

# Energy Management Concept for Trains



Modern passenger trains use electrical power for many purposes including lighting and air conditioning, but at present there are diverse approaches for distributing this power. This limits the interoperability of rolling stock and reduces opportunities for economies of scale in the design of subsystems. Also, improvements in electronics and battery technologies will in future provide cost effective opportunities for better energy efficiency and flexibility. This invention proposes a new architectural approach for automatically rearranging the distribution of electrical power in a common format when train formations change.

For locomotive-hauled trains, the old idea of the 'brake van' is revived in the driving trailer, but now recovered energy from braking is stored in local batteries and then converted to the standard power format for train services. This relieves the locomotive of that power generation task for a time until the batteries run down again, improving the overall energy efficiency of the train. The system works for electric and diesel trains, regardless of whether the traction units themselves incorporate regenerative braking or not.

The concept features:

- One common standard for the distribution of 'hotel power' in all kinds of trains, improving vehicle interoperability
- Automatic reconfiguration of power distribution when train formations change
- Suitable for locomotive-hauled, multiple-unit, power-car-and-trailer or other vehicle architectures
- Facilities for regenerative braking in various configurations to improve energy efficiency or performance

In the full implementation of the system, switches on the couplers detect 'coupling events' when vehicles are added or removed, automatically rearranging power distribution according to predetermined priorities. The electrical model shown overleaf (left) demonstrates one example of how the system would work. This illustrates a train with locomotive on the right, two coaches in the middle and an 'energy recycling driving trailer' on the left.

The 'energy recycling driving trailer' might look like the picture overleaf (right). One standard vehicle of this kind has many versatile applications, including:

- Improving the overall energy efficiency of the train
- Maintaining power at stations while locomotives are changed (e.g. electric to diesel)
- Maintaining power when a train splits (it powers one part and the locomotive powers the other part)
- Shunting vehicles (sufficient stored energy to act as a small locomotive for modest loads and short distances)
- Reducing slipping of the train under poor rail conditions (additional traction force and adhesive weight for short periods)
- Allowing train haulage by 'freight' locomotives without a 'hotel power' supply (absorbs 'excess' traction force to generate electrical power)
- Reducing diesel pollution (can shut down an engine during most station stops and rely on stored energy instead)

Further details about this technology and its relation to others to facilitate interoperability and greater flexibility can be found in the book '**Beyond the HST**' by **John Kinghorn** (Melrose Books, £16.99) ISBN 978-1-907040-65-8.

More information can be found on the Wessex Round Table of Inventors (WRTI) website [www.wrti.org.uk](http://www.wrti.org.uk)  
Click on Membership Information tab – Members Inventions in Development – Energy Management System for Trains.

Looking for partners interested in developing these concept ideas into real products. Control, battery and inverter systems with capacities up to about 0.5MW peak loads are involved.

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