VOLTAGE RISE EFFECT BY ADDING SHUNT CAP BANK

ASSUMPTION:

- Short Line.
- Voltage drop at the load:

Case 1: *without cap bank (SW off)*

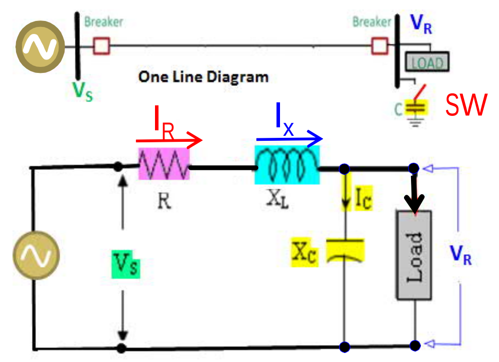
$$V_{drop_1} = I_r \cdot R + I_x \cdot (j \cdot X_L)$$

Case 2: *with cap bank connected (SW on)*

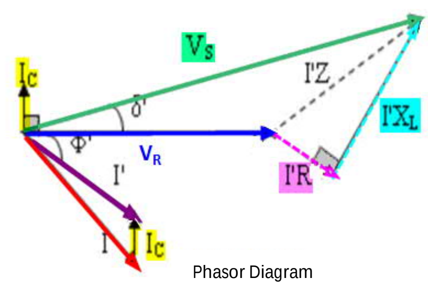
$$V_{drop2} = I_r \cdot R + I_x \cdot (j \cdot X_L) - I_c \cdot X_L$$

The difference between Case 1 & Case 2 is the voltage drop

$$\Delta V = V_{r_1} - V_{r_2} = I_c \cdot X_L$$



Equivalent Circuit



Phasor Diagram

Example:

- $V_s := 230$ *kV* *System voltage*
- $R := 5$ Ω *Feeder resistance*
- $X_L := 15 \cdot j$ Ω *Feeder Inductive reactance*
- $S_c := 100$ *kVAr* *Capacitor bank size*
- I_R = *Real component of the current*
- I_x = *Reactive inductive component of current (Laging voltage by 90°)*
- I_c = *Reactive capacitive component of current (leading the voltage by 90°)*

NOTES:
I = *current without any capacitor connected.*
I' = *current with the shunt capacitor connected.*
I' = I + I_c
without capacitor bank I_c *=0 &* I' = I .

Let $i := 1..5$ $\quad I_{c_i} := \dfrac{S_c \cdot i}{\sqrt{3} \cdot V_s}$ kA

Voltage rise: $\Delta V_i := I_{c_i} \cdot |X_L|$ kV

$\Delta V_i =$

3.765
7.531
11.296
15.061
18.827