

**NATIONAL CERTIFICATION EXAMINATION 2004
FOR
ENERGY AUDITORS**

PAPER – EA1: GENERAL ASPECTS OF ENERGY MANAGEMENT & ENERGY AUDIT

Date: 22.05.2004 Timings: 0930-1230 HRS Duration: 3 HRS Max. Marks: 150

General instructions:

- Please check that this question paper contains **7** printed pages
- Please check that this question paper contains **65** questions
- The question paper is divided into three sections
- All questions in all three sections are compulsory
- All parts of a question should be answered at one place

Section – I: OBJECTIVE TYPE

Marks: 50 x 1 = 50

- (i) Answer all **50** questions
- (ii) Each question carries **one** mark
- (iii) Put a (✓) tick mark in the appropriate box in the answer book

1.	The global primary energy consumption in 2002 was equivalent to a) 21,842 Mtoe b) 15,360 Mtoe c) 9,405 Mtoe d) 12,396 Mtoe
2.	The sector with the lowest commercial energy consumption out of four major sectors in the country is a) Industry b) Agriculture c) Residential d) Transport
3.	Non-commercial energy is a) not available in the market b) always traded for free c) no definite price set d) always ignored in energy accounting
4.	If Rs 1 Lakh = US\$ 2,000, then the annual current oil import bill of India is around a) 12 Billion US\$ b) 1.6 Billion US\$ c) 16 Billion US\$ d) 4 Billion US\$
5.	If the total installed power capacity in India was 100,000 MW at the beginning of 2001 and is increased annually by 8% then the installed capacity requirement 10 years later will be a) 215,312 MW b) 215,892 MW c) 183,846 MW d) 210,485 MW
6.	A person can do the following with solar energy a) destroy it b) create it c) burn it d) harvest it

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7.	Select the source of stored mechanical energy a) gas b) electricity c) compressed air d) water stored in reservoir
8.	The viscosity of furnace oil... a) decreases with increasing temperature b) decreases with decreasing temperature c) increases with increasing temperature d) remains same
9.	A three phase induction motor is drawing 16 Ampere at 440 Volts. If the operating power factor of the motor is 0.90 and the motor efficiency is 92%, then the mechanical shaft power output of the motor is a) 12.04 kW b) 10.09 kW c) 10.97 kW d) None of the above
10.	The term missing in the following equation: Active Power = ? x V x I x cos phi a) kV b) kW c) efficiency d) a constant
11.	Power factor (PF) is the ratio of a) active power/reactive power b) apparent power/active power c) active power/apparent power d) reactive power/active power
12.	Energy manager should be well versed with a) managerial and technical skills b) processing and technical skills c) managerial and commercial skills d) energy audit skills
13.	Carbon Dioxide measurement drawing the cold flue gas into a Fyrite kit is based on a) weight basis wet b) volume basis dry c) volume basis wet d) weight basis dry
14.	The benchmark for energy performance parameter for air conditioning equipment is a) kW/kg refrigeration b) kW/ton of refrigeration c) kWh/ton of refrigeration d) kcal/m ³ of chilled water
15.	One kWh of electricity is equivalent to how many heat units in GJ a) 0.0036 b) 0.036 c) 0.36 d) None of the above
16.	Matching energy usage to requirement means providing a) just theoretical energy needed b) just the design needs c) less than what is needed d) energy with minimum losses
17.	In a chemical process two reactants A (300 kg) and B (400 kg) are used. If conversion is 50% and A and B react in equal proportions, the mass of the product formed is. a) 300 kg b) 350 kg c) 400 kg d) 700 kg
18.	Energy supplied by combustion of fuel is equal to a) fuel mass x density b) fuel mass x specific heat c) fuel mass x calorific value d) fuel mass x heat capacity

