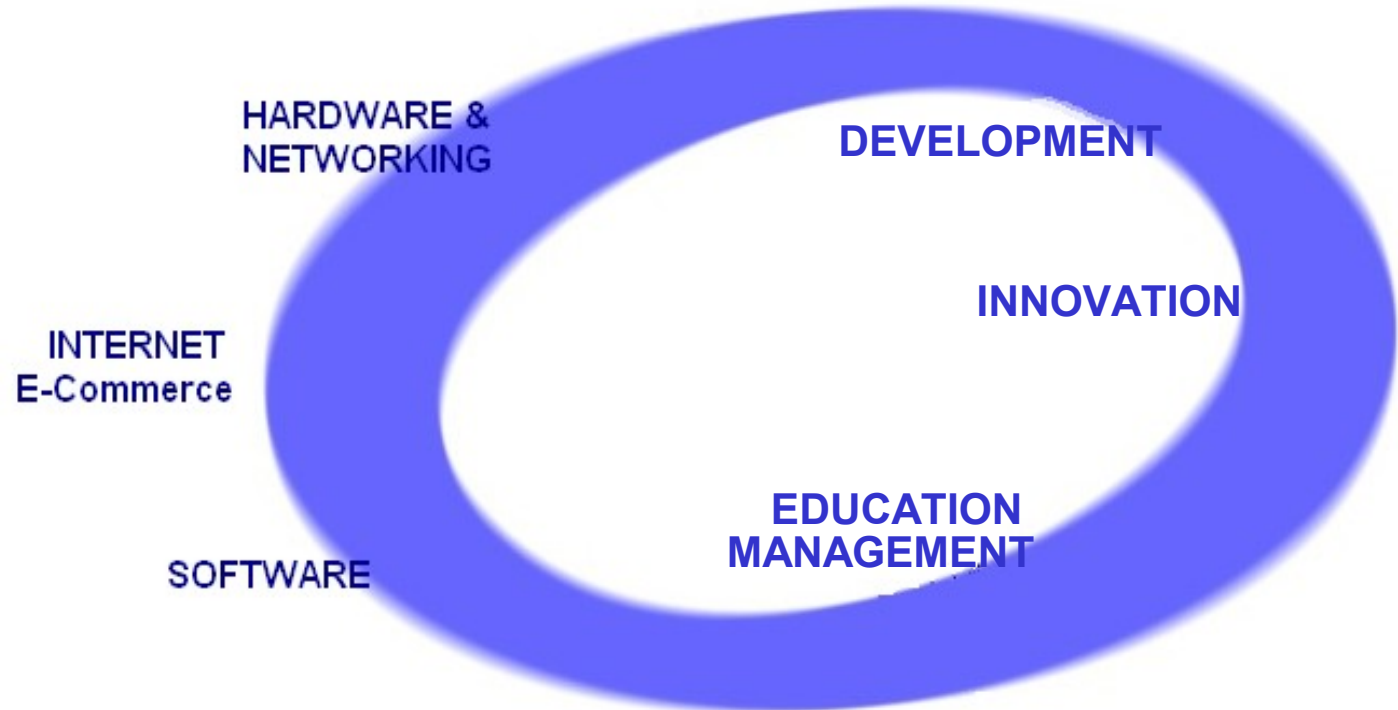


Turbo Boost for Light Electric Vehicle

BOOSTCAP® Meeting Tuesday, 8th November 2005 Fribourg | Switzerland

HYDRA



Massimo Tucci:

- Administrator of Hydra s.r.l.
- co-founder of “Zero Emission Community”
- founder of [www.firenzelettrica .org](http://www.firenzelettrica.org)
- promoter of a new Italian Consortium for EV

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**Hydra s.r.l. is a small company located in Firenze (Florence) Italy.
Since 1993 Hydra offers services in electronic system design.
Develop hardware and software for custom device or systems,
prototypes realization and project coordination is the main activity.**

Electronic

- Microprocessor**
- Software production**

Eco Power Energy

- Light Electric Vehicle Devices**
- Metallic Fuel Cell Applications**

HYDRA Turbo Boost for Light Electric Vehicle

- Background
- Product target
- Product features
- Vehicle improvement
- Pb battery performance impact
- Near future plan
- Metallic Fuel Cell

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HYDRA Turbo Boost for Light Electric Vehicle

Background

Eco Power Energy

For many years the European Union has been investing in new different technology that will limit pollution.

