

Adaptation of Transmission Capacities in HV Networks

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GRID

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Alstom Group : Key Figures

Alstom Group

- 3 poles: Alstom Transport, Alstom power, and **Alstom Grid** (formerly Areva T&D)
- Part of the CAC40 top french companies
- Engaged in mayor infrasturcture projects worldwide
- 96,000 employees
- Sales €23 billion
- Over 150 industrial sites and R&D centres worldwide



Power electronics for industry and utilities

» *DC Substations for*

Electrolysis (Al, Cl, Cu, Zn, Ni)

DC Arc Furnaces (Steel)

» *Power Quality*

SVC (Industry)

MSCDN (Utilities)

Harmonic Filters

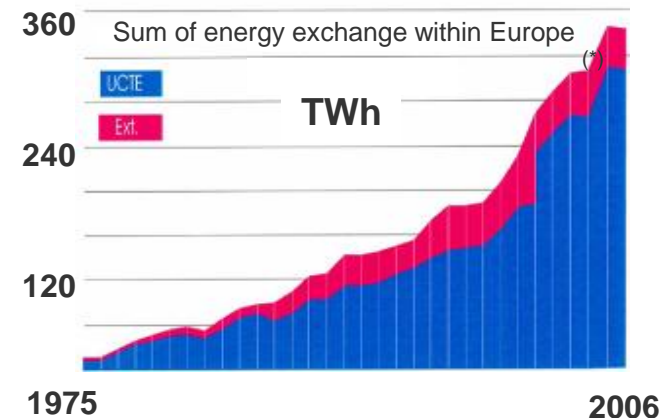
Measurements, analyses and studies



Adaptation of Transmission Capacities in HV Networks

The situation of power transmission

- More and more energy is transmitted over long distances from remote off-shore windparks to local load centers (e.g. from the North to the South)
- Cross-border energy transfer increases to balance consumption peaks, to smooth political conflicts, and to reduce the risk of black-outs



New market situation:

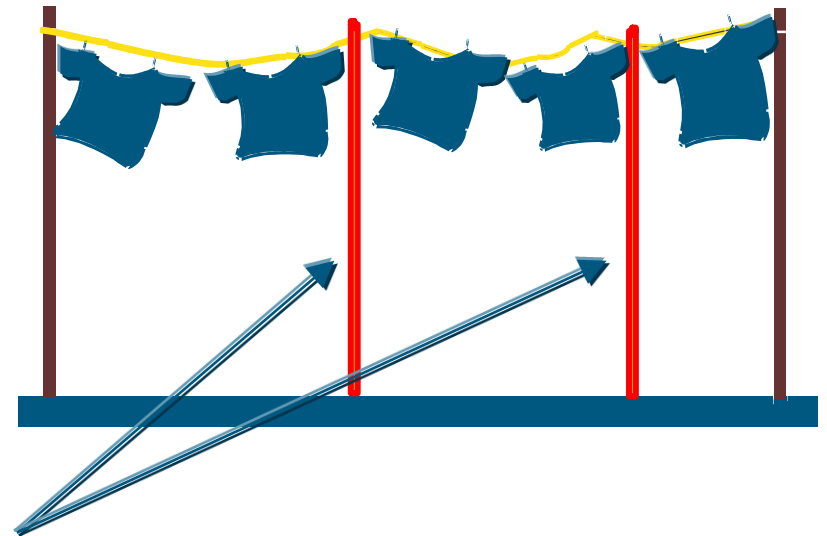
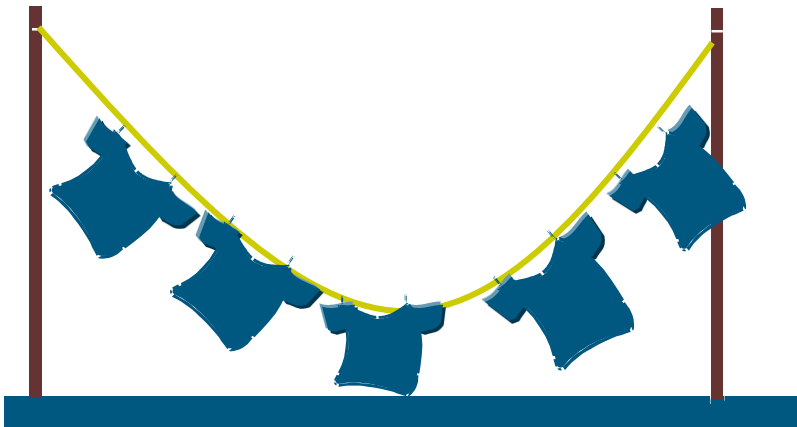
Considerable increase of energy transfer over long distances

