

EcoActive Technologies

PRIMOVE Catenary-Free Operation



In many city centres overhead lines and their surrounding infrastructure contribute to visual pollution of historic streets, parks or architectural landmarks. Catenary-free tracks for trams and light rail vehicles heighten the attractiveness of a city and provide for unobstructed views.

A world-premiere: contactless power transfer for urban rail vehicles

The new and unique *BOMBARDIER* PRIMOVE** system allows catenary-free operation of *FLEXITY** trams over distances of varying lengths and in all surroundings as well as on underground lines – just like any conventional system with overhead lines. What makes it outstanding is that the power transfer is contactless; the electric supply components are invisible and hidden under the vehicle and beneath the track.

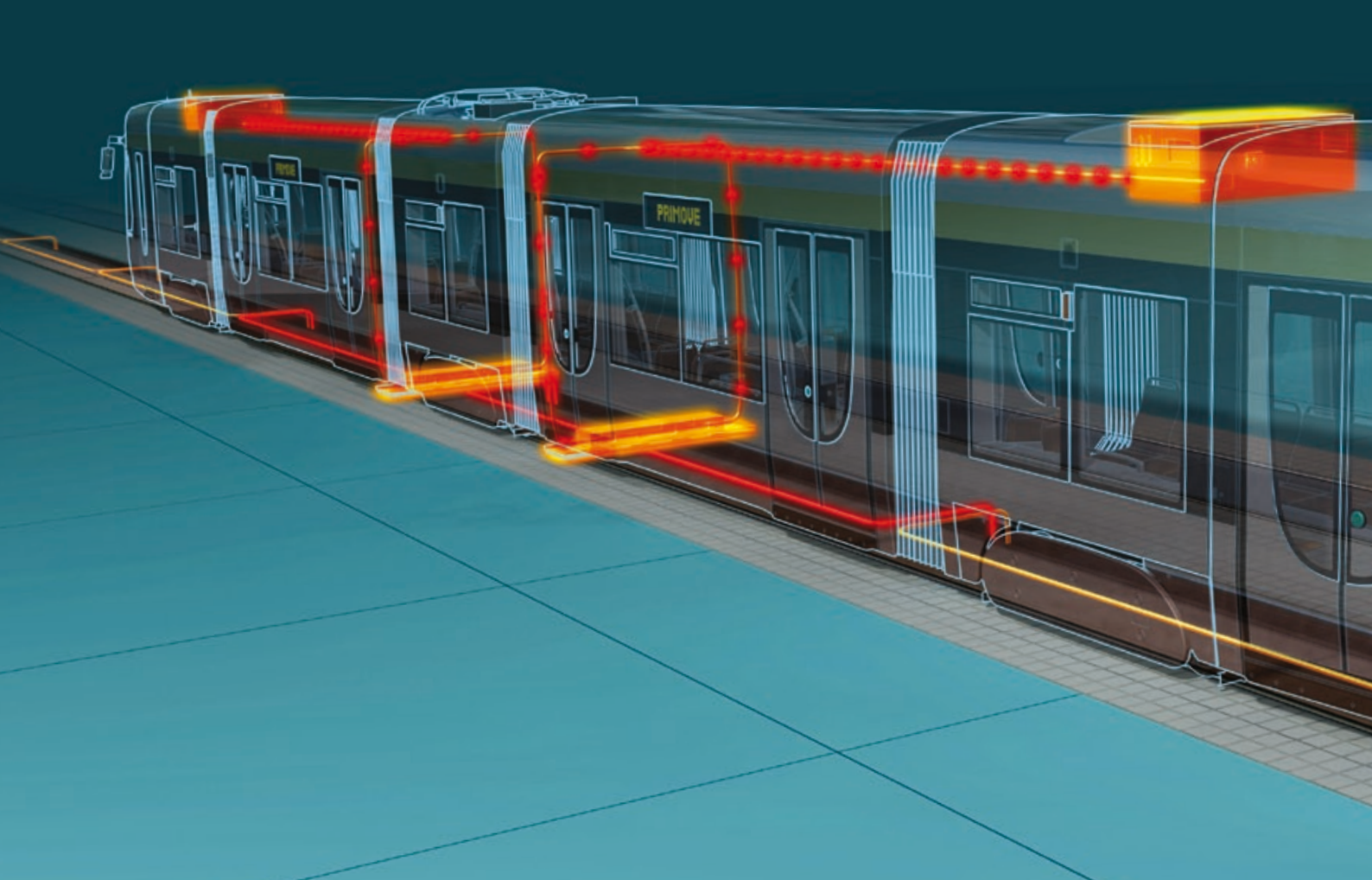
The benefits are evident:

