

Centre for Energy Studies
Indian Institute of Technology Delhi
ESL 750: Economics and Planning of Energy Systems

Time: Two Hours

Major Test (2017-2018 batch)

Maximum Marks: 40

Note: Please answer all questions. The marks assigned to each question are indicated within square brackets at the end of the question. In case any information is not provided in the numerical questions, please make an appropriate assumption and mention the same in your response to the question.

1. Explain why (any FOUR)
 - (a) Use of physical control or pricing as policy instruments should be resorted with utmost care?
 - (b) Input-output table based energy demand forecasting approach may not take into account economy of scale in production of goods?
 - (c) For a project to be profitable, the annual monetary benefits likely to accrue from a project should be more than the product of the capital cost of the project and the discount rate applicable for the project?
 - (d) Feed-in tariffs of renewable energy based electricity may need regular periodic revision?
 - (e) An economic recession may affect rich and poor differently in respect of efficiency of energy utilization? [4]
2. Write brief notes on any TWO of the following:
 - (a) System Advisor Model, (b) Energy Conservation Building Code, and (c) National Solar Mission of India [4]
3. Explain the difference(s) between (any TWO)
 - (a) Panel Consensus and Delphi Approaches for Energy Demand Assessment, (b) Energy Yield Ratio and Net Energy Yield, and (c) Scenario Analysis and Sensitivity Analysis (for Decision Making Under Uncertainty) [4]
4. Explain the potential role of Volume Effect, Economy of Scale, Learning/ Experience, and Marginal Resource Utilization in affecting marginal cost of energy supply based on renewable energy technologies in future. List desirable characteristics of a measure of financial / economic performance of an investment in a renewable energy project. Also identify the desirable characteristic that is not satisfied by the Discounted Payback Period. [6]
5. List different potential objectives of energy pricing and explain any two of them. Discuss additional issues that need to be considered while pricing electricity. Describe likely effects of an increase in the price of energy on the economy. [6]
6. Describe "Energy Intensity" based method for energy analysis of renewable energy projects. Also discuss merits and limitations of the same as compared to the "Process Analysis" method. [3]
7. A household is considering replacement of each of the five 60W incandescent bulbs with 10W LED bulb. The bulbs operate daily for six hours. The cost of each LED bulb is Rs. 300 and is expected to have a useful life of 6570 operational hours. The transmission and distribution losses of electricity are estimated at 20%. The electricity presently being used by the household is produced in a coal thermal power plant that uses coal of calorific value 22 MJ/kg with an efficiency of 36%. Estimate the cost of carbon dioxide emissions mitigation with the adoption of LED bulbs, if the price of electricity for the user is Rs. 6 per kWh, and the discount rate is 12%. The coal used has a carbon fraction of 0.62. [4]
8. A solar cooker is expected to save 48 litres of kerosene annually for a household. The current price of kerosene is Rs. 40/litre and it is expected to increase at uniform annual rate of 5%. Determine the cumulative present worth of monetary savings for the household. The useful life of the solar cooker is 15 years and the discount rate is 10%. [3]
9. The $(I - A)^{-1}$ matrix for a three sector economy (comprising of Agriculture, Industry, and Residential sectors) is determined as following:

	Agriculture	Industry	Residential
Agriculture	1.24	0.45	0.52
Industry	0.61	1.25	0.23
Residential	0.40	0.35	1.09

If the final demand is expected to be 900, 1800 and 2100 units for agriculture, industry and residential sectors respectively, determine the gross outputs required to be produced by the three sectors. [3]

10. From the surveys of fuel-wood price in 16 different suburban areas of India, the mean fuel-wood price is estimated at Rs.2.50 per kg with a standard deviation of Rs. 0.80 per kg. Determine the 95% confidence interval estimate for the fuel-wood price in the suburban areas of the country if the fuel-wood price is expected to be normally distributed. The Z value for the area under each side of the normal distribution curve to be 0.475 is 1.96. [3]