

INGETEAM TRACTION ©

INGEBER, energy recovery systems  
for railway systems



# Transportation Systems, the Environment and Energy Efficiency

There is currently a growing interest in improving the energy efficiency of the rail transportation systems. The reasons for this trend are clear:

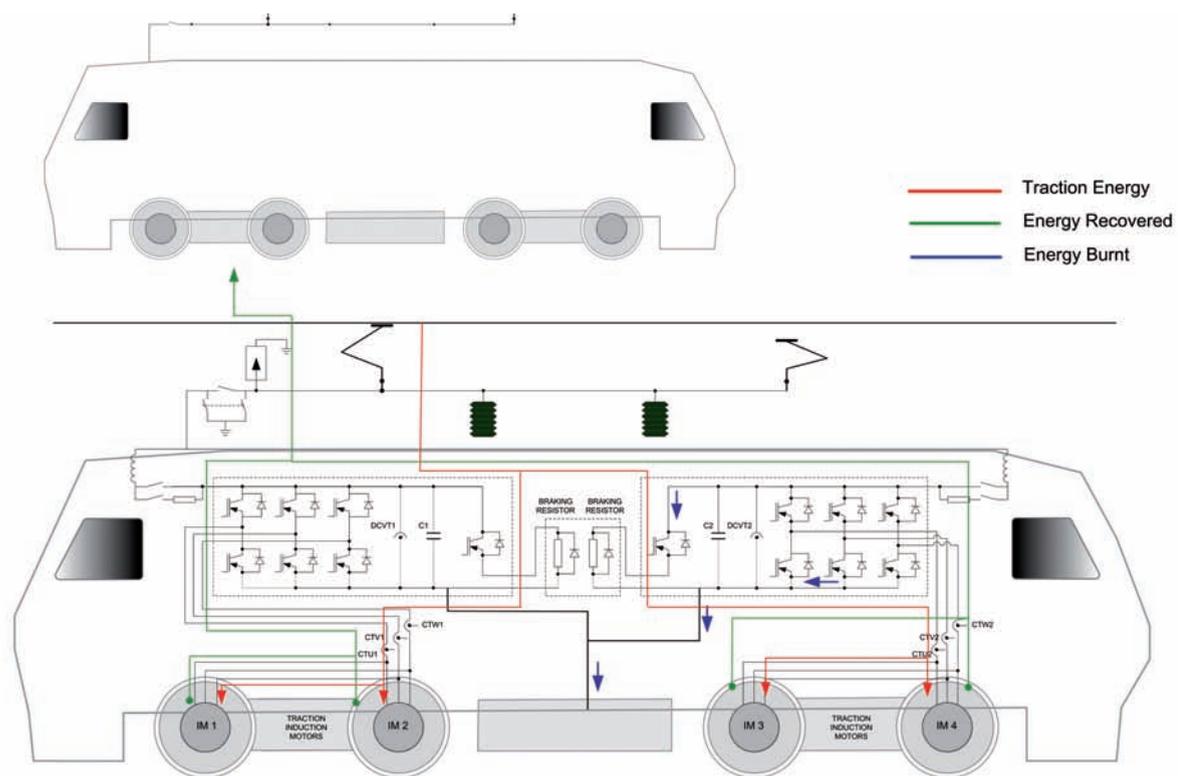
- To strengthen the positioning of the railway as the ecological means of transport as a result of the introduction of technological developments which are contributing to a reduction in energy consumption and in emissions of atmospheric pollutants.
- To reduce the operating costs of the operators.

INGETEAM is aware of the challenges currently facing railway operators. As expert in the development and manufacture of systems and equipment providing energy exchanges in strategic sectors, it supplies the rail sector with equipment which contributes to improving energy efficiency both in terms of greater efficiency of the power train of the vehicle and of maximum utilisation of the electricity present in the railway system.

**With the development of INGEBER, we offer a kinetic energy recovery system, which fits into the current operator's infrastructure (substation), optimizing the energy recovered and making it available to the distribution network.**



# Utilisation of energy deriving from regenerative braking



It is now normal for the rolling stock to incorporate regenerative braking systems which enable the energy generated during braking to be returned to the catenary.