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19.	Coal with 35% ash is fired in a boiler. Coal consumption is 70 tonnes on a specific day. Clinker is formed by 2% of the ash sticking to boiler tubes. How many tonnes of ash are going out of the boiler on this day. a) 24.0 b) 24.5 c) 25.0 d) 25.5
20.	An oil fired boiler operates at an excess air of 25%. If the stoichiometric air to fuel ratio is 14 and oil consumption is 400 kg per hour and 50% of the flue gas is diverted to a dryer, then the mass of flue gas leaving the boiler chimney in kg/ hour would be a) 6000 kg b) 3934 kg c) 3.237 ton d) 3500 kg
21.	In a force field analysis one of the indicators below is not considered a negative force a) low price of energy b) energy efficient technology available c) low salary of staff d) insufficient financial resources
22.	Which of the following is least important in a good energy information system a) data availability b) data relevance c) data volume d) data accuracy
23.	Which of the following is not a requirement for energy audit planning a) feedback b) publicity c) metering d) budgeting
24.	A public expression of an organization's commitment on energy conservation is a) energy balance b) energy policy c) energy audit d) energy savings
25.	What is not the duty of an energy manager a) prepare an annual activity plan b) report to BEE and state level designated agency once a year c) prepare a scheme for efficient use of energy d) conduct an energy audit
26.	The factor that reflects best on the risk of the project while evaluating the present value of the expected future cash flow is a) life of project b) fuel cost inflation c) discount rate d) loan interest rate
27.	A sensitivity analysis is an assessment of a) cash flows b) risks due to assumptions c) capital investment d) best financing source
28.	The sum of present values of all the cash flows associated with a project is called a) NPV b) PV c) Internal rate of return d) return on investment
29.	The Net Present Value (in Rs.) of a project at a discount rate of 18% with an investment of Rs 70,000 at the beginning of the first year, and savings of Rs 55,000 and Rs 60,000 at the end of the first and second year, respectively is a) 27,458 b) 28,091 c) 45,000 d) 19,701
30.	There are Rs 100,000 deposited in a bank at the beginning of a year. The bank pays 7% interest annually. How much money (in Rs.) is in the bank account at the end of the fifth year, if no money is withdrawn? a) 131,080 b) 135,000 c) 140,255 d) None of the above

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31.	A contract in which the costs are paid from all or part of the energy cost savings is called a) performance contract b) guaranteed savings performance contract c) traditional contract d) extended technical guarantee contract
32.	A path is characterized by 4 parameters such as ES = earliest start time, EF= earliest finish time, LF = latest finish time, LS = latest start time. A path is critical if a) ES=EF or EF=LF b) ES=LS and EF=LF c) ES=LS or EF=LF d) LF=EF and EF=LS
33.	The annual electricity bill for a plant is Rs 25 lakhs and accounts for 28% of the total annual energy bill. Furthermore the total energy bill increases by 5% each year. How high is the plant's annual energy bill at the end of the third year? a) Rs 89 lakhs b) Rs 98 lakhs c) Rs 103 lakhs d) None of the above
34.	In Project Management the critical path in the network is a) the path where no activities have slack b) the quickest path c) the shortest path d) the path from start to finish
35.	CPM in project management refers to a) critical periodic management b) critical project monitoring c) cost project management d) critical path method
36.	The major difference between CPM and PERT is a) CPM provides graphic and PERT does not b) CPM is an expansion of PERT c) PERT is an expansion of CPM d) CPM uses fixed time estimates while PERT uses several time estimates
37.	The calorific value of coal is 3,200 kcal/ kg. Find out the oil equivalent of 200 kg of coal if the calorific value of oil is 41,870 kJ/ kg a) 64 kg b) 62 kg c) 66 kg d) None of the above
38.	Fixed energy consumption can be determined from a a) bar chart b) X Y coordinate system c) vertical line chart d) pie chart
39.	Energy consumed for the period is given as 110 kWh for 10 tons and 180 kWh for 20 tons of production. The fixed energy consumption in kWh is (No graph is needed to arrive at correct answer). a) 10 b) 20 c) 40 d) 30
40.	Large scattering on production versus energy consumption trend line indicates a) many forced outages b) poor process monitoring c) poor process control d) none of the above
41.	What is the definition of specific energy consumption? a) energy input/rupee turnover b) energy consumption per month c) energy cost/total cost d) none of the above
42.	In a cumulative sum chart, if the graph is horizontal, then a) nothing can be said b) actual and calculated energy consumption are the same c) energy consumption is reduced d) specific energy consumption is going up