- Elimination of overhead wires – increasing a city's attractiveness
- Safe inductive power transfer
- No wear of parts and components
- Resistant to all weather and ground conditions including storms, snow, ice, sand, rain and water

The *PRIMOVE* system is connected to the *BOMBARDIER* MITRAC** Energy Saver, which stores electrical energy that is gained during operation and braking on board the vehicle by using high-performance double layer capacitor technology. Doing so optimizes power supply and saves energy.

Light Rail Vehicles

eco⁴ BOMBARDIER



Catenary-free operation – energy flow

Bombardier is at the forefront of continuously improving rail transportation as an ecologically leading mode of transport

Preserving our environment by reducing emissions and using energy resources in an efficient and responsible way are undoubtedly major challenges which communities all over the world face today. Exhaust emissions and noise are some of the main factors that lead to a deterioration in the quality of life in our cities. In urban transport, railbound operations are making a major contribution to relieving congestion as well as cutting CO₂ and noise emissions.

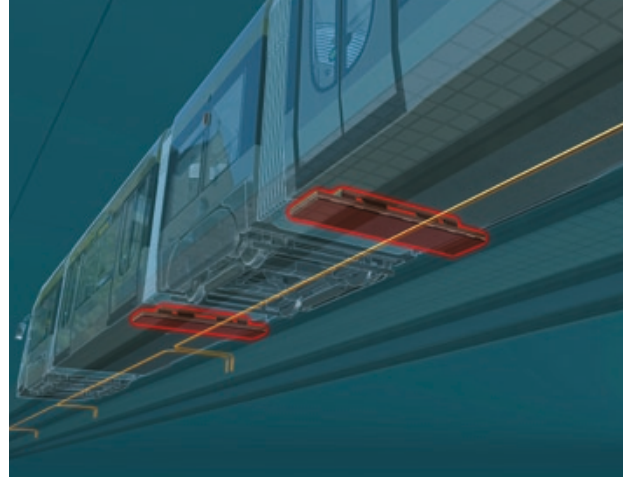
Why Catenary-Free operation?

In addition to these well-known factors, municipal authorities are increasingly facing visual pollution caused by power poles and overhead lines obstructing the visibility of landmark buildings and squares. With *PRIMOVE* catenary-free operation trams can even run through heritage-protected areas, such as parks and gardens, historic market and cathedral squares, where conventional catenary systems are not permitted, thus preserving natural and historic environments. Additionally, when planning a

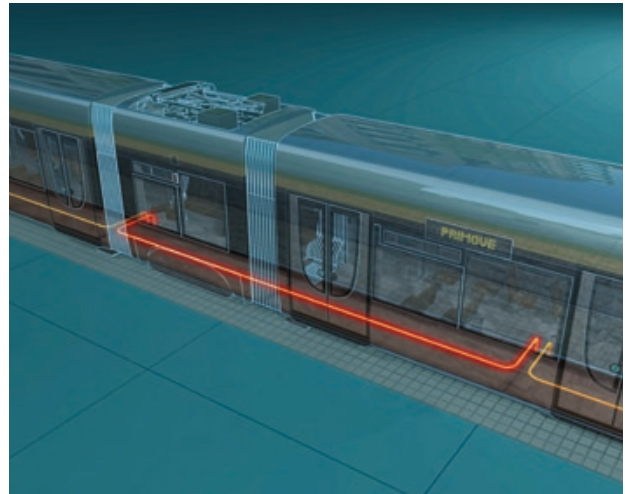
new system or extensions catenary-free operation will contribute to an attractive and forward-looking appearance.

