

SmartBUS® the Italian innovative electromobility system for urban transportation

E-CO, www.eco-hev.com, spin-off and partner of Politecnico di Milano, in JV with Chariot Motors Higer, has designed and developed SmartBUS, the world's most efficient, zero emissions electric bus, suitable for **new city bus market** industry.

This transportation solution provides an **economically competitive alternative to existing fleets** of polluting and inefficient fossil fuel powered city buses.

The SmartBUS uses an innovative HESS hybrid Ultracapacitor-based energy storage system developed by E-CO, instead of conventional ion-litium battery technology.

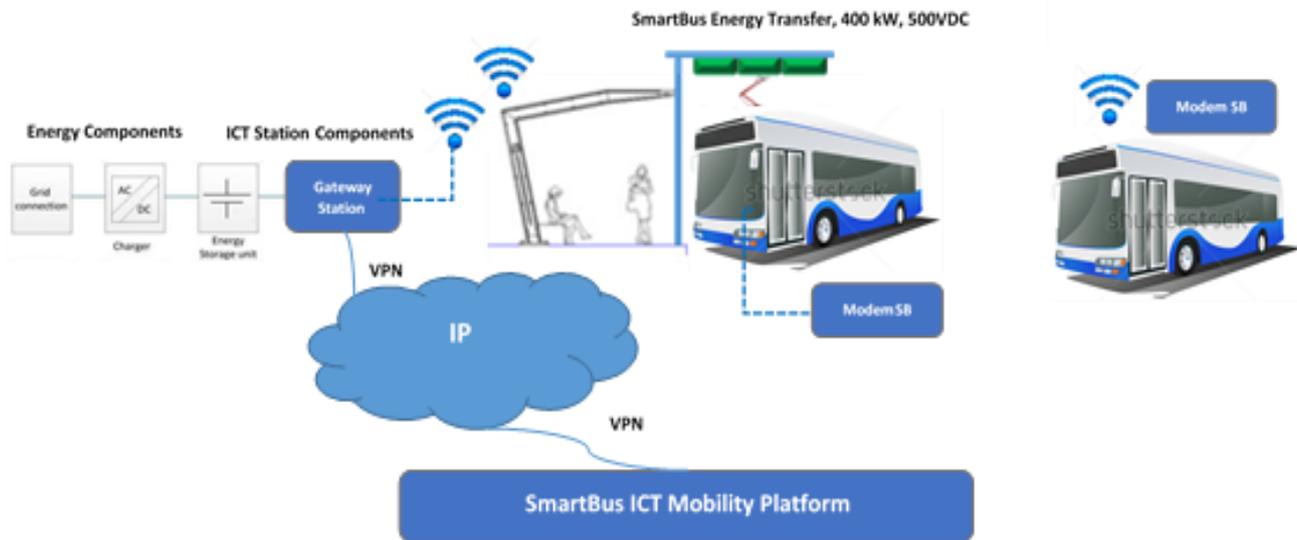
As a result, it provides a safe, reliable and cheap solution that meets or exceeds all European environmental and safety standards.



Social Benefits

SmartBUS is the world's most efficient, zero emissions, zero city envi impact, today on the road citybus. In addition to being safe, reliable and comfortable, the SmartBUS has attributes which help address social challenges, including:

- ✓ its lack of internal combustion engine, which helps to reduce noise pollution, wherever it is deployed;
- ✓ its zero-emissions profile, which improves the air quality in urban areas and contributes to the improved health of residents;
- ✓ its low-entry kneeling floor and wheel-chair ramp, which help to improve accessibility for passengers with limited mobility;
- ✓ its provision of free Wi-Fi, which allows passengers to stay connected throughout their journey;
- ✓ its environmentally friendly HESS – Hybrid Energy Storage System ultracapacitor technology, which does not contain any flammable or toxic substances

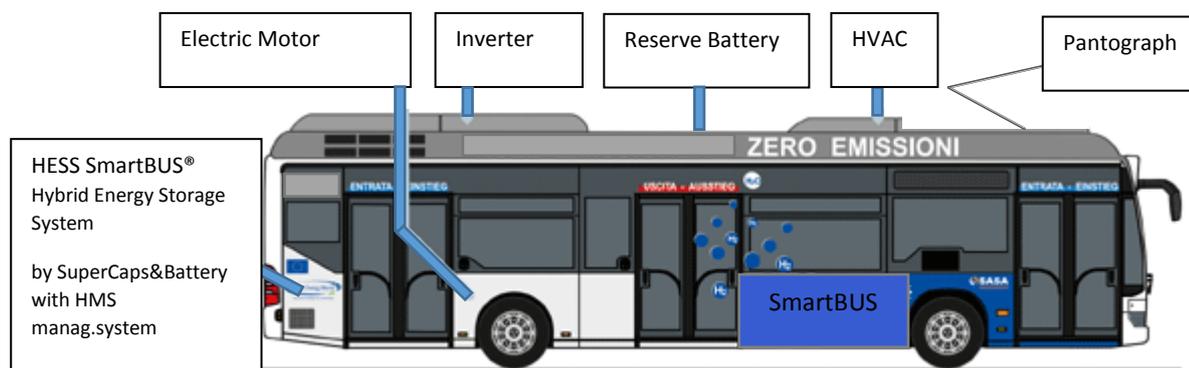


SmartBUS® Key Features

The reliability, utility and operational costs of the SmartBUS are advantageous due to:

- its range of 30 km on a single charge, in 4-5 minutes at a terminal, by HESS energy storage;
- its range up to 50 km by HESS Plus energy storage
- its 35% savings in operating and maintenance costs compared to conventional electric BUS –battery based
- its low electricity demand, with a proven average consumption of less than 1 kWh/km;
- its high average energy recuperation rate of 32%, which is achieved through the use of regenerative braking and which can reach up to an impressive 40%;
- its very low maintenance costs, which can be attributed to the absence of numerous costly systems that are typical of combustion engine vehicles;
- its contribution to significantly reducing the reliance of the transportation fleet upon traditional diesel, CNG, and trolleybus type vehicles, while having the autonomy and capacity required of regular diesel and CNG city buses;
- the fact that it does not require an overhead power line, thus avoiding the construction of heavy infrastructure and associated maintenance costs;
- the elimination of energy storage replacement costs;
- the fact that the performance is not influenced by outside temperatures, and resultantly, the vehicles are capable of operating in various weather conditions without the need for additional energy expenditures.

The SmartBUS on-board architecture



The Fast Charging Infrastructure

The charging infrastructure of the SmartBUS is marked by simplicity, while also being fast and convenient. This is demonstrated by:

- ✓ the fact that one charging station at bus terminals can service all vehicles along the route;
- ✓ the quick recharging time, as SmartBUS only need to charge for between 4-5 minutes;
- ✓ the ability of the SmartBUS to complete an entire route on a single charge, eliminating concerns about range limits;
- ✓ its fully automated charging system, which eliminates the need for human operation, removing the possibility of human error and injury;
- ✓ the convenient location of the charging pantograph, which is mounted on the bus's roof. This makes charging as simple as parking the e-bus, charging it and then driving off after the charge is completed, as the charging pantograph retracts automatically upon completion of the charge;
- ✓ the absence of unnecessarily complicated infrastructure, which is replaced by the charging stations at terminals that are easy and quick to mount;
- ✓ the availability of charging stations with both Alternating Current (AC) and Direct Current (DC) power supplies. Input AC 3x380 V / DC 660 V, Power 150 kW/340 kW, Output V 400-600 V DC, max current 200-250 A DC, Height from ground 4.5 meters



Only 5 minuts-Fast Charging Station at Terminal

The Hybrid Energy Storage System, based on Ultracapacitor

HESS is an innovative hybrid energy storage system made by Ultracapacitor in combo with a small battery both managed by a specific control unit that increases dramatically the efficiency of the system.

The characteristics of the HESS with ultracapacitor technology used in the SmartBUS make it ideally suited to its task. This results from a number of aspects, including:

- that it has been in use for nine years and has been tested on over 10 million km of roadway, making it amongst the best tested and most mature energy storage technology currently used in electric transport commercial vehicles;
- that it has highest energy density, more than 20 Watt per Kg
- that it is a lightweight and small energy storage unit, which enables a range of up to 30 km on a single charge. This allows for the SmartBUS to have a low curb weight and a high passenger capacity with a spacious passenger cabin;
- that it has a high energy recovery during braking, more than 30%
- that it is able to provide the power boost during acceleration, compared to the battery
- that the expected lifespan of the HESS-ultracapacitor based pack is higher than the expected lifespan of the vehicle, eliminating the need to replace the ultracapacitor pack;
- that an intelligent on-board and remote HESS Management System allows for quick and efficient energy management during running with diagnostic and maintenance procedures;
- the low operational and maintenance costs of the HESS system ultracapacitor system over its life-span, resulting from its high reliability;
- that since the HESS is mounted in a safety container, any risks associated with potential accidents are avoided.

Environment

As cities grow, they will have to increasingly provide improved public mass transportation for citizens in order to bolster their quality of life and mobility.

Public transportation also has positive effects on the reduction of traffic congestion and pollution in cities, which are primarily caused by internal combustion engines in cars.

Health

The World Health Organization's Air Quality Guidelines were met in European cities that the average life expectancy amongst 30-year-olds people and older could be increased by many months.

The study indicates that nearly 40% of cases of coronary heart disease amongst older people, and up to 25% of cases of asthma in youngsters in the most polluted cities in the study, such as Barcelona, could be attributed to air pollution caused by traffic.

We can proudly say that the SmartBUS is our answer to that challenge, and is its ultimate solution.