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43.	A firm substitutes (replaces) expensive oil and starts firing wood in a boiler. The following scenario is most likely a) higher energy consumption b) higher fuel cost c) better boiler efficiency d) less smoke in the stack
44.	Assume project A has an IRR of 85% and NPV of Rs 15,000 and project B has an IRR of 25% and NPV of Rs. 200,000. Which project would you implement first if financing is available and project technical life is the same? a) Neither A nor B b) B c) A d) cannot be decided
45.	Which of the following is not a part of energy consumption monitoring a) data recording b) data analysis c) energy costing d) data reporting
46.	The commitment period of industrialized countries for emission reductions as per Kyoto protocol is a) since 2001 b) there is none c) 2008 – 2012 d) 2012 -2022
47.	Global warming is due to release of a) sulfur dioxide b) greenhouse gases c) free chlorine d) ozone
48.	Under the Kyoto Protocol India has to cut emissions by a) + 8% b) -8% c) 12% d) 0%
49.	The process under the Kyoto Protocol by which industrialized countries may invest into or buy certified emission reductions is called. a) cleaner development mechanism b) clean development mechanism c) prototype carbon trading d) none of the above
50.	The ozone depletion process is due to a) Carbon Dioxide b) chlorine atoms destroying ozone molecules c) UV light breaking the ozone d) Nitrogen

----- **End of Section - I** -----

Section - II: SHORT DESCRIPTIVE QUESTIONS

Marks: 10 x 5 = 50

- (i) Answer all **Ten** questions
- (ii) Each question carries **Five** marks

- S-1 Classify the types of energy available on earth.
- S-2 Explain the importance of time of day tariff (TOD).
- S-3 A 7.5 kW rated motor has a full load efficiency of 84%. Actual input measurement shows 415 Volt, 12 Amps, and PF of 0.83. Find out the motor loading in percent.
- S-4 Explain the difference between latent heat of vaporization and super heat.

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- S-5 Explain the significance of an energy policy in an organisation?
- S-6 Classify energy conservation measures in financial terms such as costs and return.
- S-7 Calculate the Net Present Value over a period of 3 years for a project with one investment of Rs 70,000 at the beginning of the first year and a second investment of Rs 40,000 at the beginning of the second year and fuel cost savings of Rs 70,000 each in the second and third year. The discount rate is 16%.
- S-8 In a heat exchanger steam is used to heat 80 kg/ hour of furnace oil from 35° C to 85° C. The specific heat of furnace oil is 0.22 kcal/ kg° C. How much steam per hour is needed? Latent heat of steam is 540 kcal/ kg.
- S-9 List at least four different types of contracts involved in project management.
- S-10 What do you understand by CUSUM chart?

----- **End of Section - II** -----

Section - III: LONG DESCRIPTIVE QUESTIONS

Marks: 5 x 10 = 50

- (i) Answer all **Five** questions
(ii) Each question carries **Ten** marks

- L-1 Explain the difference between energy conservation and energy efficiency, and state one example where energy costs are reduced but energy consumption goes up.
- L-2 A plant is using 6 tonnes/day of coal to generate steam. The calorific value of the coal is 4,500 kcal/ kg. The cost of coal is Rs. 1,600/tonne. The plant substitutes coal with rice husks, as a boiler fuel, which has a calorific value of 3000 kcal/ kg and cost Rs. 700/tonne. Calculate the annual cost savings at 280 days of operation, assuming that the boiler efficiency decreases from 82% on coal to 78% on rice husks.
- L-3 In a pumping system the motor operating efficiency is 85% and pump operating efficiency is 75%. The pump discharge flow is throttled causing 18% loss; moreover 20% is lost through friction in pipe fittings. The three phase motor operates at a power factor of 0.82, 440 Volt and 20 Ampere.
- (I) Calculate the water power available at the end of the piping system.
(II) Calculate the overall system efficiency.

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- L-4 An investment of Rs 1 Lakh is made for a variable speed drive at the beginning of the year, which is also the date of first operation. Savings expected over 4 years are Rs. 20,000, Rs. 30,000, Rs. 40,000 and Rs. 45,000 respectively. Find out the Net Present Value at the end of the 4th year, if the discount rate is 22 %. Would you invest in this measure? Explain your decision.
- L-5 Use CUMSUM technique to develop a table and to calculate energy savings for a 6 months period. For calculating total energy saving, average production can be taken as 4000 MT per month. Refer to field data given in table below.

Month	Actual SEC, kWh/MT	Predicted SEC, kWh/MT
Jan	252	265
Feb	238	265
Mar	287	265
Apr	285	260
May	255	260
Jun	245	265

----- End of Section - III -----