

VDE Study: Alternatives to diesel multiple units in regional passenger rail transport

Assessment of systemic potential

The German railway network covers about 40,000 kilometres, only 23,000 kilometres of which are electrified. There are about 2,900 diesel multiple units running on the remaining kilometres, accounting for about one third of the train-kilometres travelled. Some of them use drive systems that are decades old. The aim is to replace these diesel multiple units with alternative systems and make rail transport climate-neutral by 2050. In its capacity as a neutral technology association, the VDE has analysed the various alternatives and evaluated their systemic potential.

Full electrification of the rail network by 2050 is unrealistic

Gaps in the overhead contact lines primarily affect local transport, especially in regions with low traffic volumes. The bridging of such gaps by means of direct electrification as well as the maintenance of overhead lines are associated with high costs. For this reason, full electrification of the rail network would not be economically viable. Moreover, the prescribed planning approval procedure remains very time-consuming. On the other hand, the intention is to replace diesel multiple units with climate-neutral solutions as soon as possible.

Electric motors with different energy supply solutions

Given that rail transport is to be fully decarbonised by 2050, it makes no sense to place orders for new diesel multiple units today. Vehicle manufacturers have adapted accordingly and are increasingly focusing on alternative climate-neutral drives. But which solution is most promising? Working this out is proving to be a complex challenge which multiple sectors are now facing. The study shows that only purely electric drives make sense as alternatives to diesel engines. It distinguishes between two solutions for the on-board provision of the required energy: a large lithium-ion battery that can be charged by means of pantographs via the overhead line, and a fuel cell that converts the energy stored in hydrogen into electricity.

Both battery-powered and fuel cell trains have their strengths and weaknesses

In principle, battery power is a good solution for infrequently used lines with gaps in the catenary that are no greater than 40 to 80 kilometres. Fuel cells are favoured in cases where there is no overhead line at all or where there are gaps of 80 kilometres or more. Both solutions are completely emission-free and climate-neutral if green electricity is used. Qualitative evaluation of the alternatives using neutral benefit analysis shows that battery-powered and fuel cell trains are equivalent solutions in systemic terms. The most suitable alternative depends on the route network in question and the given framework conditions. There is no single ideal solution for all networks.

Simplify planning approval for electrification and promote alternative technologies

In addition to replacing diesel multiple units, the prescribed planning approval procedure for electrification with overhead lines should also be consistently simplified and shortened.

Intensive support should also be given to the further development of battery-powered and fuel cell drives.



This study and further information on regional passenger rail transport and climate-neutral mobility can be found at www.vde.com/alternative-drive-solutions