Answer on question #65475, Physics / Electric Circuits

Question A high-voltage power line carries a current of about 1000 A. The formula for resistance in a conductor is linear, so over large distances the net resistance of the power line can be large. If the power is generated at a station at a typical distance from a home where the electricity is delivered, the resistance of the transmission line is 24.3 Ω. Using this information, determine the power lost between the station and the home. If the potential at the power station is 750 kV, what is the power at the station? Determine the ratio of these two numbers.

Solution The current is The power lost is

$$P = I^2 R = 1000^2 \cdot 24.3 = 24.3 \cdot 10^6\, W$$

The ratio is

$$\frac{U_1}{U_0} = \frac{U_0 - IR}{U_0} = \frac{750 \cdot 10^3 - 1000 \cdot 24.3}{750 \cdot 10^3} = 0.9676$$