EE431 Fall 2008

Include this in Report Due Nov. 18, 2008

Transmission Line Design Project – Assignment

Extend your tool to calculate line cost.

Whether an electric utility is regulated or not, it must have a mechanism to recover investment within some period of time. The 'cost' of a line consists of two components

1. Capital or up-front cost, primarily labor and materiel
2. Recurring cost of operation, for example losses, over the recovery period

Assume the following capital costs

Conductor	$ 0.8 /lb
Capacitor	$ 11,000/MVAR
Reactor	$ 20,000/MVAR
Terminals	$ 1,000,000 for 345 kV
	$ 4,000,000 for 500 kV

For conductor you need to know the weight per mile. Then, knowing line length (L miles) and the number of conductors per phase(NCP), total conductor weight is 3*NCP*L*lb/mi.

Note, for capacitors and reactors, your tool calculates the MVAR rating.

The cost of losses can be calculated as follows

Energy loss per year EY = Full load real power loss* load factor*8760 MWH/yr

The term load factor, a number less than 1, accounts for the fact that the line is not at full load all the time. Note there are 8760 hours per year, thus the unit for energy loss is MWH/yr. Assume a load factor of 0.7.

The cost of losses depends on the energy price (EP $/MWH)

Loss Cost per year LC = EY * EP

Assume EP = $ 10/MWH for this assignment. This number will be changed for the final project.

Finally, the energy loss and loss cost above recurs every year. If we want to recover the cost in N years, and the interest or discount rate (time value of money!) is r %, the Present worth of loss is

$$PW = LC*(1-(1+(r/100))^{-N}) / (r/100)$$

For this assignment assume N=10; r= 10%.

Assignment

1. Extend your tool to take the following additional inputs from the user

    1. Conductor cost, Reactor cost, capacitor cost, terminal cost
    2. Cost, recovery period, discount rate

2. Calculate and display Conductor cost, Reactor cost, Capacitor cost, Terminal cost Total Capital cost, present worth of loss cost, and total cost.