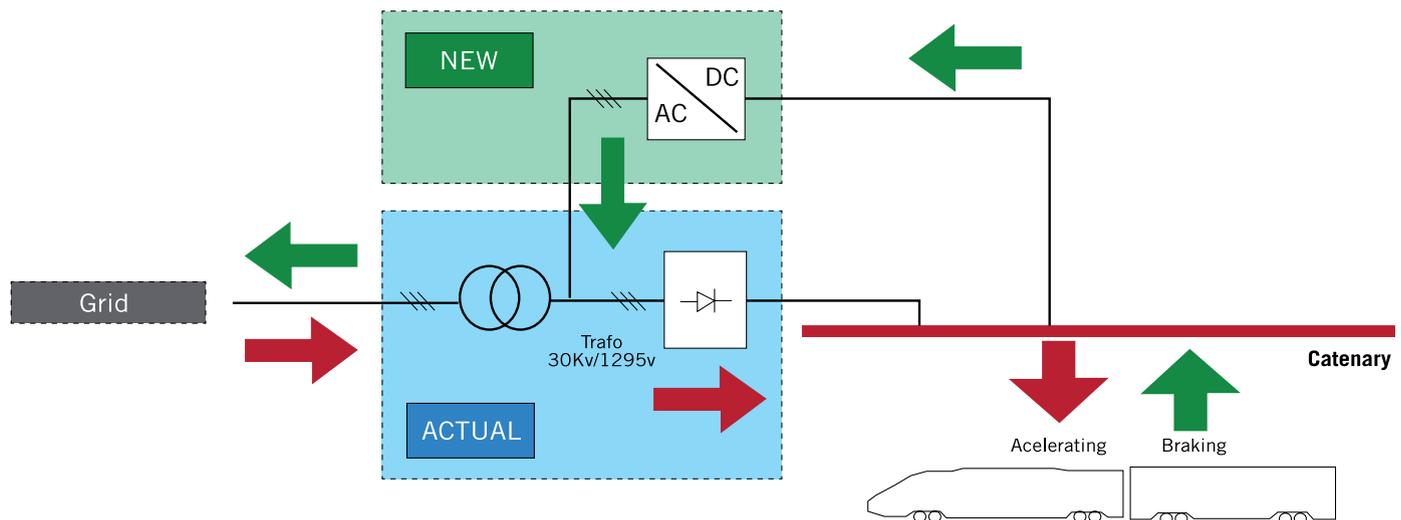
However, in d.c. systems this kinetic energy cannot be used to the optimum degree because, since they are equipped with unidirectional electrical substations, the use of the energy is limited to cases where there is another rail vehicle in the vicinity consuming energy at the same time that the other vehicle is generating it whilst the non-recoverable energy is burnt off in the brake resistors of the vehicle.

The operators must optimise the traffic management operations by attempting to ensure that the braking operations of some vehicles coincide with the starting of others so as to maximum energy utilisation. However, the percentage of non-recoverable energy is currently high.



# INGEBER

## An efficient tailor-made solution



The INGER system developed by Ingeteam enables all the limitations associated with the return of energy from the units to be overcome.

The system consists of power electronics equipment installed in the substation and connected to the main equipment that already exists in the substation, such as the transformer and rectifier.

The system continuously monitors the catenary until it detects the point at which there is braking energy from one vehicle that is unable to be used by another vehicle. At this time the system extracts this energy from the catenary and transforms it according to the quality parameters of the supply grid so that this energy can be injected into the grid.

Depending on the legislation of each country, this returned energy can then be discounted from the invoice for the energy consumed (regulations already in force, e.g. in Spain), or it can be used in other infrastructures of the railway operator.

### Preliminary Study

The step preceding installation of the system is an analysis of the existing network with software developed by Ingeteam, taking into account both the locations of the substations and the operation and type of rolling stock so that the number, location and optimum power of the systems to be installed can be defined both from the technical point of view and from the point of view of the return on investment.

# Advantages of the INGEBER system

- Its installation provides a considerable energy saving and a high return on investment.
- The device enables the energy saving function to be separated from the train operation, with no link between the energy recovery operations and consumption of the same.
- The current contributed to the three-phase grid is of high quality and is generated from a stable d.c. voltage.
- The system's power is planned based on the anticipated savings and not on the total installed power, hence costs are adjusted.
- Its use does not result in a modification of the current installations of the substation, making use of high cost components such as the transformer.
- Its operation is transparent to the existing system; so that it can be isolated in the case of damage without interrupting the operation of the system.
- The components of the same do not require exhaustive maintenance because there are not mechanical items.
- It can be used in high grid voltage environments without affecting the quality parameters of the energy fed back.
- The device is not affected by short-circuits in the catenary.
- In addition, the device can be used as an active filter for regulating the consumption of the substation (with the resultant saving due to the  $\cos \phi$  improvements).