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Internal Assesment Test - I

Sub:	ENERGY AUDITING & DEMAND SIDE MANAGEMENT						Code:	10EE842
Date:	28 / 03 / 2017	Duration:	90 mins	Max Marks:	50	Sem: 8	Branch:	EEE

Answer Any **FIVE** FULL Questions

		Marks	OBE CO	OBE RBT
1	Discuss the Energy Scenario in the world and in India.	[10]	CO1	L2
2	List out the different codes and standards with respect to electrical equipments.	[10]	CO1	L1
3 (a)	Explain time value of money concept? What are the different cash flow models?	[6]	CO3	L4
(b)	Explain payback analysis.	[4]	CO3	L4
4	Compare & calculate the depreciation rate using the i) straight-line ii) sum of years digit and iii) declining balance methods, for the data given below: Salvage value is Rs 0 Life of equipment, n= 5years Initial expenditure, p = Rs 150,000 For declining balance use a 200% rate.	[10]	CO1	L4
5	Explain in detail the ten step methodology of energy auditing.	[10]	CO2	L4
6	Explain the broad features of Indian Electricity rule 1956.	[10]	CO3	L4

Course Outcomes		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1:	Understand the concept of energy audit, types, index and cost risk analysis with depreciation Techniques	1	-	-	-	-	-	-	-	1	-	-	-
CO2:	Measurement and presentation of audit results	2	-	-	-	1	-	-	-	-	-	-	-
CO3:	Describe the analysis of load management, conservation of energy, power factor Improvement methods, energy efficient motors	2	-	-	-	2	-	-	1	-	-	-	-
CO4:	Analyze energy saving studies on lighting system	1	-	-	-	1	-	-	1	1	-	-	-
CO5:	Explain power factor correction and location of capacitors	2	-	-	-	-	-	-	0	-	-	-	-
CO6:	analyse the benefits of demand side management and organize awareness programs	1	-	-	-	1	-	-	1	1	-	-	-

Cognitive level	KEYWORDS
L1	List, define, tell, describe, identify, show, label, collect, examine, tabulate, quote, name, who, when, where, etc.
L2	summarize, describe, interpret, contrast, predict, associate, distinguish, estimate, differentiate, discuss, extend
L3	Apply, demonstrate, calculate, complete, illustrate, show, solve, examine, modify, relate, change, classify, experiment, discover.
L4	Analyze, separate, order, explain, connect, classify, arrange, divide, compare, select, explain, infer.
L5	Assess, decide, rank, grade, test, measure, recommend, convince, select, judge, explain, discriminate, support, conclude, compare, summarize.

PO1 - *Engineering knowledge*; PO2 - *Problem analysis*; PO3 - *Design/development of solutions*; PO4 - *Conduct investigations of complex problems*; PO5 - *Modern tool usage*; PO6 - *The Engineer and society*; PO7- *Environment and sustainability*; PO8 – *Ethics*; PO9 - *Individual and team work*; PO10 - *Communication*; PO11 - *Project management and finance*; PO12 - *Life-long learning*

ANSWER KEY

1. **world scenario:**

Global Primary Energy Reserves and Commercial Energy Production

Coal

It has been estimated that there are over 826 billion tons of proven coal reserves worldwide. Around half of the world's proven reserves are bituminous coal and anthracite, the grade of coal with the highest energy content. There is enough coal to last around 122 years at current rates of production (Source: BP Statistical Review of World Energy, June 2009).

