Electronics Engineering Fundamentals
Tutorial Sheet – 4

Question A:
The electricity supplier wishes to deliver 100 MW of power at a distance of 330 km. Due to the poor quality of the grid, we must use a maximum voltage of 110 kV and a line resistance of 0.1 Ω/km.

(i) If this was a DC connection, how much current would flow and how much power would be wasted in the wires?
(ii) If the electricity supplier upgraded the network so that the power could be delivered at 400 kV. If the same cable was used, what would be the power saving?

Question B: A local area with six houses is supplied with a single phase 230 Volt power supply using a 3 km cable from the local substation.

(i) If the cable supplying the power has a resistance of 0.1 ohms/km and if each house on average uses 5kW of power, what voltage will the houses actually see?
(ii) If one house increases its power consumption to 10kW, what voltage will then be seen by the houses? **HINT: An approximate answer is acceptable**

Question C: An interconnector between two countries carries 700 MW of power at 400 kV. If the typical sized long-distance cable is used, the resistance will be approximately 0.02 Ω/km (a big fat cable). If the distance is approximately 500 km, what is the cost of the wasted energy in the interconnector when calculated for a full year (running cost). The price for a unit of electricity can be assumed to be 1 yuan/kWh.

Question D: Discuss the issues and challenges implicit in maintaining a national electricity distribution network. What impact does the addition of renewal energy sources have on these issues?

Question E: Discuss the benefits and disadvantages in having large numbers of small distributed generators in your network (eg home-based wind generation)?

Question F: What are the benefits and disadvantages of having a large number of small energy producers distributed around the country, as compared to a small number of very large generating stations?