The electric vehicle is one of the most promising.

In particular Florence PA which gives many incentives to private electric vehicle owners. There are some 3500 such vehicles in circulation.

Unfortunately however in many cases there is no proper after sales market and service to support proper growth.



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HYDRA Turbo Boost for Light Electric Vehicle

Product Target 1/2

This design would produce a device able to enhance the usability of an Electric Vehicle.

TBLEV Reduces the driver absorption due to heavy throttle usage.

The range increment aimed at is 20 / 40 % depending on travel conditions.

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HYDRA Turbo Boost for Light Electric Vehicle

Product Target 2/2

At present we are evaluating the following Vehicles:

bicycles, scooters and city cars.

A specific device for these vehicles could be fitted at manufacture of the EV or for retrofit.

Energy recuperation in braking and downhill driving is also being targeted but is not currently a priority.

BOOSTCAP is the solution to supply high energy

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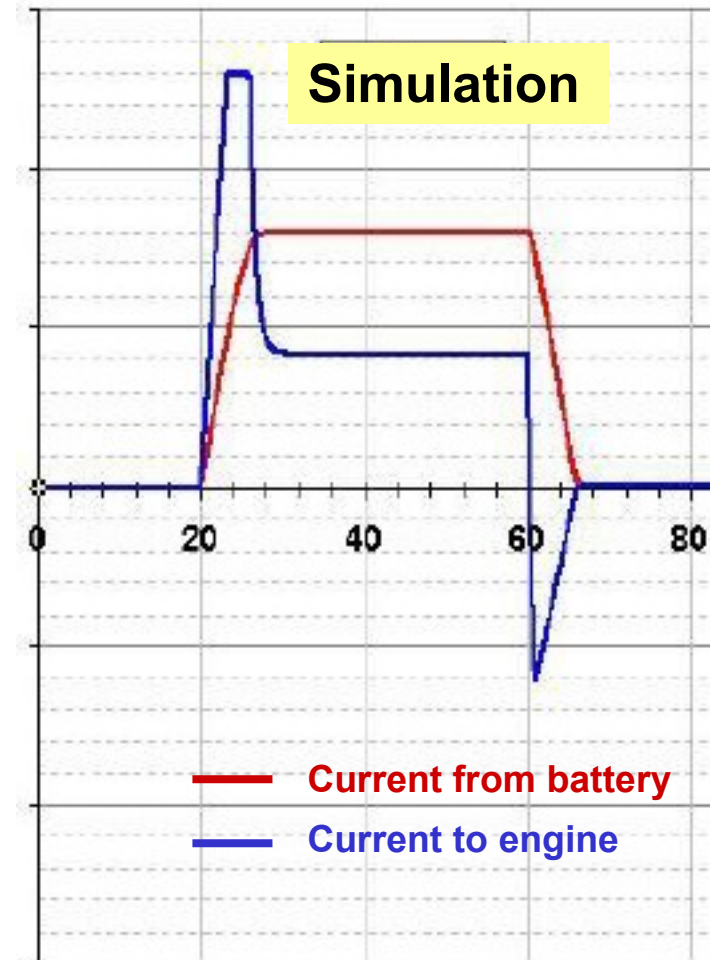
HYDRA Turbo Boost for Light Electric Vehicle

Product features 1/2

- Nominal voltage: 24 Vdc
- Maximum voltage: 27,5 Vdc
- Turbo and Boost.
- Steep Climbing Function.
- Battery Current limiter.
- LinBus Programmable on work.

Single UCaps are internally compensated in active mode to reduce energy loss.

