

EcoActive Technologies

◁ MITRAC Hybrid The Dual Power Propulsion Chain ▷



The **BOMBARDIER* MITRAC* Hybrid** enables vehicles to operate with comparable efficiency on electrified tracks as well as on non-electrified tracks. This is made possible with a common propulsion chain that is capable of utilizing both electric and diesel power sources. Customer benefits include minimal use of fossil fuels, low emissions and economic and flexible allocation of the fleet.

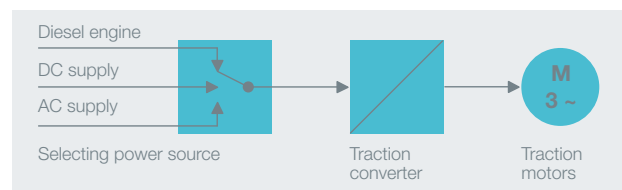
The Functionality

The efficiently designed propulsion chain fulfills multiple functions such as AC or DC power conversion and recuperation on electrified tracks. Using the latest environmental-friendly technology, the same power semiconductors also rectify the power generated by the diesel machines, while the generator also eliminates the need for a separate starter motor. With two diesel engines available per vehicle, the intelligent electronics can activate one or both engines, depending on the power needed, to keep fuel consumption and noise at minimum levels.

The Added Value

To power the traction motors, *MITRAC Hybrid* dual power rail vehicles are equipped with both catenary and diesel engines; these allow instant power switch-over, either while on the move or during regular passenger boarding stops.

Regardless of the extent to which the network is electrified, operators are finally able to address important customer needs: providing new direct routes, and focusing on optimized train schedules in an economic and environmentally friendly way.

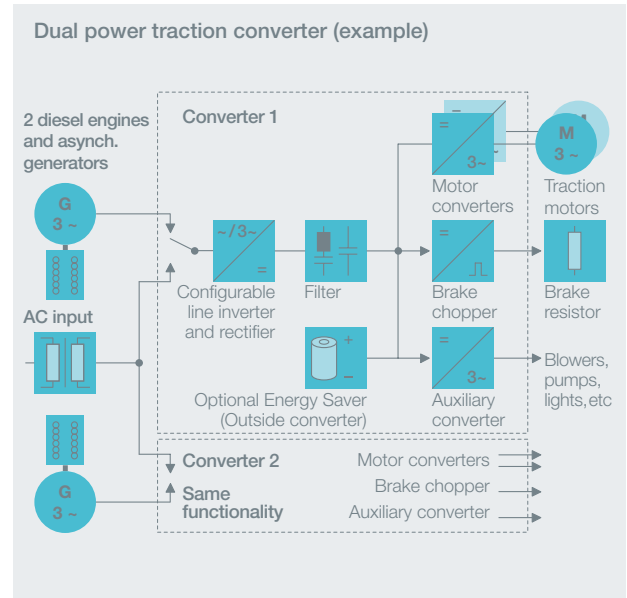


How it Works

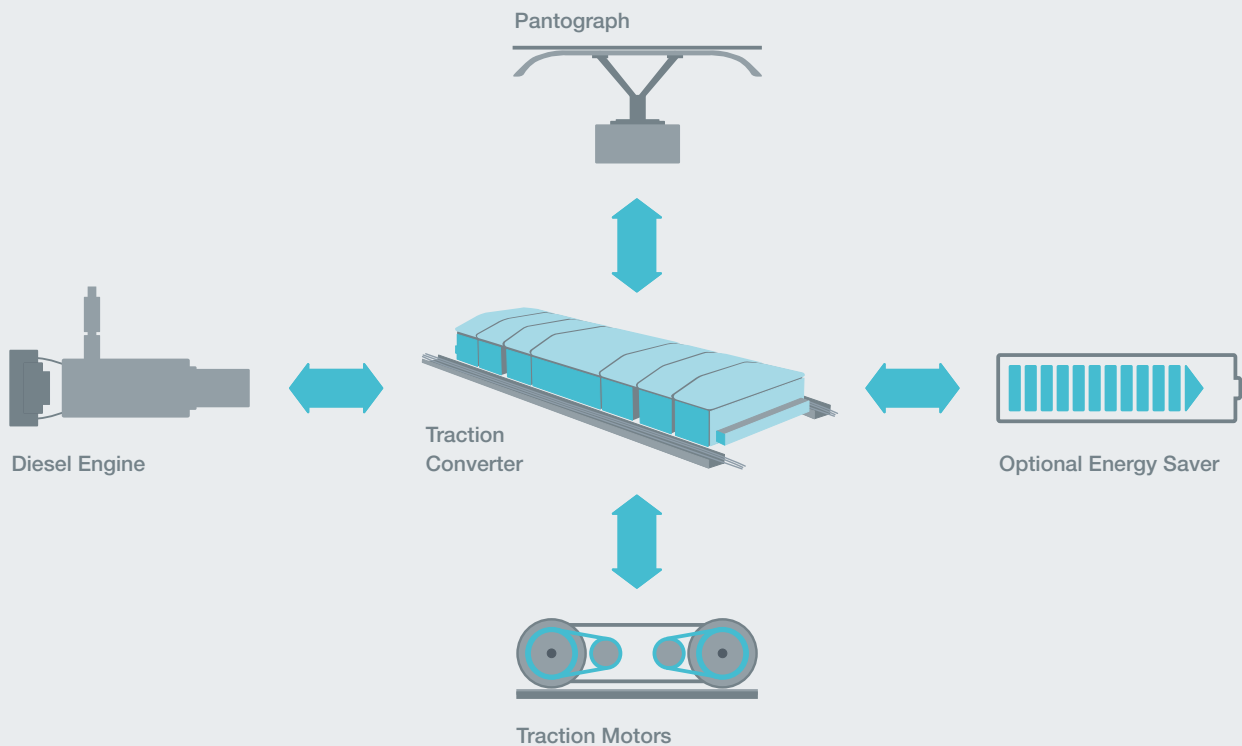
MITRAC Hybrid dual power rail vehicles are equipped with diesel engines as well as pantographs. The traction converter contains shared power semiconductors to support both diesel and electric operation.

