Paris Session 2022

TOV Mitigation

SC4 : Power System Technical Performance

PS 2: Challenges and advances in insulation coordination and lightning research

Question 7: What are the experiences regarding harmonic resonance temporary overvoltages (TOVs)? Are there practical examples for their mitigation, other than what is currently described in the international standards?

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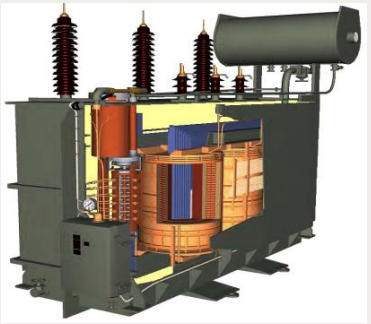
Experience in TOV management : causes and solutions



- *TOV due to transformer switching*
- Saturation of the magnetic circuit of the transformer
- Inrush currents
- Harmonic impedance of the power network excited by th Inrush current

- *Solutions : Mitigation of magnetising inrush current in three-phase power transformer*
  - *Solution #1 : Point on the wave switching*
  - *Solution #2 : Gradual energizing of the network*

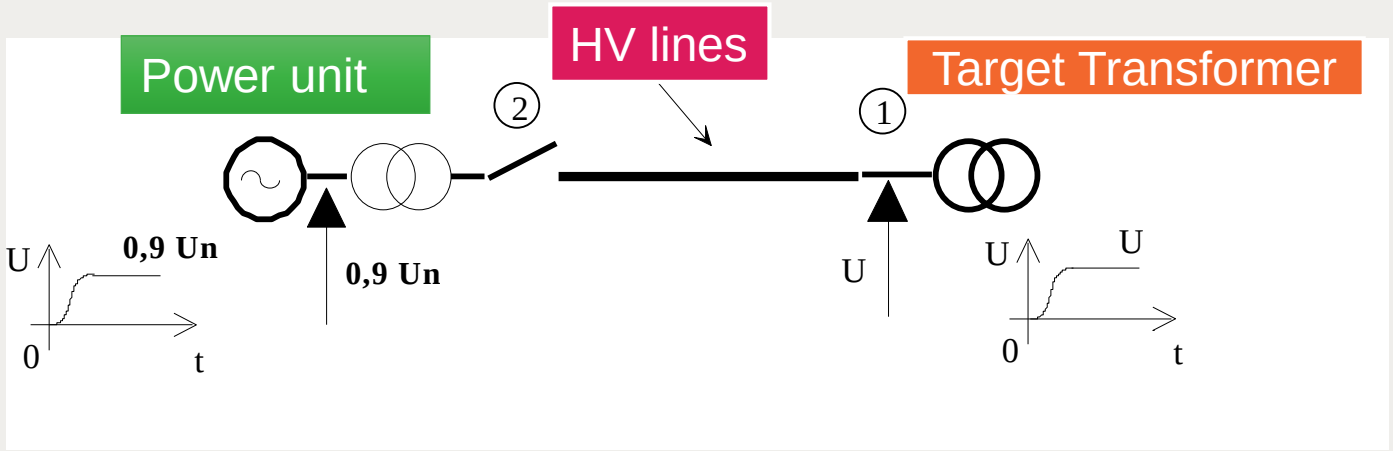
Experience in TOV management : *Gradual energization of the network*

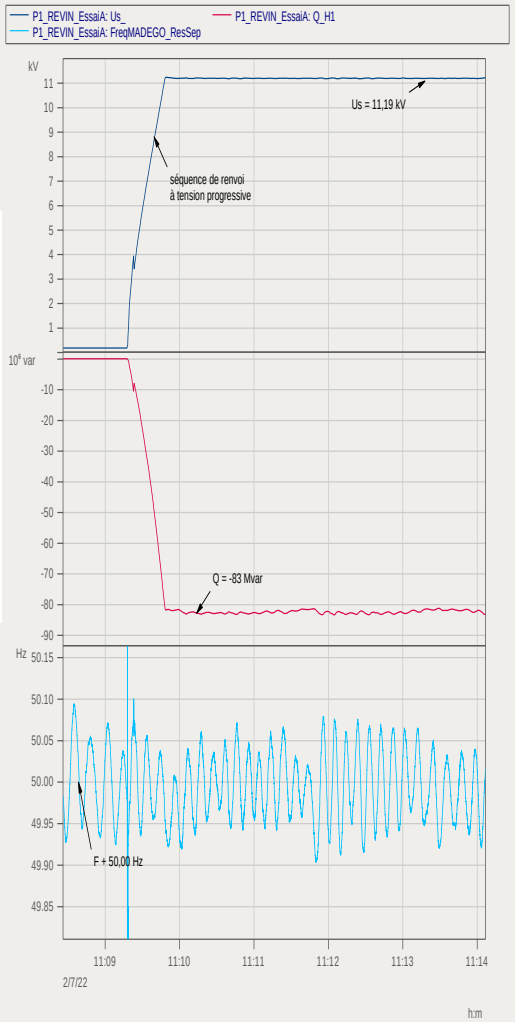
•*TOV due to transformer switching*

Power system restoration ⇨ gradual energizing of the lines and of the transformers from power units that can work from black-start

(but beware of the ferroresonance phenomenon → limit of the rated output of the various transformers, related to the rated output of the source unit)

POWER GENERATING UNIT = *HYDRO OR COMBUSTION TURBINE UNIT*





by means of a specific sequence :

1) the turbine-generator unit is brought to its rated rotational speed, without being excited or coupled ;

2) we re-form the line up to including the transformers (all circuit-breakers (1) are closed except for the unit circuit-breaker) ;

3) The unit circuit-breaker (2) is closed on a “dead” network,

4) the excitation contactor of the power unit is closed: the generator output voltage will increase gradually - with the use of a ramp- from zero until it reaches the set-point value (usually 0.9Un).