ESL 750: Economics and Planning of Energy Systems

Time: Two Hours   Major Test (2014-2015 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.*

1. Explain why (any five)
   (a) The marginal cost of harnessing renewable energy sources may decrease initially but would increase beyond a certain level of resource use rate?
   (b) Energy pricing may have mutually conflicting objectives?
   (c) The cost of electricity produced by a solar power plant is expected to be more stable in the long term as compared to the cost of electricity produced by a fossil fuel based power plant?
   (d) Time-trend models should preferably be used for short term demand forecasting only?
   (e) Input – Output table based energy accounting cannot normally be used for estimated the energy intensity of a domestic solar water heating system?
   (f) Energy demand should be estimated accurately and also much before the expected time of energy use?
   (g) With an increase in income of a household, consumption of kerosene for domestic cooking is expected to decrease and that of LPG is expected to increase? [10]

2. As per the data compiled by an office, a two sector economy while producing Rs. 500 million worth of the output of its sector 1 uses Rs. 20 million worth of the output of sector 2 of the economy and also Rs. 550 million worth of the output of sector 1. Calculate the value of input-output coefficients a_{11} and a_{21} and comment on the values of the coefficients obtained. [3]

3. A 100 MW rated capacity wind farm that costs Rs. 750 crore is expected to operate with an annual capacity utilization of 33% during its useful life of 25 years while the annual cost of operation and maintenance of the wind farm is estimated at 8% of its capital cost. The project owner is eligible for selling the Renewable Energy Certificates (RECs) at a price of Rs 900 per REC. Estimate the annual revenue generation to the project developer from the sale of RECs. Also determine the debt service coverage ratio of the project with and without REC benefits if 75% of the capital cost is made available as debt at an annual interest rate of 6% and the debt is to be paid back in ten equal annual installments. The electricity delivered by the wind farm is sold at a rate of Rs. 5.00 per kWh. [4]

4. On an increase of 20% in the income of a household the consumption of electricity increases by 30%. Determine the income elasticity of electricity demand for the household. Also indicate whether electricity is an inferior or superior commodity for the household. [2]

5. An energy planner suggested the following econometric model for the petrol consumption (PC) of a country at time t (in million litres)

   PC (t) = 525 + 0.8 [Population (t)] - 0.145 [Income(t)] + 3.28 [Price of Petrol(t)]

   Assuming the numerical values of the coefficients in the model to be correct, point out apparent inconsistencies with the above model and suggest its correct version.

   Also, if the time trends for population, income and price of petrol are given by the following expressions (with year 2001 representing as t = 1):

   Population (t) = 1250(1 + 0.015)(t)   (population in million),
   Income (t) = 24000 + 500(t)   (annual income in rupees) and
   Price (t) = 64.00 + 2.80 (t)   (unit price in rupees per litre) respectively,

   estimate the expected consumption of petrol in the country for the year 2030. [4]

6. Explain the likely impact(s) of an increase in the price of energy or restrictions on its physical availability on (a) physical output of an economy, (b) prices of goods produced and services provided in the economy and (c) demand side substitution in the economy. [6]

7. Describe and discuss issues that need to be considered in the pricing of electricity. [3]

8. Describe different policy instruments available to energy planners. Why Physical Control should not be used as a long term energy policy instrument? What are the limitations of Pricing of Energy as a policy instrument? [4]

9. Describe the merits and limitations of energy demand analysis and forecasting using
   (a) Econometric Models
   (b) Input-Output Tables   [4]