(*) Source: UCTE

Adaptation of Transmission Capacities in HV Networks

New market situation and old constraints:

Considerable increase of transmission load over long distances requires more transmission capacity w/o new transmission lines

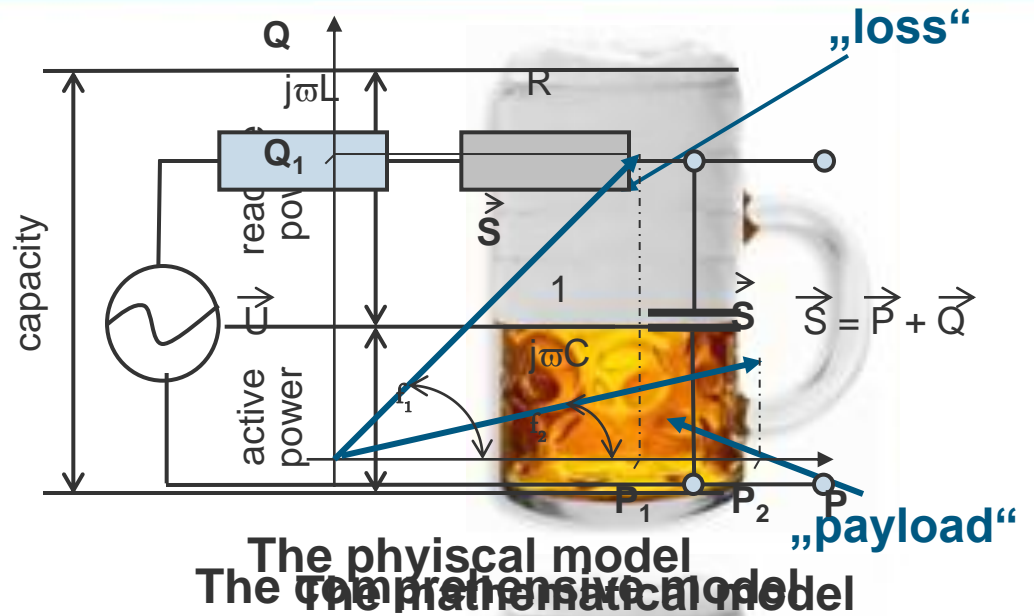
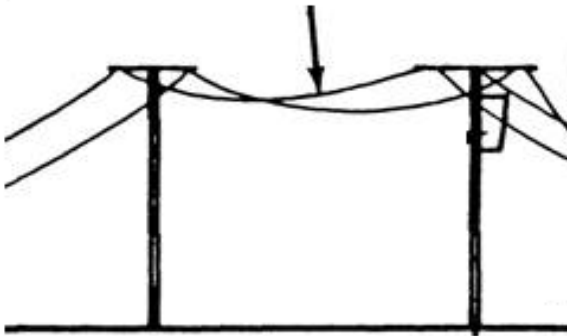


The approach:

support the **HV transmission network** with the installation of **reactive power compensation**

Reactive Power Compensation

Transmission **capacity** for **active** and **reactive** power



The objective:

Compensate reactive power

Increase active power

Reduce waste of capacity



Reactive power compensation in HV Networks

An appropriate reactive power compensation system for HV energy transmission networks is:

MSCDN

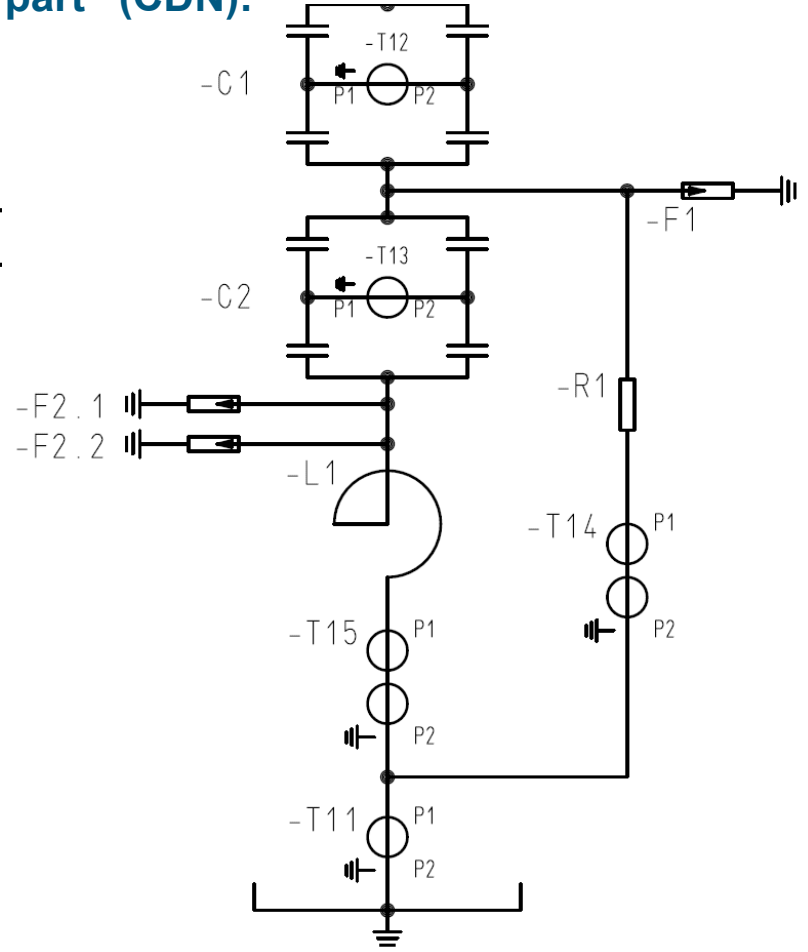
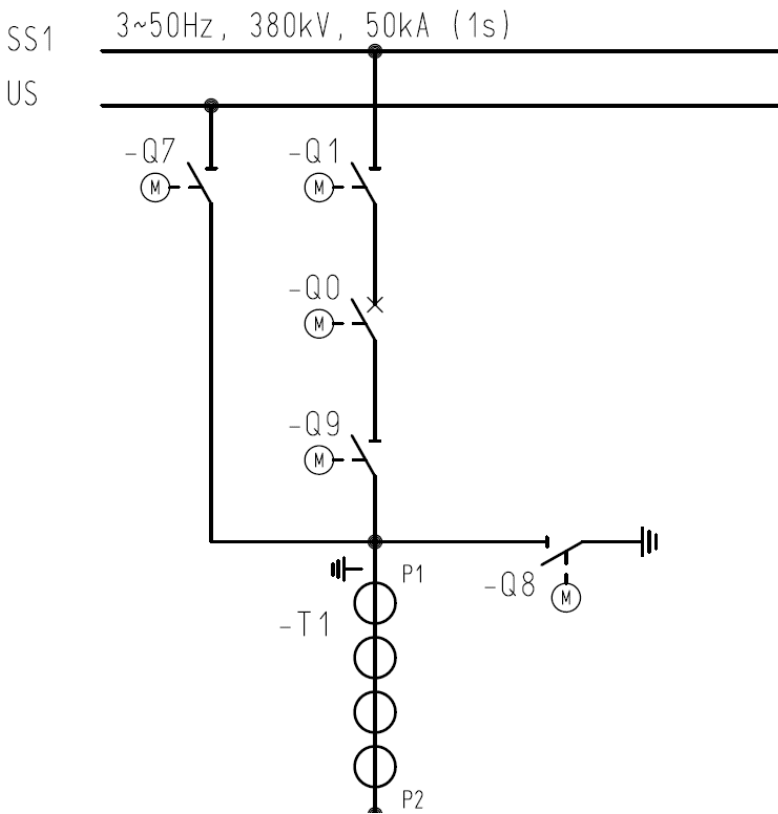
Mechanically **S**witched **C**apacitor **D**amping **N**etwork