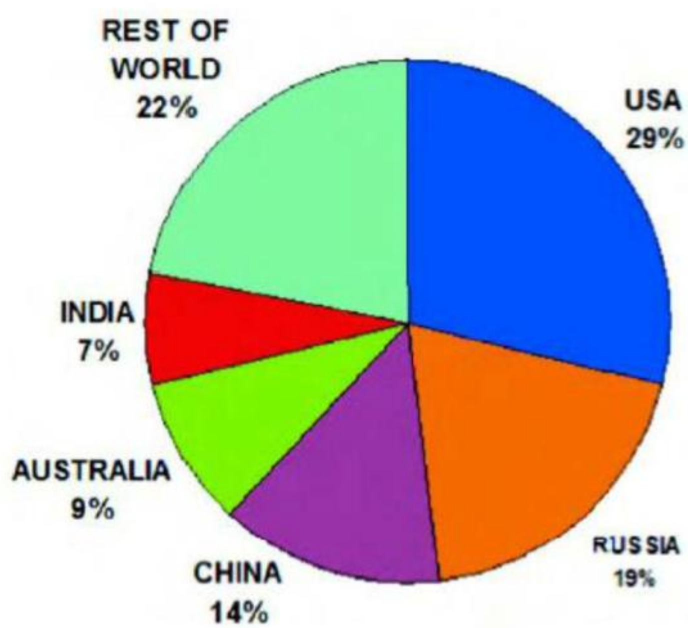

Figure 1.4 Coal Reserves by Country (Total Reserves 826 Billion Tonnes in 2008)
(Source: World Coal Institute)

The top 10 coal producers are given in Table 1.1. Most of the demand for coal comes from power sector.

Table 1.1 Top Ten Coal Producers in Million Tonnes (2008)

China	2761	Indonesia	246
USA	1007	South Africa	236
India	490	Kazakhstan	104
Australia	325	Poland	84
Russia	247	Colombia	79

Source: International Energy Agency 2009

Oil

The global proven oil (conventional crude oil) reserve was estimated to be 1258 billion barrels by the end of 2008. Almost, 60% of the proven oil reserves are in the Middle East. Saudi Arabia has the largest share of the reserve with about 21%. Top proven world oil reserves (in billion barrels) are given in Figure 1.5

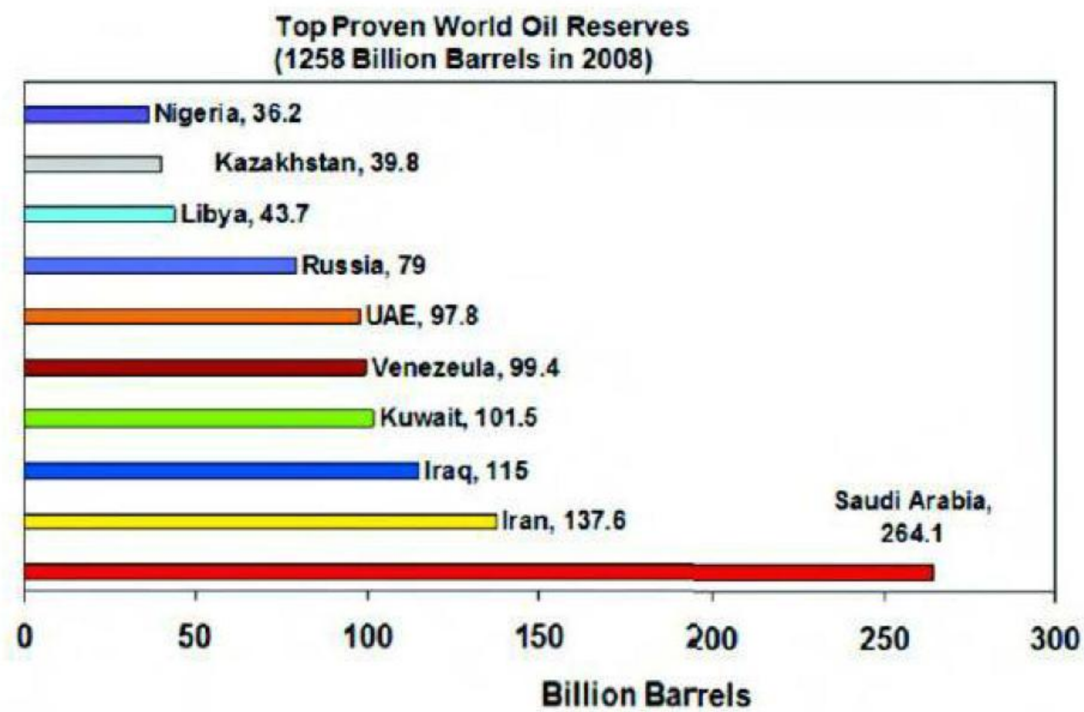

Figure 1.5 Top Proven World Oil Reserves (1 barrel ≈ 160 litres)

Global Primary Energy Consumption

The global primary energy consumption at the end of 2008 was equivalent to 11295 Million tones oil equivalent. The share of oil is the largest at 35% followed by coal and natural gas with 29% and 24% respectively. The demand for natural gas in future will increase as industrialized countries take strong action to cut CO2 emissions.

