K-VEC

Improving Ultracapacitors for Fast and “On-demand” Charging of Public Transport Vehicles

Electromobility+ Conference | 20 May 2015 | Berlin

Key Data

Project acronym K-VEC

Start date 1st June 2012

Project partners: - Sequoia Automation – SEQ (IT)

- Bergische Universitat Wuppertal – WUP (DE)

Project envisaged completion: June 2015

Project Funding: - envisaged cost: € 680,610

- envisaged grant: € 329,400

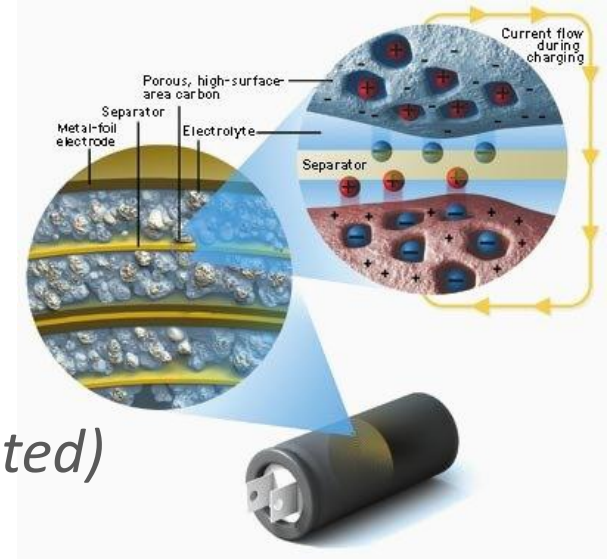
K-VEC Focus

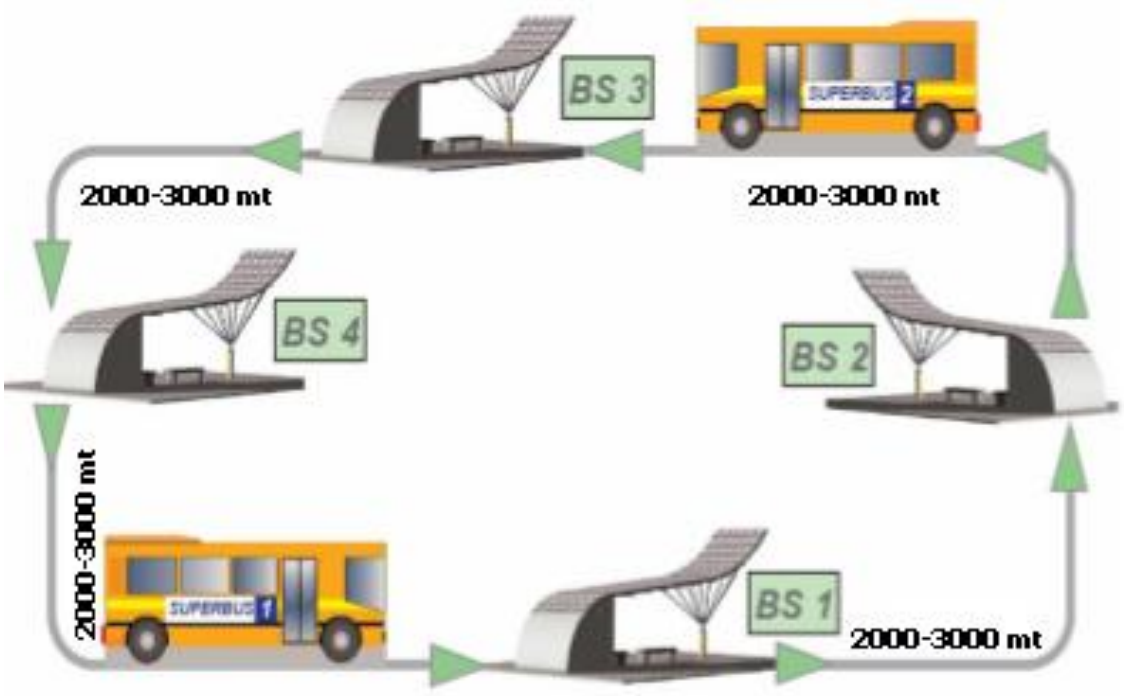
The Supercapacitor Technology

is the energy storage system

*with the highest **ESOEI***

(Energy Storage On Energy Invested)

