**EN 218**

Energy Resources, Economics and Environment

## Tutorial 01: Energy balance, Lorenz curve, Gini index

**Q1.** The power sector of an Indian state has a coal consumption of 25 million tonnes annually (average calorific value 4500 kcal/kg) and 1 million tonnes of oil to generate (gross) 44 billion kWh of electricity in coal based thermal power plants. The annual auxiliary consumption in the thermal power plants is 3 billion kWh. There is also an annual generation of 18 billion kWh of electricity from hydro (efficiency 80 %). There is a gas-based power plant that uses 900 million $m^3$ of natural gas (calorific value 9300 kcal/$m^3$) to generate 3.5 billion kWh of electricity with 0.3 billion kWh being used for auxiliary consumption.

The total sales of units to customers is 49 billion kWh. Draw an energy balance for the power sector. Compute the percentage shares of coal, oil, gas, hydro in terms of the primary energy consumption in the power sector. Compute the auxiliary consumption percentages for the coal and gas-based power plants. Determine the T&D and commercial losses in the power system.

[Ans: coal in PE = 74.89 %, oil in PE = 6.66 %, gas in PE = 5.57 %, hydro in PE = 12.88 %, aux consumption coal plant = 6.82 %, aux consumption gas plant = 8.57 %, Losses = 21.22 %]

**Q2.** Distributions of total disposable income (by quintile of the population) of two countries are given in the following table. Compare the degree of income inequality between these two countries using Lorenz curves and Gini coefficients.

| | Percentage of Total Disposable Income | |
|---|---|---|
| Quintile | Country A | Country B |
| 1st | 50 % | 40 % |
| 2nd | 25 % | 28 % |
| 3rd | 12 % | 26 % |
| 4th | 8 % | 4 % |
| 5th | 5 % | 2 % |

[Ans: Gini coefficients for A: 0.428, for B: 0.4]

**Q3.** Can Lorenz curve be represented by $L(x) = x^3$? If yes, determine the Gini coefficient.

[Ans: 0.50]

**Q4.** If the Lorenz curve is given as $L(x) = x^n$, prove that the Gini coefficient is given as $(n–1)/(n+1)$.

**Q5.** In a company, each of the 20 people in the service department earns ₹ 10,000 per month. The monthly salaries of the 80 junior engineers and the 80 senior engineers are ₹ 22,500 and ₹ 37,500, respectively. Each of the 20 managers earns ₹ 2,50,000 per month. Determine the Gini coefficient of income distribution for this company.

[Ans: 0.48]