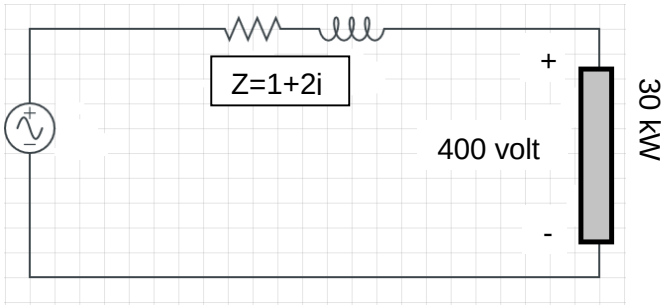
Q1)
A load draws 30 kW from a 400 V at a power factor of 0.7 lagging. The line impedance is Z=1+2j as show in figure 1

1. Find the complex power at load $S_{Load} = P_{Load} + Q_{Load}$.
2. Find I.
3. Find the active power losses in the line P_{Loss}
4. If the load is compensated with a capacitor whose output (Q). What value of Q raises the pf to 0.9

5. Find the active power losses in the line P_{Loss} With power factor 0.9



Q2) The fuel-cost curves for two generators are given as follows:

$C1(P1) = 600 + 15\,P1 + 0.05\,P1^2$

$C2(P2) = 700 + 20P2 + 0.04\,P2^2$

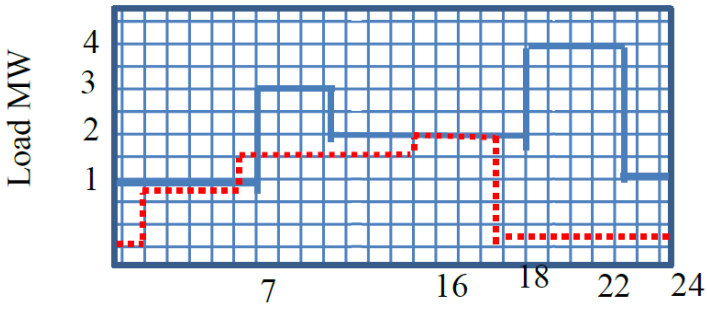
Constraints

200 ≤P1 ≤ 800 MW
100 ≤P2 ≤500 MW

What is the optimal value of P1 and P2 to cover a load of (1) 400 MW (2) 1000 MW

Q3) For the load shown in Figure 2

(Active and Reactive power).



(1)Using the electricity price at EEX

EEX (www.eex.com) on 28.10.2015,

Calculate the cost to run this load

For simplicity assume the company pays only for the active power. Furthermore, multiply the electricity price on the EEX website by 3 (to reflect power transmission costs, EEG-Umlage, taxes…).

(2) Then assume that it is possible to reallocate 1MWh. How much would be the savings?

(3) What is the power factor at time 16:00? (4) Determine the reactive power required from a capacitor bank to bring the power factor of the parallel combination up to 0.9.