WHITE PAPER

MAXWELL SUPERCAPACITORS: HIGH-EFFICIENCY STORAGE SYSTEM FOR PUBLIC TRANSPORTATION

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Efficiency in public transportation

With petrol reaching a cost of 120$ per barrel just 5 months after having crossed the 100$ per barrel limit, and the CO2 produced by human kind increasing steadily, and new dynamic countries like India or China targeting the same level of consumption as in Europe or USA, the time of waste is over. The solution is to increase dramatically the efficiency of all our energy converting systems. Public transportation, thanks to its visibility, is an excellent way to promote new technology. The latest hybrid buses, more comfortable and more efficient than ever, are the proof that the technology is today available and ready for environment friendly solutions.

Bus hybridisation

At its beginning, the main goals of the hybridisation were to propose more dynamic buses with higher comfort levels. The gain in fuel consumption was relativized by the poor general efficiency of the vehicle. During the last years, the hybridisation became a real mean to achieve the high efficiency required to limit fuel consumption and pollution. The associate challenge was to take into account all high comfort standards which are today a must.

The 2 main means of hybridisation are better control of the engine (steady rpm, start-stop) and the recuperation of the braking energy. To slow down a running bus, its kinetic energy will have to be dissipated mainly in form of heat at the brakes, which means that this energy is purely wasted to wear out a critical safety part. Furthermore, an internal combustion engine (ICE) works on an exothermic and unidirectional reaction. Until today, nobody has found a way to convert the kinetic energy back into fuel. The addition of an electrical system, which is per nature efficient, very flexible and bi-directional, makes here total sense.

A piano to the 30th floor

Recuperating 80% of the kinetic energy of a 15 tons bus running at 20km/h (average city bus speed), represents the recuperation of the energy necessary to lift a piano of 200kg to the top of a 30 floor building within a few seconds!

The supercapacitor is the perfect component to store this kinetic energy. In comparison with battery technology and its chemical reaction, energy storage in supercapacitor is

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based on an electrostatic reaction, with an extremely short time constant. The storage will start immediately when electrons are available. During the acceleration of the bus, this energy will then be resent to the wheels. Due to the extreme low internal resistance of Maxwell supercapacitors, the losses are reduced to a minimum and the energy transfer efficiency is maximized. Furthermore, supercapacitors can be cycled more than 1 million times, which correspond to the life of the bus (15 years).

The results is well represented by the Scania Serial Hybrid Bus Concept: the efficiency of the vehicle is so optimised that the fuel consumption is cut by 25% in comparison with a modern bus of similar capacity at the European standard, and thanks to the use of ethanol, the CO2 emissions are cut by 90%. Scania buses based on this technology will be running this year in Stockholm. Each bus is equipped with 4 HTM125 Maxwell modules, enough to store about 400Wh.

Other opportunity in bus segment

In the bus retrofit market, special modules with supercapacitors can be installed on existing buses. Together with clever electronics, promising tests are on-going which prove that the fuel consumption can be reduced up to 8%, with a minimum addition of weight and with a return on invest of about 1 to 2 years. Thousand of buses could be rapidly be equipped with this technology, resulting in enormous reduction of CO2 and other polluting gas emission.

Time of efficiency in energy management has come. Maxwell supercapacitor, with perfectly adequate technology, has proven to be an essential part in any efficient hybrid system for public transportation. Every running bus could see its consumption significantly reduced, not later than today.

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