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ALS-REVERSIBLE DC SUBSTATION

The braking energy feedback is one of the most promising lever of energy saving into a transport system.

Modern traction units nowadays are fitted as a standard with regenerative dynamic braking. Although in AC systems fed with transformer substations the receptivity of the line section is naturally set at 100%, in DC systems this target of braking energy recovery is difficult to obtain due to unidirectional flow of power in diode rectifier substations.

The efficiency of such energy feedback is dependant upon:

- The kinetic energy available when a train unit is braking, mainly conditioned by the mass and power of the train unit, the initial speed of the braking phase, and frequency of braking,

- The quantity of energy a network is able to absorb, which is mainly conditioned by the headways used in the system and the probability of trains braking and start-up phasing, called the receptivity of the line.

The target of this project is to improve the DC power line receptivity, in order to regenerate almost completely the energy braking of the trains by providing a new concept of reversible DC substation suitable for all DC power supply systems ranging from 750 V, to 1500 V, and 3000 V, and able :

- to maximize the braking energy feedback to the upstream network, up to 99% of the recoverable energy, while leaving priority to natural exchange of energy between trains,
- to regulate its output voltage in traction and regeneration modes to reduce losses, and increase the pick-up of energy from non-frequent and distant trains,
- to ensure a good quality of power supply, for the DC and AC part of power supply systems, by reducing the level of harmonics.

It will thus be possible to cancel the on-board brake resistors and associated equipments reducing weight and volume of on-board traction equipment, the dynamic braking being then achieved exclusively under regenerative braking.

This new development will take the best from the technologies developed by other industrial sectors like low voltage and high voltage stationary variable speed drive converters, especially in terms of active harmonic filtering technology, high power semiconductor modules, modern controls and protections, modularity, high integration, alighting thus the financial effort and time of a development applied to railway infrastructure technology.