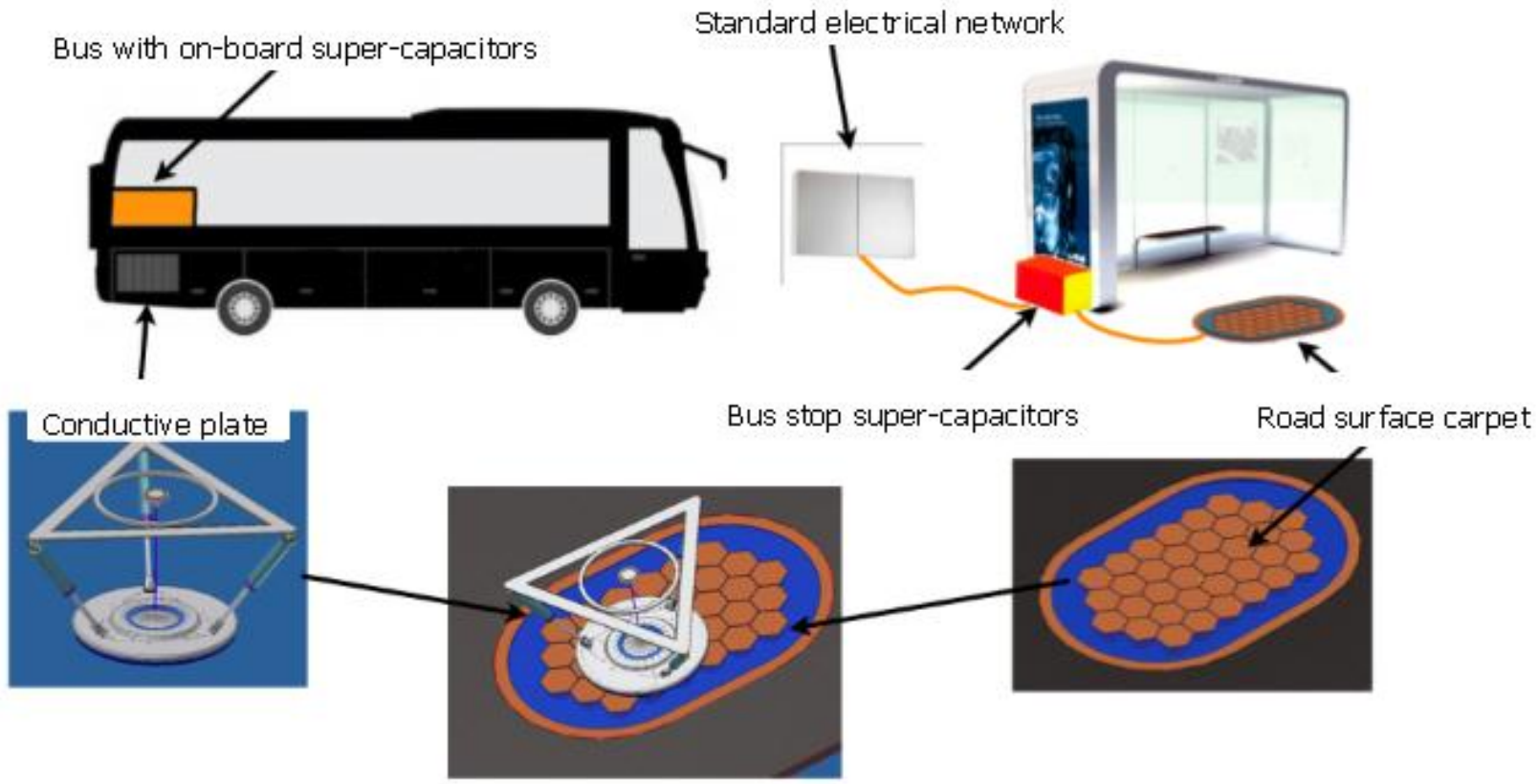




Hence the mobility model is based on the availability of multiple ultrafast recharge points distributed over the territory

K-VEC Bus Application Case - Lay-out

The bus is fully recharged at the bus stop, during the usual pick-up and drop-off time (< 60 s)



K-VEC Supercapacitor Advantages

- *ultrafast recharge capability (<20 sec)*
    - *made by of **common** and **cheap materials** (carbon and aluminium)*
- *lifetime of over **1,000,000** cycles*

