

3 Basis of Investigation

3.1 Simulation Model

The simulation model for the calculations comprises:

- 220 kV interconnected system as equivalent impedance.
- 304 MVA gas turbine generators 11MKA/12MKA with unit transformers 11BAT01/12BAT01.
- 311 MVA steam turbine generator 10MKA with unit transformer 10BAT01.
- 6.6 kV switchgear 11BBE and 12BBE.
- 0.4 kV switchgear (00BHL – 01BHA – 01BHB – 01BHE – 01BHF – 01BMA – 10BFG – 10BME – 11BFE – 11BME – 12BFE – 12BME).
- MV motors at 6.6 kV switchgear are considered as individual motors.
- LV motors at 0.4 kV switchgear are considered as equivalent lumped LV-motors.
- 6.6 kV cables and 0.4 kV cables.

3.2 Data Base

The data of the study is based on the data provided by Siemens E F ES EN 26.

For the purpose of calculation the 220 kV network is modelled by an equivalent impedance. The maximum three-phase short-circuit current contribution of 220 kV interconnected system is considered in such a way that the total short-circuit current with considering of power plant NHON TRACH 2 CCPP reaches the rating of the 220 kV switchgear ($I_k=63$ kA). This is the worst case which also covers possible extensions in the future. The minimum initial symmetrical short-circuit current contribution from EVN grid at 220 kV substation is $I_k''_{3p\ min}=28.7$ kA which was given for the year 2010 (Ref. No. LLM-NT2\LOT 1\L-0418, dated 11st March 2010).

The LV motors connected to each LV main distribution inclusive their connection cables are treated as an equivalent motor. For the equivalent lumped LV-motors the following data were considered for short-circuit calculations according to IEC EN 60909-0:2001:

$$U_n = 0.4 \text{ kV} \quad \text{rated voltage of low voltage motors in kV}$$

$$I_d/I_n = 5.0 \text{ p.u} \quad \text{ratio of locked-rotor current to rated motor current in p.u.}$$

$$\cos(\varphi)_n = 0.84 \quad \text{rated power factor}$$

$$\eta_n = 0.95 \text{ p.u} \quad \text{rated efficiency in p.u.}$$

The lumped equivalent LV motors each switchgear are determined on basis of the actual consumer list.