The Figure 1.8 shows the breakup of various constituents of primary energy consumption (Million Tonnes of Oil Equivalent, Mtoe) worldwide.

The primary energy consumptions for some of the developed and developing countries are shown in Table 1.2. It may be seen that India's absolute primary energy consumption is only 3.8% of the world, 20% of USA's and 85% of Japan's consumption.

Table-1.2 Primary Energy consumption at the end of 2008							
Country	Million tones of oil equivalent (Mtoe)						
	Oil	**Coal**	**Natural Gas**	**Nuclear**	**Hydro**	**Total**	%
USA	884.5	565	600.7	192	56.7	2298.9	20.4
Canada	102	33	90	21.1	83.6	329.7	2.92
France	92.2	11.9	39.8	99.6	14.3	257.8	2.28
Russian Federation	130.4	101.3	378.2	36.9	37.8	684.6	6.06
UK	78.7	35.4	84.5	11.9	1.1	211.6	1.87
China	375.7	1406.3	2.3	15.5	132.4	1932.2	17.1
India	135	231.4	37.2	3.5	26.2	433.3	3.84
Japan	221.8	128.7	84.4	57	15.7	507.6	4.49
Malaysia	21.8	5	27.6	0	1.5	55.9	0.49
Pakistan	19.3	6.7	33.8	0	6.3	66.1	0.59
Singapore	49.9	66.1	8.3	34.2	0.9	159.4	1.41
Total World	**3927.9**	**3303.7**	**2726.1**	**619.7**	**717.5**	**11294.9**	**100**

*<u>**Source:**</u> *BP Statistical Review of World Energy, June 2009-Page-41)*

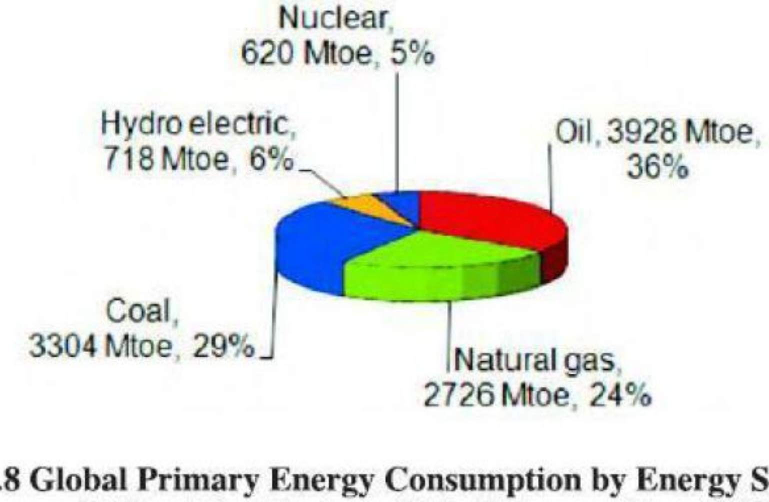

Figure 1.8 Global Primary Energy Consumption by Energy Source
(*Source: BP Statistical Review of World Energy, June 2009*)

World Energy Consumption

Final energy is the form of energy available to the end user following conversion from primary energy. Final Energy consumption, measured in Million tonnes of oil equivalent (Mtoe) is the sum of the energy consumption in the end-use sectors. Energy used for transformation and for own use by the energy producing industries are excluded. Final consumption reflects energy delivered to the consumers.

Total final energy consumption of the entire world is around 8286 Mtoe. The transport sector's share in the total is 27.7% followed by the industrial sector (27.5%) and the combined residential, services and agricultural use (23.4%). Aggregate demand in final-use sectors (industry, transport, residential, services, agriculture and non-energy use) is projected to grow at the rate of 1.4% per year till 2030. The total energy consumption, country wise, is given in Table 1.3