*extremely **flexible,** can be employed on different vehicles and contexts;*

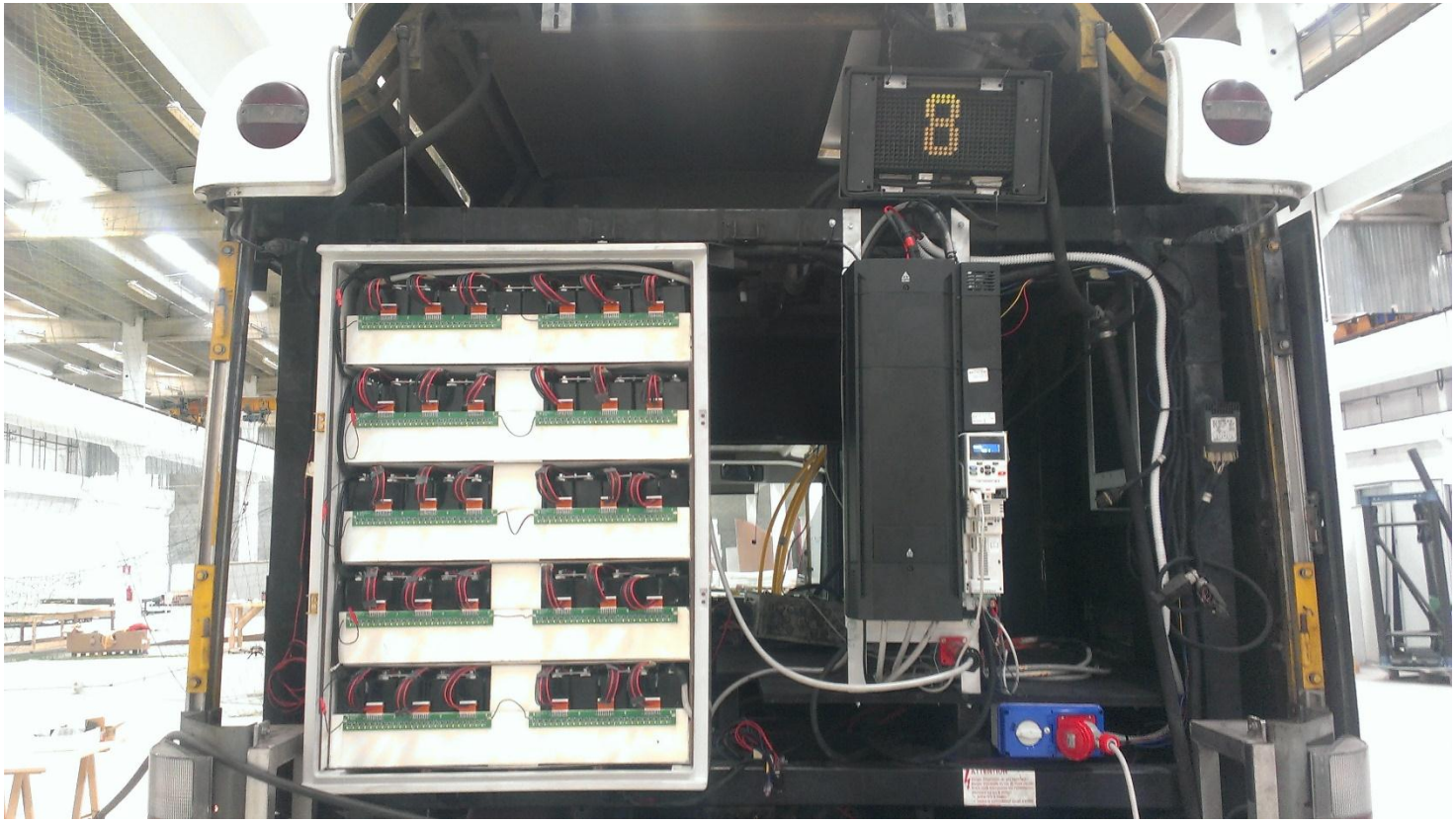
***minimized environmental impact,** low CO2 emissions, long product life-cycle vs conventional batteries;*

***Virtually infinite autonomy of the vehicle,** relying on the existing structures in the area;*

K- VEC Supercap Storage

on-board:

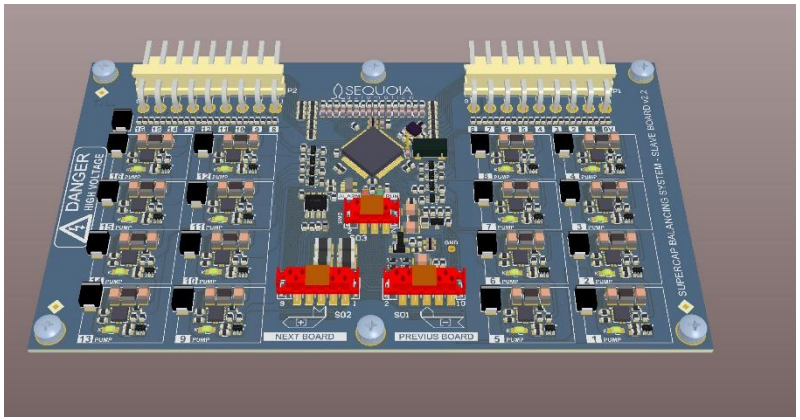
- (2,7 V – 3 Wh)* 240 supercap = 650 Volt – 720 Wh
- Inverters (adaptable A/h, Volts);

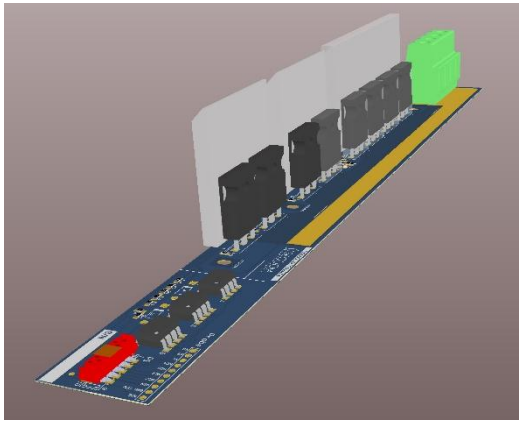


K- VEC Supercap Storage

on-board :

- Active balancing;





- Kers;

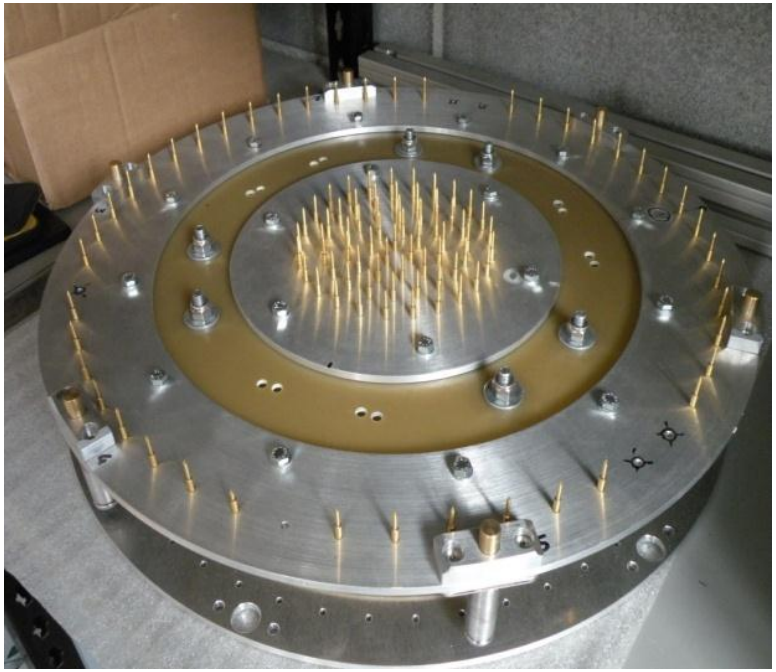
K- VEC Supercap recharging device

- conductive ground recharging device (carpet)