Typical Single Line MSCDN

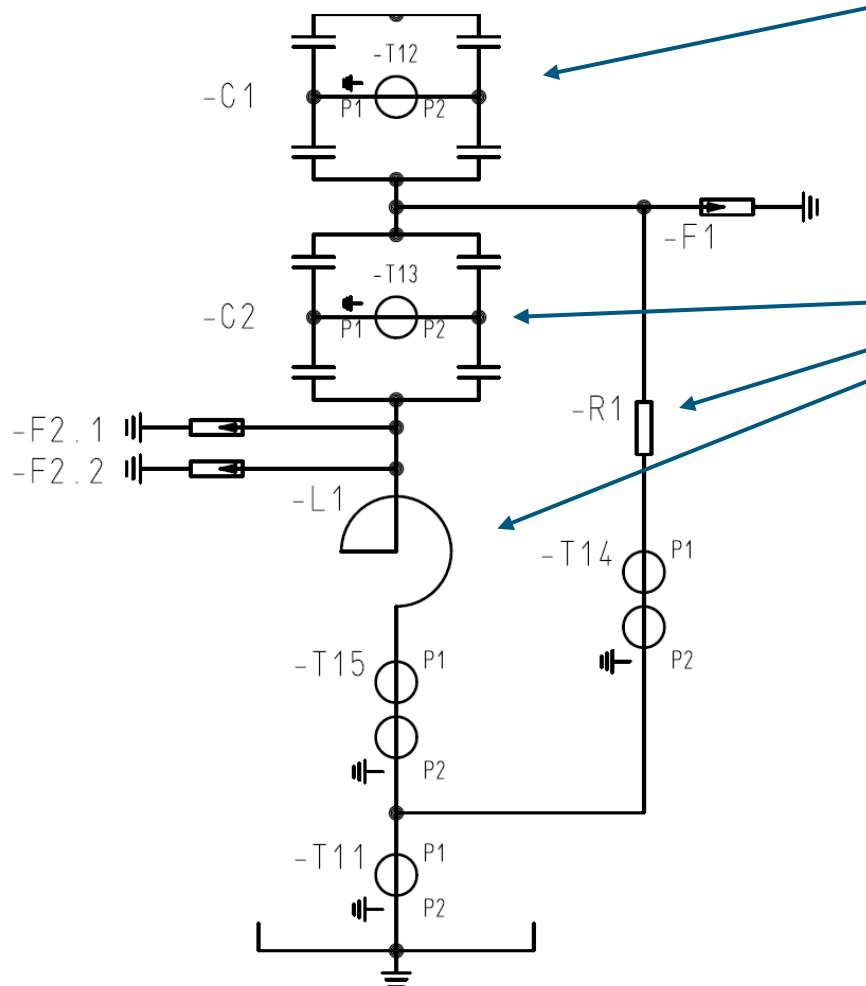
EnBW: 380 kV, 250 Mvar

„Active part“ (CDN):

Switch bay (MS):



MSCDN EnBW: 380 kV, 250 Mvar



Main capacitor -C1

-> includes nominal reactive power
(e.g. 250 Mvar at 380 kV)

Damping network

-> consists of auxiliary capacitor -C2,
reactor -L1, damping resistor -R1
-> decreases inrush currents
-> designed for adaptation to the HV
network

MSCDN EnBW: 380 kV, 250 Mvar

Damping Resistor

Capacitor Bank

-> includes main and auxiliary capacitor



Reactors



MSCDN EnBW: 380 kV, 250 Mvar

MSCDN in substation Oberjettingen:



MSCDN TenneT TSO: 380-kV-/300-Mvar



MSCDN – example and characteristics

E.ON / TenneT (380 kV / 300 Mvar)

- A compact system that increases the line capacity by > 50% and that integrates well into existing substations
- A proven technology adapted in response to a new market situation
- A competitive system design to comply to the customer needs
- An appropriate solution for sustainability and CO₂-reduction in transmission networks



Var compensation in Germany

TenneT TSO 380 kV

UW Dollern: 300 Mvar

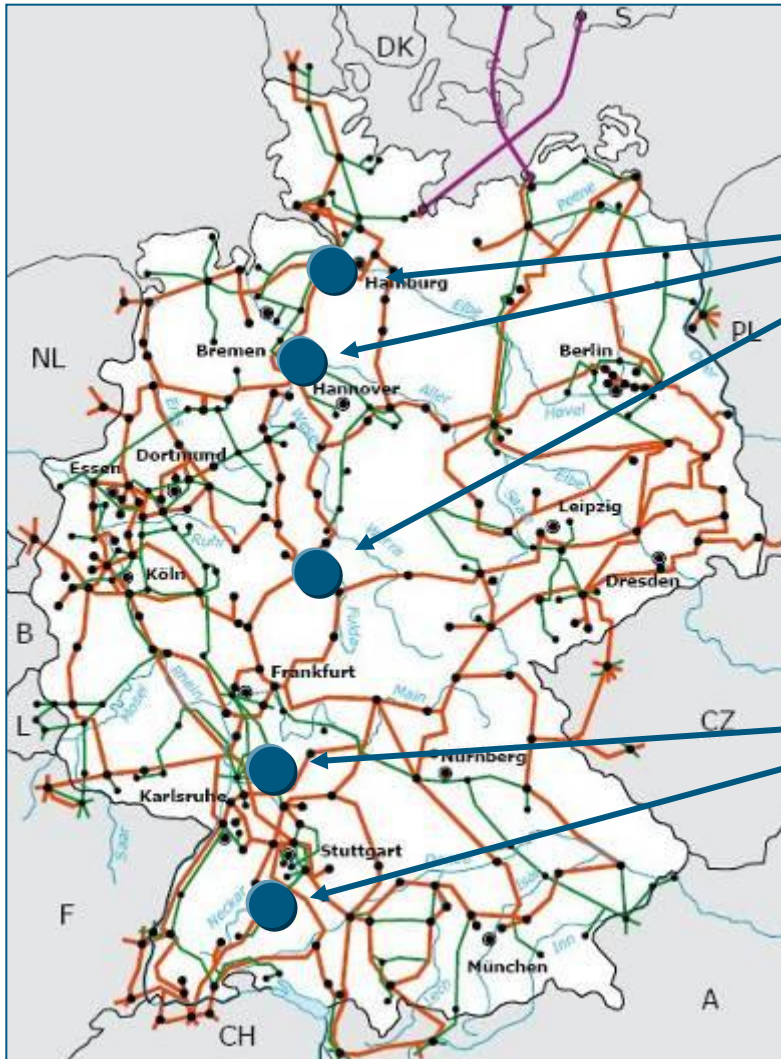
UW Landesbergen: 300 Mvar

UW Borken: 250 Mvar

EnBW 380 kV

UW Mühlhausen: 250 Mvar

UW Oberjettingen: 250 Mvar



A dark-themed map of Europe is shown. A region in the south of France and northern Spain is highlighted in a brown color. Overlaid on this region are several grey lines representing flight paths, with small red and white airplane icons. The text 'CO2' is written in a light grey font near several of these flight paths. A green rectangular button with the word 'play' in white text is positioned in the center of the map.

play

Conclusion

Benefits of MSCDN

- » Significant increase of transmission capacity
- » New construction of overhead lines can be postponed or totally suspended
- » Environment friendly integration in existing substations
- » A proven technology adapted to a new market situation
- » Easy supply of reactive power wherever needed
- » Less emission of CO₂ due to reduced power losses
- » Quick amortization of investment

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