Table 1.3 Energy Consumption by Country During 2007				
Country	Mtoe	% of Total Final Energy Consumption		
	Total Final Energy Consumption	Industry	Transport	Residential
China	1248.2	45.9	11.1	25.3
Japan	341.7	29.0	24.1	14.4
Republic of Korea	146.8	28.1	20.6	12.6
Indonesia	145.1	32.6	16.8	39.0
Malaysia	43.4	44.3	31.2	9.3
Philippines	22.9	23.6	37.9	27.7
Singapore	13.2	9.8	18.5	5.1
Thailand	69.6	33.3	26.1	15.2
Vietnam	48.5	21.3	16.2	56.6
Bangladesh	19.9	15.0	8.2	58.1
India	392.9	29.0	10.4	41.4
Iran	144.7	23.7	24.4	32.7
Nepal	9.5	4.6	3.1	89.6
Pakistan	68.9	27.5	16.1	47.3
Sri Lanka	8.3	25.4	25.7	41.5
Russian Federation	429.8	29.7	21.5	26.1
Europe	1394.8	26.0	26.3	23.5
North America	17,92.8	19.5	38.7	16.7
World	**8286.1**	**27.5**	**27.7**	**23.4**

ENERGY SCENARIO IN INDIA

The utility **electricity sector in India** had an installed capacity of 281.423 GW as of 30 November . Renewable Power plants constituted 28% of total installed capacity and Non-Renewable Power Plants constituted the remaining 72%. The gross electricity generated by utilities is 1,106 TWh (1,106,000 GWh) and 166 TWh by captive power plants.

THERMAL POWER

- Thermal power plants convert energy rich fuel into electricity and heat. Possible fuels include coal, natural gas, petroleum products, agricultural waste and domestic trash / waste.
- Global coal consumption grew by 0.4% in 2014.
- Coal and lignite accounted for about 67% of India's installed capacity.
- India's electricity sector consumes about 80% of the coal produced in the country. A large part of Indian coal reserve is similar to Gondwana coal. On average, the Indian power

plants using India's coal supply consume about 0.7 kg of coal to generate a kWh, whereas United States thermal power plants consume about 0.45 kg of coal per kWh.

- Thermal power plants can deploy a wide range of technologies. Some of the major technologies include:
- Steam cycle facilities (most commonly used for large utilities);
- Gas turbines (commonly used for moderate sized peaking facilities);
- Cogeneration and combined cycle facility (the combination of gas turbines or internal combustion engines with heat recovery systems); and
- Internal combustion engines (commonly used for small remote sites or stand-by power generation.

Vindhyachal is the largest thermal power plant in india with capacity of 3260 MW

The installed capacity of Thermal Power in India, as of June 30, 2011, was 115649.48 MW which is 65.34% of total installed capacity.

- Current installed base of Coal Based Thermal Power is 96,743.38 MW which comes to 54.66% of total installed base.
- Current installed base of Gas Based Thermal Power is 17,706.35 MW which is 10.00% of total installed capacity.
- Current installed base of Oil Based Thermal Power is 1,199.75 MW which is 0.67% of total installed capacity.

The state of Maharashtra is the largest producer of thermal power in the country.

NUCLEAR POWER

- India had 4.8 GW of installed electricity generation capacity using nuclear fuels

- India's Nuclear plants generated 32455 million units or 3.75% of total electricity produced in India.
- India's nuclear power plant development began in 1964 by commissioning of two boiling water reactors at Tarapur.

CAPACITY

- India's share of nuclear power plant generation capacity is just 1.2% of worldwide nuclear power production capacity, making it the 15th largest nuclear power producer.
- Nuclear power provided 3% of the country's total electricity generation in 2011.
- India aims to supply 9% of it electricity needs with nuclear power by 2032.
- 2032. India's largest nuclear power plant project under implementation is at Jaitapur, Maharashtra in partnership with Areva, France.

HYDRO-ELECTRIC POWER

- India is one of the pioneering countries in establishing hydro-electric power plants. The power plants at Darjeeling and Shivanasamudra were established in 1898 and 1902 respectively and are among the first in Asia.
- India is endowed with economically exploitable and viable hydro potential assessed to be about 84,000 MW at 60% load factor. In addition, 6,780 MW in terms of installed capacity from Small, Mini, and Micro Hydel schemes have been assessed. used form of renewable energy.
- India is blessed with immense amount of hydro-electric potential and ranks 5th in terms of exploitable hydro-potential on global scenario.

SOLAR ENERGY

- India is bestowed with solar irradiation ranging from 4 to 7 kWh/square meter/day across the country, with western and southern regions having higher solar incidence.