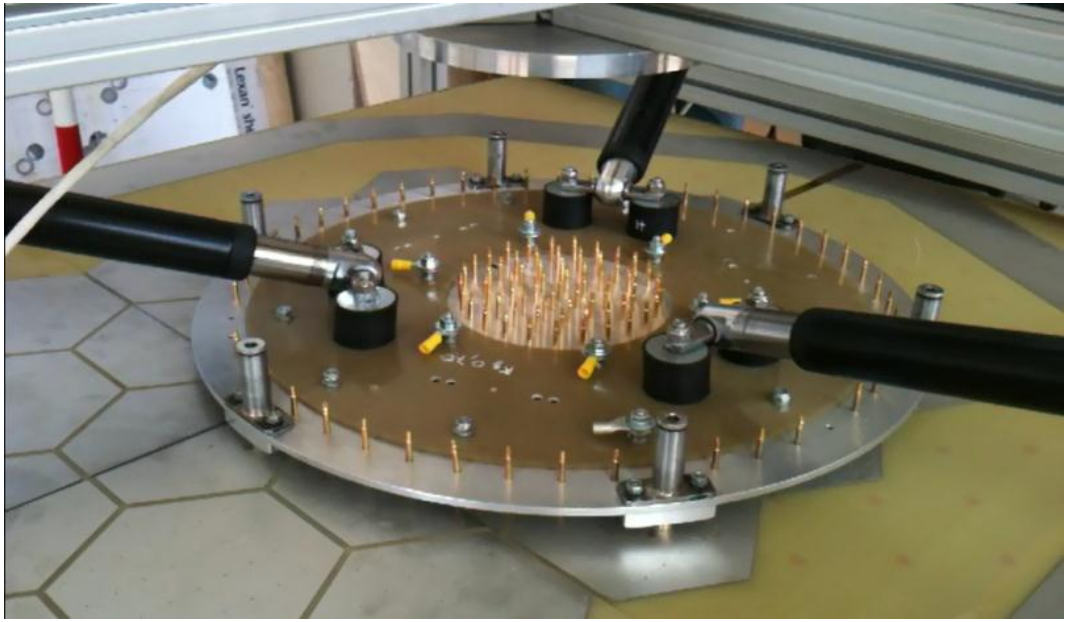
- on-board conductive recharging device

K- VEC Supercap recharging device

- Plate of the recharging device



- Plat + carpet of the recharging device



K- VEC Supercap Storage

Charging Station: ground based recharge control system

- 475 Volt (2,7 V *176)
- Supercap: 176 * 2 = 176 *3Wh = 1056 Wh
- Inverter: (190 A/h * 6); Volt 30V – 70V;

K-VEC Achievements

SEQUOIA automation

- ✓ demo prototype based on retrofitting of:
  - Cito Mercedes (weight 8550 Kg, length 9,5 m, 53 passengers);
  - generator 120 kW, motor 85 kW;

- ✓ Engineering of supercapacitor management system (**balancing and ultrafast recharge**):
  - 5 sec – 0,5 kW – 1Km autonomy;
  - **No charging speed reduction + minimal Joule effect** by means of an electronic current management system;

- ✓ proof of concept: **connection module**

- ✓ security: the conductive carpet is completely «at ground potential»; the total safety is guaranteed by a computerized control system which applies the voltage only on the part of the carpet connected to the plate.

K-VEC Predictable impact

Extended lifetime and cost efficiency:

- the **cost** of supercap **bus is equal** to an electric bus;
- supercap **storage life** is greater than the bus lifetime itself;
- CAPEX and OPEX projections over 20 years are even lower than public diesel buses;

Higher energy efficiency:

- during braking, supercapacitors allow near **100% of energy recovery**, saving **+ 40% of energy** than electric vehicles;

Intermobility of the public charging station grid:

- the k-bus system is designed in order to adapt to different kinds of vehicles;
- the carpet can withstand the passage of every means of transport;
- **tram grid efficiency**, releasing the grid in squares and highly maintenance rate areas.

K-VEC Scenarios

SEQUOIA automation

Public transports with **defined paths and regular stops**:

- Urban logistics (postal system, courier…);
- Trams;
- Waste management;
- Environmentally protected areas (pedestrian zones, hospitals..);
- School bus;

Private transport in **limited areas with frequent journeys**:

- Airports (service vehicles, passengers, etc..);
- Factories (service vehicles, forklifts, etc..);

K-VEC Development

Sequoia Automation is part of the KiteGen Venture Group. The core business of the company regards the realization of an electric generator that exploit the High Altitude Winds thanks to sophisticated powerwings.

The group owes the **international patent** that protects the supercapacitor management technology for the charging system applied at the electric mobility and the next steps of the company are the following:

- **Urban pilot** project for extended tests;
- **Dissemination**;
- **Fund raising**;
- **Industrial partnerships**;

Thank You!

KiteGenVenture

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