project.

Total savings : Rs 42,000

Capital cost : Rs 20,000

a) Gross return on capital : (Total savings/capital costs) x 100%
: (42000/20000) x 100% = 210%

b) Net return on capital : ((Total savings-capital costs)/capital costs) x 100
: ((42000-20000)/20000) x 100 = 110%

c) Average gross annual rate of return : Gross return on capital/no. of years

	: 210%/6 = 35% d) Average net annual rate of return : Net return on capital/no. of years : 110% /6 = 18.3%																													
3.	Look at two purely fictitious lighting systems, A and B. Lighting System A is the existing system and Lighting System B is a proposed retrofit system which simply includes more-energy-efficient lamps and ballasts. They produce comparable light output. <table><thead><tr><th></th><th>Lighting System A</th><th>Lighting System B (proposed)</th></tr></thead><tbody><tr><td>No. of fixtures</td><td>100</td><td>100</td></tr><tr><td>Input Watts/Fixture</td><td>175</td><td>100</td></tr><tr><td>Hours of Operation/Year</td><td>3,000</td><td>3,000</td></tr><tr><td>Energy Consumption/Year (kWh)</td><td>525 / fixture</td><td>300 / fixture</td></tr><tr><td>Utility Cost/kWh</td><td>Rs 1.0</td><td>Rs 1.0</td></tr><tr><td>Cost of implementation</td><td></td><td>Rs 700/fixture</td></tr></tbody></table> Define the following for above case study and also calculate: a) Simple payback b) Five-year cash flow c) Simple return on Investment Ans. Simple payback is the amount of time that will go by before a system upgrade option's energy savings reach the net installation cost (also called the initial cost): Payback (Years) = Net Installation Cost (Rs) ÷ Annual Energy Savings (Rs) Five-year cash flow is chosen based on expectations of the life of the lamps; by factoring in the cost of lamp replacement and other maintenance costs. 5-Year Cash Flow (Rs) = Savings for 5 Years – Investment Simple return on investment is an internal rate of return, expressed as a percentage, based on the relationship between annual energy savings and the net installation cost: ROI (%) = [Annual value of Energy Savings ÷ Net Installation Cost (Rs)] x 100 Together, they represent a simple and effective first step at determining whether the new equipment would be a good for investment or not. <table><tbody><tr><td>Energy Savings/Year</td><td>225 kWh</td></tr><tr><td>Number of Fixtures Retrofitted</td><td>100</td></tr><tr><td>Total Cost Energy Savings/Year</td><td>22,500</td></tr><tr><td>Total Cost of implementation</td><td>Rs 70,000</td></tr></tbody></table> Simple payback is : Rs. 70,000 ÷ 22500 = 3.1 Years Five-year cash flow is : (5 x 22500) –(70,000) = Rs 42,500 ROI is : (22500 ÷ 70000) x 100 = 32%		Lighting System A	Lighting System B (proposed)	No. of fixtures	100	100	Input Watts/Fixture	175	100	Hours of Operation/Year	3,000	3,000	Energy Consumption/Year (kWh)	525 / fixture	300 / fixture	Utility Cost/kWh	Rs 1.0	Rs 1.0	Cost of implementation		Rs 700/fixture	Energy Savings/Year	225 kWh	Number of Fixtures Retrofitted	100	Total Cost Energy Savings/Year	22,500	Total Cost of implementation	Rs 70,000
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