

Skeleton Technologies



A Growing Trend for the Present and the Future: Supercapacitors in the Rail Industry

Transport accounts for 27% of Europe's total CO2 emissions. Rail is one of the greenest modes of transport so having a higher share of passenger and freight journeys performed by train is fundamental for decarbonising the transport sector.

However, despite rail transport being one of the most energy-efficient modes of transport, the rail industry is also making efforts to reduce its carbon footprint and save energy.

“Environmental stewardship is a priority for the rail industry and this impacts everything. Everyone is on board with the goal of

reducing consumption of energy and lowering carbon emissions, and this is becoming a competitive edge for companies when they apply for tenders,” confirms Tobias Ragnarsson, Sales Director at Skeleton Technologies. *“This is precisely one of the main reasons why supercapacitors are becoming increasingly popular among rail companies.”*

Supercapacitors are an energy storage technology that offers high power density, almost instant charging and discharging, high reliability, and very long lifetimes. They are routinely used in trams, and they have been implemented on trains as well. Increasingly, they are becoming key to rail transport. Their implementation provides effective voltage stabilisation for rail systems, greatly improves the performance of propulsion for light rail vehicles, and significantly advances the locomotive engine starting technologies.

One of the key applications for supercapacitors in the rail industry is KERS (Kinetic Energy Recovery System), an onboard energy storage system, which captures braking energy in trams to power acceleration and decreases carbon emissions. Implementation of this

system results in improved fuel efficiency, reduced CO2 emissions, faster tram acceleration and less noise.

“Using Skeleton’s rail-certified SkelMod 51V module in KERS applications, trams can recover up to 30% of electricity. This module is currently trusted by companies such as Škoda Transportation, Medcom, and CAF,” details Ragnarsson.

But supercapacitors don’t have to be added on-board to be used for capturing braking energy. Ragnarsson also highlights the high potential of these devices for wayside energy storage in trains. Wayside energy storage for rail is electrical energy storage, which is typically located in, or close to a rail traction power substation. In this case, systems such as Skeleton’s SkelGrid Ultracapacitor System

are used in train stations. Wayside KERS captures energy during the braking of a train arriving at the station and provides energy during the acceleration of a train leaving the station. This offers several advantages over lithium-ion batteries such as a higher safety and a longer lifetime.

Supercapacitors are also used in diesel multiple unit (DMU) trains for engine starting applications. Safety and reliability matter especially in extreme weather conditions of -40°C. The main reason why equipment can fail to start is the use of lead-acid batteries as power packs to get started. *“Supercapacitor modules are ideally suited for starting diesel train generators and provide all the necessary power while taking up 6x less space at about 30x lower weight than lead-acid batteries,*



making it an easy retrofit solution,” says Ragnarsson.

In addition, Ragnarsson explains that supercapacitors are key enablers for catenary-free operations. *“Sometimes, the catenary is not entirely available for the planned route due to limitations regarding preservation orders in certain city quarters. In this case, using onboard supercapacitors could be a perfect solution, providing energy in track sections without catenary. This application has several significant advantages: no catenary-related constructions needed (fast and easy implementation) and lower public grid connection costs (energy is being regenerated when the train is braking).”*

As the growing trend of using them in trains and trams

suggests, supercapacitors have the potential to revolutionise the rail industry. The technology can significantly improve train efficiency, reducing costs and CO2 emissions, and increasing energy savings, contributing to making rail transportation one of the greenest options for the decarbonised future.

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