With AC power available, the line converter is configured as a 4-quadrant controller to provide a stable DC link voltage. When DC power is available, it is supplied directly into the DC link. When the electric brake is applied, the power generated by the traction motor is fed back to the line network.

During diesel operation, the line converter is configured as a 3-phase rectifier. When the vehicle slows down, the excess power generated by the traction motor is used for the auxiliaries and allows the diesel engine to idle. Any remaining excess power can either be dissipated in brake resistors or supplied to an optional energy saving system.



MITRAC Hybrid Components



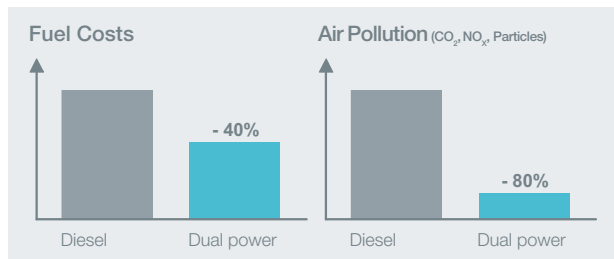
The Benefits

- **Up to 80% reduction in air pollution**

Diesel engines run only when necessary. CO₂, NO_x and particle emissions are reduced accordingly, regardless of motor type.

- **Up to 40% lower fuel consumption**

Locomotives with multiple diesel engines can be powered separately to reduce consumption. When used in combination with shorter diesel routes, fuel costs and tanks are minimized.



- **Up to 20% reduction in travel time**

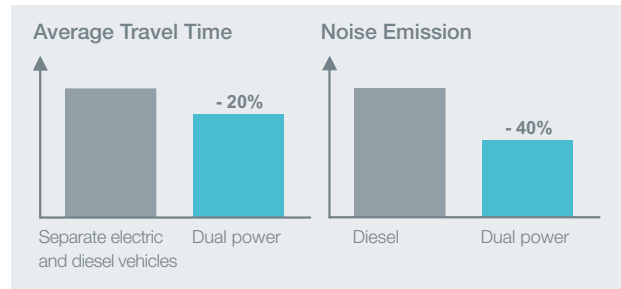
Diesel-to-electric switch-overs mean same-seat rides with no time lost from transferring passengers to or from diesel and electric trains, or from waiting for locomotives to be exchanged. In electric mode the vehicle is also significantly more powerful than in diesel mode, allowing shorter travel times and enhanced track capacity in mixed traffic between electric and hybrid fleets.

- **Up to 40% lower noise emissions**

Less noise in the train stations and along the tracks.

- **More efficient fleet disposition**

A small fleet of dual power vehicles on a mixed rail network can be more flexible and efficient than a larger fleet of conventional vehicles.



- **Improved logistics efficiency**

Energy efficient, rapid and reliable transportation even to the most distant destinations.

- **Fewer components**

Shared hardware and fewer components mean increased reliability and reduced weight, leading to lower energy consumption and cost of ownership.

Charts and quantitative statements relate to rail network with at least 80% electrification. Assumptions: diesel: 1.1 €/l; electricity: 0.11 €/kWh

MITRAC Hybrid – Already on Tracks

Hybrid Multiple Units: Autorail Grande Capacité (AGC)

The AGC is a family of multiple units manufactured for the French regions that includes electric, diesel electric and dual power versions – a single, versatile vehicle type with different propulsion systems. This modular approach permits mixed-unit configurations such as electric and dual power units.

