

# CITADIS ECOPACK

## Full on-board autonomy for trams

Alstom's Citadis Ecopack, on-board energy storage solution, revolutionizes the way tramway systems manage power consumption. The latest full on-board autonomy system provides trams with a high level of energy autonomy so they can run without catenary power, consume less energy and be more effectively integrated into the urban landscape.

### GENERAL DESCRIPTION

The Citadis Ecopack system is based on an integrated energy storage solution. Its objective is twofold: allow a tram to operate without overhead catenary lines and increase tramway system energy efficiency. Latest technology supercapacitors installed on the roof of the tram store energy recharged in 20 seconds during tram station stops and regenerated during braking - allowing the tram to run autonomously between stops without the use of a catenary hook-up. Building new lines without catenary can reduce investment costs, as well as optimize integration into the urban environment.

### CUSTOMER BENEFITS

#### Close-to-zero impact on infrastructure

Construction time is shortened as implementation is limited to the installation of charging systems in passenger stations. This also leads to reduced trackside-related costs and disturbances.

#### High availability

The solution reaches high availability thanks to dual components integrated in the tram.

#### Energy savings

Citadis Ecopack allows for 40% of regenerative power-supply during braking, leading to savings on energy consumption.

#### Preserves the beauty of city centers

Citadis Ecopack provides the possibility to eliminate any overhead and wayside infrastructure obstacles (overhead wire and masts), thus providing better use of the platform for all needs (roads, sidewalks, access to firefighters' ladders) and facilitating traffic in narrow streets, as well as preserving historic sites, trees along the track and overall urban environment.

### HIGHLIGHTS

- Over 18 million kilometres run without catenary by Citadis trams
- Life duration: 15 years leading to optimized cost of ownership
- Fast charging time in station: 20 seconds



## Technical features

Citadis Ecopack, based on latest supercapacitor technology\*, combines the high energy density of batteries to the strong power of condensers. Per Citadis tram, this **offers an installed reserve of energy from 9 to 13.5 kWh, well beyond needs in nominal or degraded mode.** The identical energy storage boxes installed on the tram roof facilitate the operation for the drivers who do not have to manage the transition between a main source of energy (supercapacitor) and a second source of energy used exclusively in degraded mode.

When the tram runs in autonomous mode, the Citadis Ecopack **powers both traction and the auxiliaries for passenger comfort** including heating or air-conditioning.

The Citadis Ecopack architecture is straightforward making **life easy for driver and fleet maintainers.**

The recharging equipment in tram stops is compact and integrated into the tram stop shelter – **no need for obtrusive street-level or buried cabinets** to house it.

As an alternative to ground recharge, recharge in station by catenary is also possible.

## How does it work?

As a tram approaches a tram stop, it picks-up a coded signal from the in-street power supply equipment. Once the tram is stationary, a power charging shoe - **based on proven design thanks to 15 years' return of experience** - is lowered to make contact with the power supply rail providing over 99.95% availability. The supercapacitors are recharged in just 20 seconds. They store more energy for their weight and size than alternatives and give superior life cycle performance. **Fast-charging is insured without impact on the time spent in station during tram stop.**

**Transition between the recharge and the running modes is automatic – there's no action for the driver.** The power charging shoes are raised and coded signals are exchange between the vehicle and the ground to cut power supply before the tram moves off.

**When the Citadis Ecopack unit is not fully charged, energy from braking is used to recharge it.**

When a tram reaches the end of a catenary-free line section, the transition to continuous catenary power supply is done automatically, triggered by a transponder.

*\* Citadis Ecopack can also be based on a mixed APS & on-board autonomy solution. This solution was chosen for Porto Maravilha integrated tramway project in Rio de Janeiro.*



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