***PRIMOVE* Catenary-free operation – safe, cost-efficient, reliable and flexible:**

- Due to invisible and contactless power supply, operation of the *PRIMOVE* catenary-free system is safe for pedestrians and other road users such as bikes, motorbikes or cars
- With no direct contact during energy transfer there is no wear of parts and components which keeps service and maintenance costs at a minimum – the initial construction costs lie far below those of any comparable solution on the market
- Reliable performance in all weather and ground conditions
- Same vehicle performance as with conventional catenary systems
- With the on-board *MITRAC* Energy Saver the system can continuously recharge the energy levels needed for uninterrupted maximum performance
- The *PRIMOVE* system can be tailored to the individual needs of each city: it is adaptable to different topographical conditions, performance expectations and distances



Pick-up coils



Underground cables

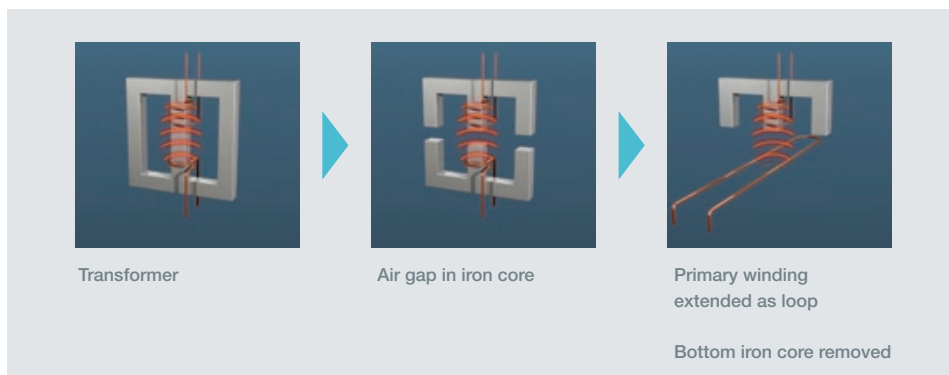
How does the PRIMOVE system work?

When running on conventional systems, trams and light rail vehicles take their energy from an overhead electrical line. Equipping the tracks and the vehicle with the *PRIMOVE* components also allows operation without a catenary. Cables laid beneath the ground are connected to the power conditioning and supply network. They are only energized when fully covered by the vehicle, which ensures

safe operation. A pick-up coil underneath the vehicle turns the magnetic field created by the cables in the ground into an electric current that feeds the vehicle traction system.

Inductive power transfer principle

The functional principle is based on the inductive power transfer of a transformer (see illustration below) – a principle that is up to now has only been used in certain industrial applications (in the automotive industry for transportation systems in manufacturing) or with household appliances (i.e. electric toothbrush).



Working principle –
inductive power transfer

MITRAC Energy Saver

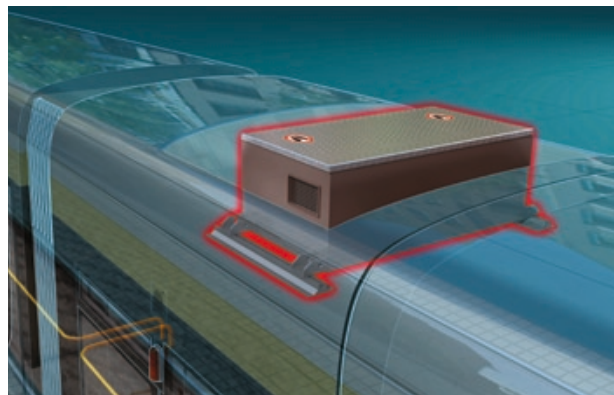
The vehicle mounted *MITRAC* Energy Saver stores the energy gained during braking and is constantly charged up during operation, either when the vehicle is in motion or waiting at a stop, picking up the power from the underground section. Doing so allows both maximum vehicle performance and constant inductive power levels, ensuring continuous operation of the vehicle just like conventional catenary systems.

Testing at Bombardier in Bautzen

The new *PRIMOVE* catenary-free solution is undergoing extensive testing at the test track of the Bombardier site in Bautzen, Germany. A low-floor tram and the test track are equipped with the *PRIMOVE* components and different phases simulating regular operation are being carried out.

ECO4 – Energy, Efficiency, Economy and Ecology

PRIMOVE catenary-free operation forms part of Bombardier's *ECO4** environmentally friendly technologies. Addressing the growing challenges among operators to reduce Energy consumption, improve Efficiency, protect the Ecology while making sense Economically, *ECO4* is the concrete validation of Bombardier's declaration – *The Climate is Right for Trains**.



MITRAC Energy Saver

Performance of the PRIMOVE System

- 250 kW continuous output of the *PRIMOVE* system, designed for a typical light rail vehicle (30 metres long, operating at a speed of 40 km/h with a gradient of six percent). A prototype vehicle is currently undergoing tests at Bombardier in Bautzen
- Performance can be provided to vary from 100 to up to 500 kW, depending on the respective vehicles and system requirements: length and number of vehicles, topographic conditions, range of application

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