Dual Power Locomotives: ALP-45DP

The ALP-45DP dual power locomotives, ordered by New Jersey Transit in the USA and Agence Métropolitaine de Transport in Montreal, Canada, deliver an impressive 4 MW at the wheel on electric power, and up to 2.5 MW¹ with two diesel engines at speeds of up to 201 and 160 km/h respectively.

Parameter	AGC (3, 4 cars)	ALP-45DP
Country	France	USA, Canada
Vehicle type	Multiple Units	Locomotives
Maximum speed		
• electric	160 km/h	201 km/h (125 mph)
• diesel	160 km/h	160 km/h (100 mph)
Diesel engine power	2 x 662 kW	2 x 1,567 kW
Power at wheel		
• electric	1,800 kW	4,000 kW
• diesel	890 kW	2,500 kW ¹
Systems	1.5 kV DC 25 kV 50 Hz	12 kV 25 Hz 25 kV 60 Hz
Number of vehicles ordered or delivered	327	46

¹ Maximum traction power if no head end power is consumed by the attached cars.

Extending Coverage

Europe

Because of their ability to operate on multiple electric systems (e.g. AGC: 1.5 kV DC and 25 kV AC), vehicles powered by MITRAC Hybrid are the ideal solution to provide seamless transportation services across regions with different power systems and even country borders.

North America

Presently, metropolitan areas in North America provide only limited electrification. Although most downtown and central tracks are electrified, many of the more remote lines are not; electric operation is also required in tunnels to control air pollution.

In these situations, MITRAC Hybrid vehicles offer the most effective solution by providing seamless commuter transit services from downtown to the outskirts. Passengers benefit from shorter commuting times, while the inherent advantages of public transportation – reduced pollution plus increased safety and comfort – further increase the competitiveness of rail.

Leading into the Future of Railways

MITRAC Hybrid solutions are ideal in regions where there is currently little or no electrification, but where electrification projects are ongoing or planned. With MITRAC Hybrid propulsion, rail operators are able to offer efficient and ecologically advantageous transportation services and, especially, an attractive and regular schedule of same-seat rides while the electrification is proceeding.

Having to provide separate electric and diesel rail vehicles, as well as time-wasting locomotive changes, finally belong to the past. In a mixed electrified and non-electrified network, MITRAC Hybrid dual powered trains are able to exploit the full traction power where the catenary is available. Particularly on busy lines, these trains permit shorter travel time without jeopardizing slot management.

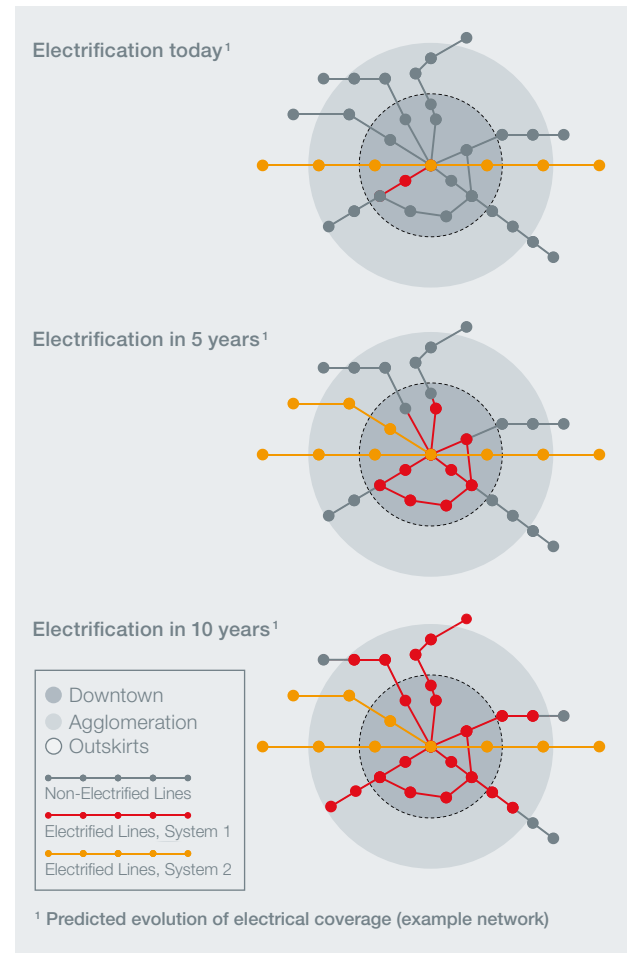
Bombardier Transportation

Brown Boveri Strasse 5
CH-8050 Zurich, Switzerland

Tel +41 44 318 33 33
Fax +41 44 318 21 77

www.bombardier.com

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ECO4 – Energy, Efficiency, Economy and Ecology

The MITRAC Hybrid 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**.