Summary

Kinetic or potential (or: gravitational) energy in a transportation system is being lost in conventional systems during braking of the system. The energy disappears then by means of heat via the brake disks into the air. This lost energy can be recovered by means of so-called regenerative braking. The recovered energy is stored and can be used later e.g. during the acceleration of the system. Because of this, energy is saved and the energy consumption of the transport system will be reduced. Recently many several ways have been developed to recover and to store energy.

Theoretically, it is possible to recover and to store up to approximately 80% of the total brake energy. The reduction of the energy consumption also results in a reduction of among other things the operational costs and the emissions. The theory of regenerative brake systems shows two important components: the system to regenerate energy and the system to store and (later) to deliver energy. The electric motor is the most used system to recover energy, because the electric motor can be used as well as a motor and as a generator.

To store the recovered energy, an energy storage system is required. There are several types of systems for several types of energy. Important characteristics of energy storage systems are energy density, specific energy and discharge time. With these two mentioned components, it is possible to construct a regenerative braking system. This is realised in a hybrid system, in which two power sources are constructed. The prime mover delivers energy from fuel, whereas the other power source is used to recover energy during braking. The different configurations of hybrid systems are: series hybrid, parallel hybrid and series-parallel hybrid.

These theoretical systems are being used in practice and are subject of research and development. The applications can be categorized in kinetic and potential energy recovery. A few applications are in production, whereas most other applications are just in prototyping phase. These prototypes will continue to be tested in practice. Most of the applications do reach energy savings of approximately 20% up to 35%. A few of them reach saving levels of more than 50%, which especially is the case in system for potential energy recovery. There are several ways of determining the costs of regenerative braking systems with the purpose to compare the different systems or components of the systems. With this, the economic feasibility can be determined.

Currently, the developments of regenerative brake systems are especially aimed at applications for kinetic energy recovery. However, the largest energy savings can be found in applications for potential energy recovery.

The conclusion, which results from all this is that many companies do give high priority to research and development of regenerative braking systems. It is expected that in future more and more applications with a regenerative braking system will be taken in production. This will be even more

supported by the current high levels of energy and oil prices, which makes it easier to come up with economically feasible regenerative braking systems.