- India is endowed with rich solar energy resource. India receives the highest global solar radiation on a horizontal surface.
- Government of India launched its Jawaharlal Nehru National Solar Mission.
- The first Indian solar thermal power project (2X50MW) is in progress in Phalodi Rajasthan.
- Land acquisition is a challenge to solar farm projects in India.
- exploring means to deploy solar capacity above their extensive irrigation canal projects, thereby harvesting solar energy while reducing the loss of irrigation water by solar evaporation.

2. CODES AND STANDARDS: (10 MARKS)

CODES AND STANDARDS

Energy codes specify how buildings *must* be constructed or perform, and are written in a mandatory, enforceable language. State and local governments adopt and enforce energy codes for their jurisdictions. Energy standards describe how buildings *should* be constructed to save energy cost effectively. They are published by national organizations such as the American Society of Heating, Refrigerating, and Air Conditioning Engineers (ASHRAE). They are not mandatory, but serve as national recommendations, with some variation for regional climate. State and local governments frequently use energy standards as the technical basis for developing their energy codes. Some energy standards are written in a mandatory, enforceable language, making it easy for jurisdictions to incorporate the provisions of the energy standards directly into their laws or regulations. The requirement for the Federal sector to use ASHRAE 90.1 and 90.2 as mandatory standards for all new Federal buildings is specified in the Code of Federal Regulations—10 CFR 435.

Most states use the ASHRAE 90 standard as their basis for the energy component of their building codes. ASHRAE 90.1 is used for commercial buildings and ASHRAE 90.2 is used for residential buildings. Some states have quite comprehensive building codes (for example: California Title 24).

ASHRAE Standard 90.1

- Energy efficient design for new buildings sets minimum requirements for the energy-efficient design of new buildings so they may be constructed, operated, and maintained in a manner that minimizes the use of energy without constraining the building function and productivity of the occupants
- ASHRAE 90.1 addresses building components and systems that affect energy usage
- Sections 5-10 are the technical sections that specifically address components of the building envelope, HVAC systems and equipment, service water heating, power, lighting, and motors. Each technical section contains general requirements and mandatory provisions. Some sections also include prescriptive and performance requirements

ASHRAE Standard 90.2

- Energy efficient design for new low-rise residential buildings

When the Department of Energy determines that a revision would improve energy efficiency, each state has two years to review the energy provisions of its residential or commercial building code. For residential buildings, a state has the option of revising its residential code to meet or exceed the residential portion of ASHRAE 90.2. For commercial buildings, a state is required to update its commercial code to meet or exceed the provision of ASHRAE 90.1.

ASHRAE standards 90.1 and 90.2 are developed and revised through voluntary consensus and public hearing processes that are critical to widespread support for their adoption. Both standards are continually maintained by separate Standing Standards Projects Committees. Committee membership varies from 10 to 60 voting members. Committee membership includes representatives from many groups to ensure balance among all interest categories. After the committee proposes revisions to the standard, it undergoes public review and comment. When a majority of the parties substantially agree, the revised standard is submitted to the ASHRAE Board of Directors. This entire process can take anywhere from two to ten years to complete. ASHRAE Standards 90.1 and 90.2 are automatically revised and published every three years. Approved interim revisions are posted on the ASHRAE website (www.ashrae.org) and are included in the next published version.

The energy cost budget method permits tradeoffs between building systems (lighting and fenestration, for example) if the annual energy cost estimated for the proposed design does not exceed the annual energy cost of a base design that fulfills the prescriptive requirements. Using the energy cost budget method approach requires simulation software that can analyze energy consumption in buildings and model the energy features in the proposed design. ASHRAE 90.1 sets minimum requirements for the simulation software; suitable programs include BLAST, eQUEST, and TRACE.

CLIMATE CHANGE

Kyoto Protocol

The goal of the Kyoto Protocol is to stabilize green house gases in the atmosphere that would prevent human impact on global climate change. The nations that signed the treaty come together to make decisions at meetings called Conferences of the Parties. The 38 parties are grouped into two groups, developed industrialized nations and developing countries. The Kyoto Protocol, an international agreement reached in Kyoto in 1997 by the third Conference of the Parties (COP-3), aims to lower emissions from two groups of three green house gases: carbon dioxide, methane, and nitrous oxide and the second group of hyrdofluorocarbon (HFC): sulfur hexafluoride and perfluorocarbons.

