

VDE Study: Evaluation of climate-neutral alternatives to diesel multiple units

Economic viability assessment based on the example of the 'Düren network'

Since the end of 2017, the VDE, a German technical-scientific association, has been undertaking a neutral technical and systemic assessment of the economic viability of various climate-neutral alternatives as a replacement for diesel multiple units on regional rail passenger transport branch lines. In its third study, the VDE evaluates the economic viability of the alternatives based on the practical example of the 'Düren network'.

Fuel cell or battery-powered multiple units?

In the second study, the VDE came to the conclusion that there is not just one ideal solution for all networks and that the search for the best alternative therefore requires an individual analysis of the network in question. In the third study, the economic viability of battery-powered and fuel cell multiple units is examined and evaluated based on the example of the 'Düren network'.

Each alternative has its own special features

When assessing the battery-powered multiple-unit solution, it is important to know where, for how long and at what power level recharging is possible in the network. It is also important to know what percentage of the energy generated by recuperation during the braking phases can be returned to the lithium ion battery for storage. The price of electrolytically produced green hydrogen as well as the energy conversion efficiency and the working life of fuel cells are decisive for operation of the fuel cell multiple unit. Furthermore, hydrogen consumption depends on the extent to which the recuperated braking energy can be stored and used in the buffer battery.

Data basis for economic viability analysis

The economic viability analysis of the VDE is based on data relating to the year 2026, including timetables, fleet size, operating capacity, speeds and stopping times. Added to this are procurement and maintenance costs, costs for the replacement of components and the installation and operation of the necessary infrastructure.

The energy requirements of the multiple units on the 'Düren network' lines are calculated on the basis of simulations which take idling times, speed curves, terrain profiles and performance values of auxiliary units into account. The observation period is 30 years, which is typical for rail traffic, and the net present value method is used as a dynamic investment calculation procedure.

The battery-driven multiple unit represents a more economical solution for the 'Düren network'

The comparison of the alternatives shows that battery-powered multiple units can be operated more economically than fuel cell multiple units in the 'Düren network'. The main reasons for this are the energy costs and the relative costs of replacing traction batteries and fuel cells.

Transferability of the results to other networks

The VDE study reveals the extent to which the findings can be transferred from the 'Düren network' to other diesel networks, and the conditions under which fuel cell multiple units or battery-powered multiple units can represent the more economical investment project in the long term.



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