Experiment H: Electromagnetism (age 14 – 16) – Transmission of Electricity

Experiment Objective:

The demonstration experiment shows the significant energy losses along any low-voltage transmission line.

Experiment:

- Fix two of the dowel rods, which form the power line terminals, horizontally in two bosses at a height of about 30 cm above the bench and roughly 1.5 m apart.
- Stretch two lengths of resistance wire between the terminals to form the power line.
- Connect one of the two lamps directly to the 12 volt DC supply at the 'power station' end.
- Connect the supply directly to one of the terminal rods.
- Connect the second lamp to the other end of the power line, where it represents the 'village'. Switch on the power supply. The 'village' lamp will just glow, in contrast with the fully-lit pilot lamp at the 'power station'.
- Observe the effect of connecting a second lamp in parallel with the single 'village' lamp.
- Connect a voltmeter in parallel with each of the lamps, and note the voltages.

As well as measuring voltages, an ammeter (reading to at least 2 amp) can be connected into the supply line. Students can check that the current remains the same around the power line circuit; the current to the 'power station' lamp is greater than that to the 'village' lamp.

By measuring the current and potential difference at the power station end of the line and at the village end one can calculate the 'power loss' along the line. The potential difference measured across one wire multiplied by the current in the wire will give the power loss of one wire, and so the total power loss of the wires is twice as much.

Resource materials needed:

Power line terminal rods, 2 Retort stands and bosses, 2 Lamps (12 V, 24 W) in lamp holders, 2 Eureka wire, bare (28 SWG), 1.5 m, 2 lengths Power supply, 0 to 12 V, DC DC voltmeters, 2, reading to at least 12 V Ammeter, DC, reading to at least 2 A

Expected outcomes:

Student learning of the reasons for high energy loss on low voltage transmission lines and therefore reason transmission of electricity is at high voltage.

Linked Resources

www.twothirtyvolts.org

Transmission of Electricity Student Revision Notes
Transmission of Electricity Revision Quiz
Transmission of Electricity Lesson Plan