INDOOR AIR QUALITY STANDARDS

Indoor air quality (IAQ) is an emerging issue of concern to building managers, operators, and designers. Recent research has shown that indoor air is often less clean than outdoor air and federal legislation has been proposed to establish programs to deal with this issue on a national level. This, like the asbestos issue, will have an impact on building design and operations. Americans today spend long hours inside buildings, and building operators, managers, and designers must be aware of potential IAQ problems and how they can be avoided.

IAQ problems, sometimes termed "sick building syndrome," have become an acknowledged health and comfort problem. Buildings are characterized as sick when occupants complain of acute symptoms such as headache, eye, nose, and throat irritations, dizziness, nausea, sensitivity odors, and difficulty in concentrating. The complaints may become more clinically defined so that an occupant may develop an actual building-related illness that is believed to be related to IAQ problems.

The most effective means to deal with an IAQ problem is to remove or minimize the pollutant source, when feasible. If not, dilution and filtration may be effective.

3.TIME VALUE OF MONEY CONCEPT & CASH FLOW MODELS (6 MARKS)

Time Value of Money

A project usually entails an investment for the initial cost of installation, called the capital cost, and a series of annual costs and/or cost savings (i.e. operating, energy, maintenance, etc.) throughout the life of the project. To assess project feasibility, all these present and future cash flows must be equated to a common basis. The problem with equating cash flows which occur at different times is that the value of money changes with time. The method by which these various cash flows are related is called discounting, or the present value concept.

For example, if money can be deposited in the bank at 10% interest, then a Rs. 100 deposit will be worth Rs.110 in one year's time. Thus the Rs.110 in one year is a future value equivalent to the Rs. 100 present value.

In the same manner, Rs.100 received one year from now is only worth Rs.90.91 in today's money (i.e. Rs.90.91 plus 10% interest equals Rs.100). Thus Rs.90.91 represents the present value of Rs.100 cash flow occurring one year in the future. If the interest rate were something different than 10%, then the equivalent present value would also change. The relationship between present and future value is determined as follows:

$$\text{Future Value (FV)} = \text{NPV}\,(1 + i)^n \quad \text{or} \quad \text{NPV} = \text{FV} / (1+i)^n$$

Where, *FV = Future value of the cash flow*
NPV= Net Present Value of the cash flow
i = Interest or discount rate
n = Number of years in the future

Net Present Value Method

The net present value method considers the time value of money. This is done by equating future cash flow to its current value today, in other words determining the present value of any future cash flow. The present value is determined by using an assumed interest rate, usually referred to as a discount rate. Discounting is the opposite process to compounding. Compounding determines the future value of present cash flows, whereas discounting determines the present value of future cash flows.

The net present value method calculates the present value of all the yearly cash flows (i.e. capital costs and net savings) incurred or accrued throughout the life of a project and summates them. Costs are represented as negative value and savings as a positive value. The sum of all the present value is known as the net present value (NPV). The higher the net present value, the more attractive the proposed project.

The net present value (NPV) of a project is equal to the sum of the present values of all the cash flows associated with it. Symbolically,

$$\text{NPV} = -\frac{CF_0}{(1+\kappa)^0} + \frac{CF_1}{(1+\kappa)^1} + \cdots + \frac{CF_n}{(1+\kappa)^n} = \sum_{t=0}^{n} \frac{CF_t}{(1+\kappa)^t}$$

Cash Flow

Capital Investment Considerations

To judge the attractiveness of any investment, we must consider the following four elements involved in the decision: 1 Initial capital cost or net investment V Net operating cash inflows (the potential benefits) 1 Economic life (time span of benefits) 1 Salvage value (any final recovery of capital)

Initial capital cost or net investment

When companies spend money, the outlay of cash can be broadly categorized into one of two classifications; expenses or capital investments. Expenses are generally those cash expenditures that are routine, ongoing, and necessary for the ordinary operation of the business. Capital investments, on the other hand, are generally more strategic and have long term effects. Decisions made regarding capital investments are usually made by senior management and carry with them additional tax consequences as compared to expenses.

The capital investments usually require a relatively large initial cost. The initial cost may occur as a single expenditure or occur over a period of several years. Generally, the funds available for capital investments projects are limited.

