ECE 311 - Homework #4

Transformers and AC Impedance

Problem 1: Assume a 1:1 transformer (i.e. it does nothing)

1a) Determine the voltages for the following circuit.

1b) What percent of the power goes to the 8-Ohm speaker.

Problem 2: Assume a 10:1 transformer (1V at the load required 10V on the left side of the transformer)

2a) Convert the impedances to the load side (right side).

2b) Determine the voltages as seen by the load (right side)

2c) What percent of the power goes to the 8-Ohm speaker?

2d) In order to deliver 10W to the load, what does the input voltage (20Vrms shown) have to be?
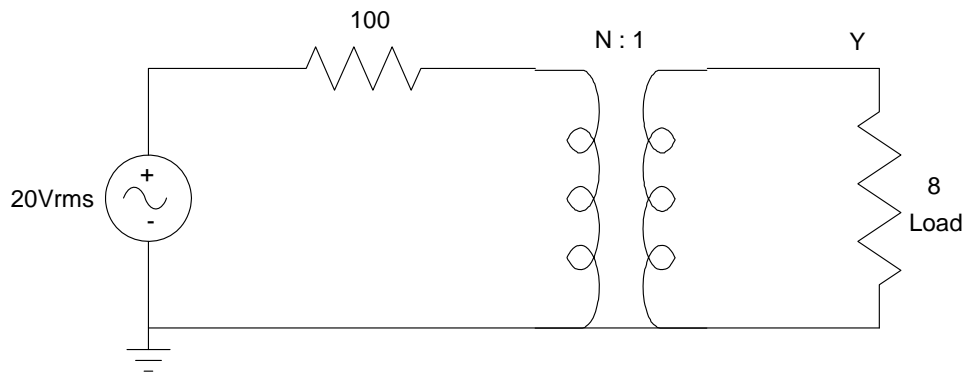
Problem 1 & 2.

Suppose a utility grid transmitted power at 120Vrms
- A 1cm diameter copper wire has a resistance of 0.2 Ohms/km.
- The distance from Williston to Minneapolis is 1000km (200 Ohms)

A typical customer uses 10kW of electricity
- 10kW @ 120Vrms = 1.44 Ohms

Problem 3: No Transformer Solution (i.e. what if we ran our power grid at DC)

3a) Determine the votlage the customer sees for the following power grid

3b) What is the efficiency of the transmission system? (i.e. the percent of the power delivered to the customer)
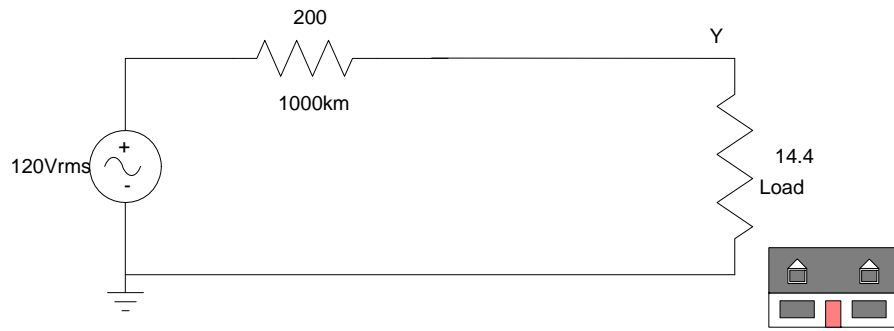
Problem 3: Power of a residence at 120V without transformers

Suppose instead a utility uses transformers to transmit the power at 345kV, which is stepped down to 13.2kV and 120V as shown below.

4a) Convert the impedances to the load side (right side).

4b) Determine the voltages as seen by the load (right side)

4c) What is the efficiency of the transmission system? (i.e. the percent of the power delivered to the customer)
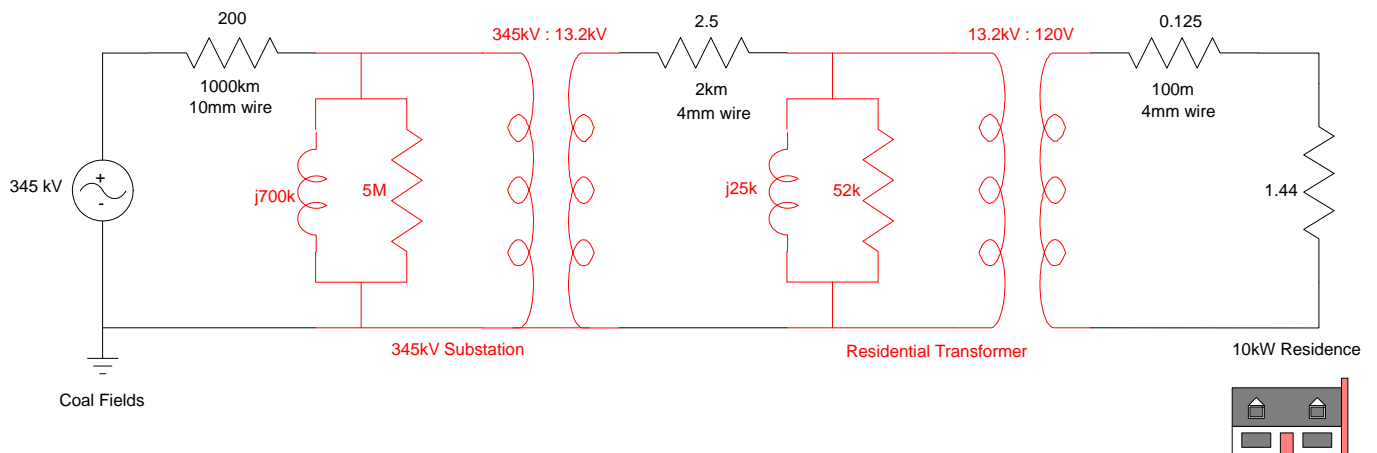
Problem 4: Power Transmission System with Transformers