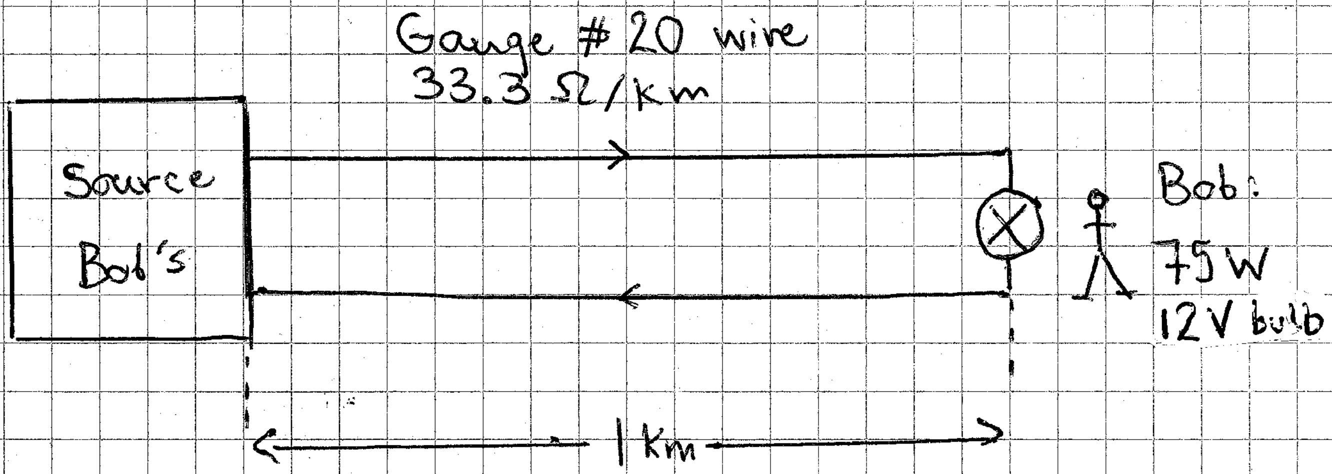


$P = I \cdot V$, $V = 12V$ $\Rightarrow I_B = \frac{75W}{12V} = 6.25A$

The resistance of the Bob's bulb:

$R = \frac{V}{I} \Rightarrow R_B = 12V/6.25A = 1.92\,\Omega$

Another way: $P = I^2R \Rightarrow R = \frac{P}{R^2} = \frac{75W}{(6.25A)^2} = 1.92\,\Omega$

So, the total resistance of Bob's instalation

is: $R_{wire} + R_B + R_{wire} = 2 \times 33.3\,\Omega + 1.92\,\Omega$

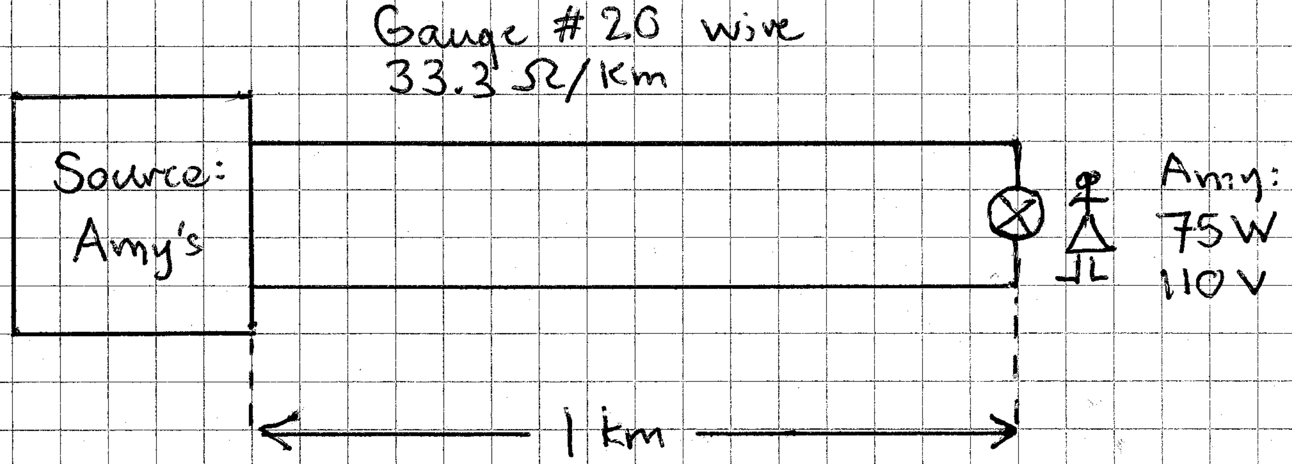
$= 68.52\,\Omega$

$R_{B\,TOT} = 68.52\,\Omega$

Power needed to be sent from the source is:

$P = I^2R \Rightarrow P_{BOB\,TOT} = (6.25A)^2 \times 68.52\,\Omega = \underline{\underline{2676W}}$

(2601 W is dissipated in the wires).



$P = I \cdot V, \quad V = 110\,V \Rightarrow I_A = \frac{75W}{110V} = 0.6818\,A$

The resistance of the Amy's bulb is then:

$R = \frac{V}{I} \Rightarrow R_A = \frac{110V}{0.682A} = 161.3\,\Omega$

Another way: $P = I^2 R \Rightarrow R_A = \frac{75W}{(0.682A)^2} = 161.3\,\Omega$

So, the total resistance of Amy's installation is: $R_{wire} + R_A + R_{wire} = 2 \times 33.3\,\Omega + 161.3\,\Omega =$
$= 227.9\,\Omega$

$R_{ATOT} = 227.9\,\Omega$

Power needed to be sent from the source is

$P = I^2 R \Rightarrow P_{AMY\ TOTAL} = (0.6818\,A)^2 \times 227.9\,\Omega = 105.94\,W$

(only 30.94 W is dissipated in the wires).

An extra analysis:

The voltage of the Bob's source must be:

$$V = I \cdot R \Rightarrow V_{BOB'S\ source} = 68.52\,\Omega \cdot 6.25\,A = 428\,V$$

While the voltage of the Amy's source must be:

$$V_{AMY'S\ SOURCE} = 227.9\,\Omega \cdot 0.6818\,A = 155.4\,V$$

Conclusions: Bob has to use a voltage source of much higher voltage than Amy's source, and delivering much more power (2676 W vs. 106 W, 25 times more!)

Ergo – the transmission line is the key!

Try to use all possible means to minimize the current in the transmission line!!!

$$P_{LOST} = R \cdot I^2$$

Making I smaller is much more efficient than making R small, because I is <u>squared</u>, and R is not.