Initial capital costs include all costs associated with preparing the investment for service. This includes purchase cost as well as installation and preparation costs. Initial costs are usually nonrecurring during the life of an investment.

Net operating cash inflows

The benefits (revenues or savings) resulting from the initial cost for a capital investment occur in the future, normally over a period of years. As a rule, the cash flows which occur during a year are generally summed and regarded as a single end-of-year cash flow. Annual expenses and revenues are the recurring costs and benefits generated throughout the life of the investment after adjusting for applicable taxes and effects of depreciation. Periodic replacement and maintenance costs are similar to annual expenses and revenues except that they do not occur annually.

Economic life

The period between the initial cost and the last future cash flow is the life cycle or life of the investment.

Salvage value

The salvage (or terminal) value of an investment is the revenue (or expense) attributed to disposing of the investment at the end of its useful life. If substantial recovery of capital from eventual disposal of assets at the end of the economic life, these estimated amounts have to be made part of the analysis. Such recoveries can be proceeds from the sale of facilities and equipment (beyond the minor scrap value), as well as the release of any working capital associated with the investment.

Cash Flow Diagrams

A convenient way to display the revenues (savings) and costs associated with an investment is a cash flow diagram. By using a cash flow diagram, the timing of the cash flows is clear and the chances of properly applying time value of money concepts are increased.

The economic life establishes the time frame over which the cash flows occur first. This establishes the horizontal scale of the cash flow diagram. This scale is divided into time periods which are frequently, but not always, years. Individual outlays or receipts are indicated by drawing vertical lines appropriately placed along the time scale.

Upward directed lines indicate cash inflow (revenues or savings) while downward directed lines Indicate cash outflows.

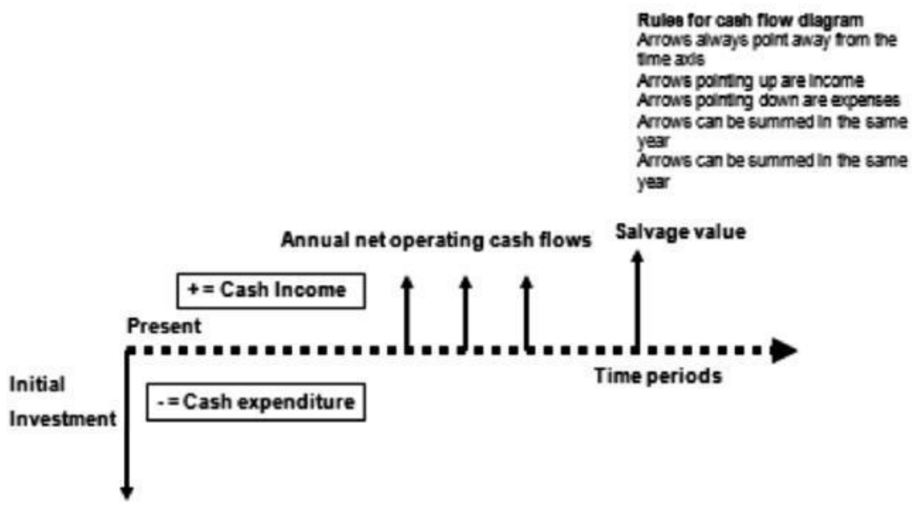

Figure 7.2 Typical Cash Flow Diagram for an Investment

3.b)PAYBACK ANALYSIS (3MARKS)

PAYBACK ANALYSIS

The simple payback analysis is sometimes used instead of the methods previously outlined. The simple payback is defined as initial investment divided by annual savings after taxes. The simple payback method does not take into account the effect of interest or escalation rate.

Since the payback period is relatively simple to calculate, and due to the fact managers wish to recover their investment as rapidly as possible, the payback method is frequently used.

It should be used in conjunction with other decision-making tools. When used by itself as the principal criterion, it may result in choosing less profitable investments which yield high initial returns for short periods as compared with more profitable investments which provide profits over longer periods of time.

4.

Ans: straight line method:

$$D = \frac{P-L}{n} = \frac{150,000 - 0}{5} = Rs\ 20,000/\text{year}$$

rate $= \frac{20,000}{150,000} \times 100 = 20\%$

sum of year digits:

$$N = \frac{n(n+1)}{2} = \frac{5(6)}{2} = 15$$

1st year $D_1 = \frac{n}{N}(P) = \frac{5}{15} \times 150000 = 5$

$$D_2 = \frac{n-1}{N}(P-L) = \frac{4}{15} \times 150,000 = Rs\ 40,000$$

$$D_3 = \frac{n-2}{N} \times P = \frac{3}{15} \times 150,000 = 30,000$$

$$D_4 = \frac{n-3}{N} \times P = \frac{2}{15} \times 150,000 = Rs\ 20,000$$

$$D_4 = \frac{n-4}{N} \times P = \frac{1}{15} \times 150,000 = Rs\ 10,000$$

years	P
1	Rs 50,000
2	Rs 40,000
3	Rs 30,000
4	Rs 20,000
5	Rs 10,000

Declining Balance:

$D = 2 \times 20\% = 40\%$ (double of st line depreciation 200% of st line method).

year	At begining of year	dep charge	
1	150,000	$\frac{40}{100} \times 150,000$ =	60,000
2	150,000 − 60,000 = 90,000	$\frac{40}{100} \times 90,000$ =	36,000
3	54,000		21,600
4	32,400		12,960
5	19,440		7,776
		TOTAL	138,336

∴ Undepreciated Book value = 150,000 − 138,336 = Rs 11,664

5. ten step methodology of energy audit (10 marks)

Ten Steps Methodology for Detailed Energy Audit

Step No	PLAN OF ACTION	PURPOSE / RESULTS
	Phase I –Pre Audit Phase	
Step 1	• Plan and organise • Walk through Audit • Informal Interview with Energy Manager, Production / Plant Manager	• Resource planning, Establish/organize a Energy audit team • Organize Instruments & time frame • Macro Data collection (suitable to type of industry.) • Familiarization of process/plant activities • First hand observation & Assessment of current level operation and practices
Step 2	• Conduct of brief meeting / awareness programme with all divisional heads and persons concerned (2-3 hrs.)	• Building up cooperation • Issue questionnaire for each department • Orientation, awareness creation
	Phase II –Audit Phase	
Step 3	• Primary data gathering, Process Flow Diagram, & Energy Utility Diagram	• Historic data analysis, Baseline data collection • Prepare process flow charts • All service utilities system diagram (Example: Single line power distribution diagram, water, compressed air & steam distribution. • Design, operating data and schedule of operation • Annual Energy Bill and energy consumption pattern (Refer manual, log sheet, name plate, interview)
Step 4	• Conduct survey and monitoring	• Measurements : Motor survey, Insulation, and Lighting survey with portable instruments for collection of more and accurate data. Confirm and compare operating data with design data.
Step 5	• Conduct of detailed trials /experiments for selected energy guzzlers	• Trials/Experiments: - 24 hours power monitoring (MD, PF, kWh etc.). - Load variations trends in pumps, fan compressors etc.

		Equipments Performance experiments etc
Step6	• Analysis of energy use	• Energy and Material balance & energy loss/waste analysis
Step 7	• Identification and development of Energy Conservation (ENCON) opportunities	• Identification & Consolidation ENCON measures • Conceive, develop, and refine ideas • Review the previous ideas suggested by unit personal • Review the previous ideas suggested by energy audit if any • Use brainstorming and value analysis techniques • Contact vendors for new/efficient technology
Step 8	• Cost benefit analysis	• Assess technical feasibility, economic viability and prioritization of ENCON options for implementation • Select the most promising projects • Prioritise by low, medium, long term measures
Step9	• Reporting & Presentation to the Top Management	• Documentation, Report Presentation to the top Management.

Step10	<u>Phase III –Post Audit phase</u> • Implementation and Follow-up	Assist and Implement ENCON recommendation measures and Monitor the performance • Action plan, Schedule for implementation • Follow-up and periodic review

6ans:

Indian Electricity rules, 1956 :

1.Authorization of electric installations

2.Inspection of electric installations

3.Licensing

4.General safety precautions

5.General conditions relating to supply and use of energy

6.Electric supply lines, system and apparatus for low, medium, high and extra high voltages

7.Overhead lines

8.Electric traction

9.Additional precautions for mines and oil fields

10.Miscellaneous provisions

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