With **Turbo Boost**
you can do what you couldn't
before

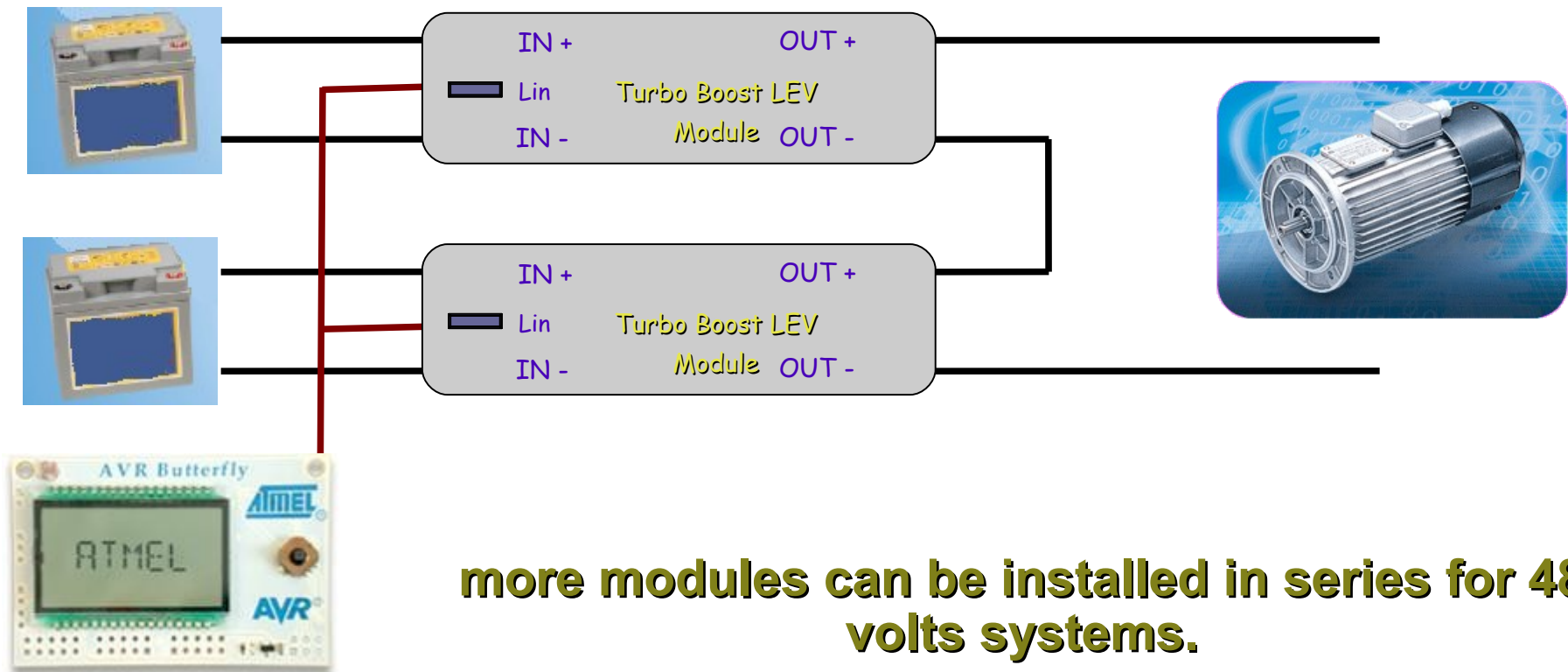


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HYDRA Turbo Boost for Light Electric Vehicle

Product features 2/2

This device is a module



more modules can be installed in series for 48 volts systems.

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HYDRA Turbo Boost for Light Electric Vehicle

Cell Capacitance	350 F
Number of cell in serie	11
Number of paralleled stacks	1
Quantity of cell for a system	11
Surge Voltage	29,7 V
Nominal Voltage	27,5 V
System nominal Capacitance	31,82 F
Stored Energy	3,34 Wh
	12,03 kJ
Peak Power	5,22 kW
ESR Boostcap	35,2 mOhm
System ESR	36,2 mOhm

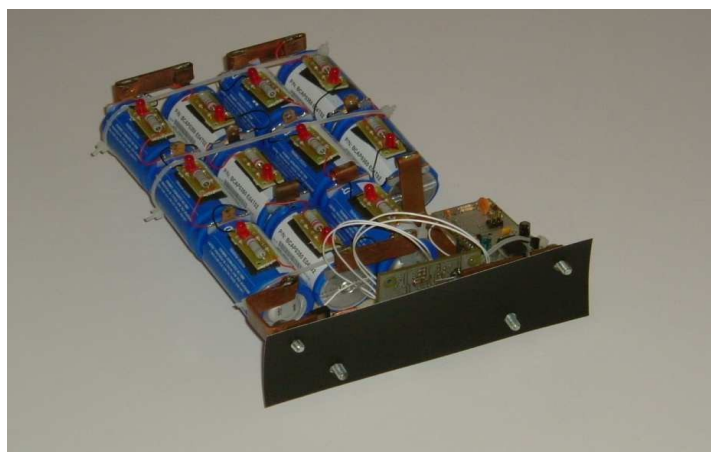
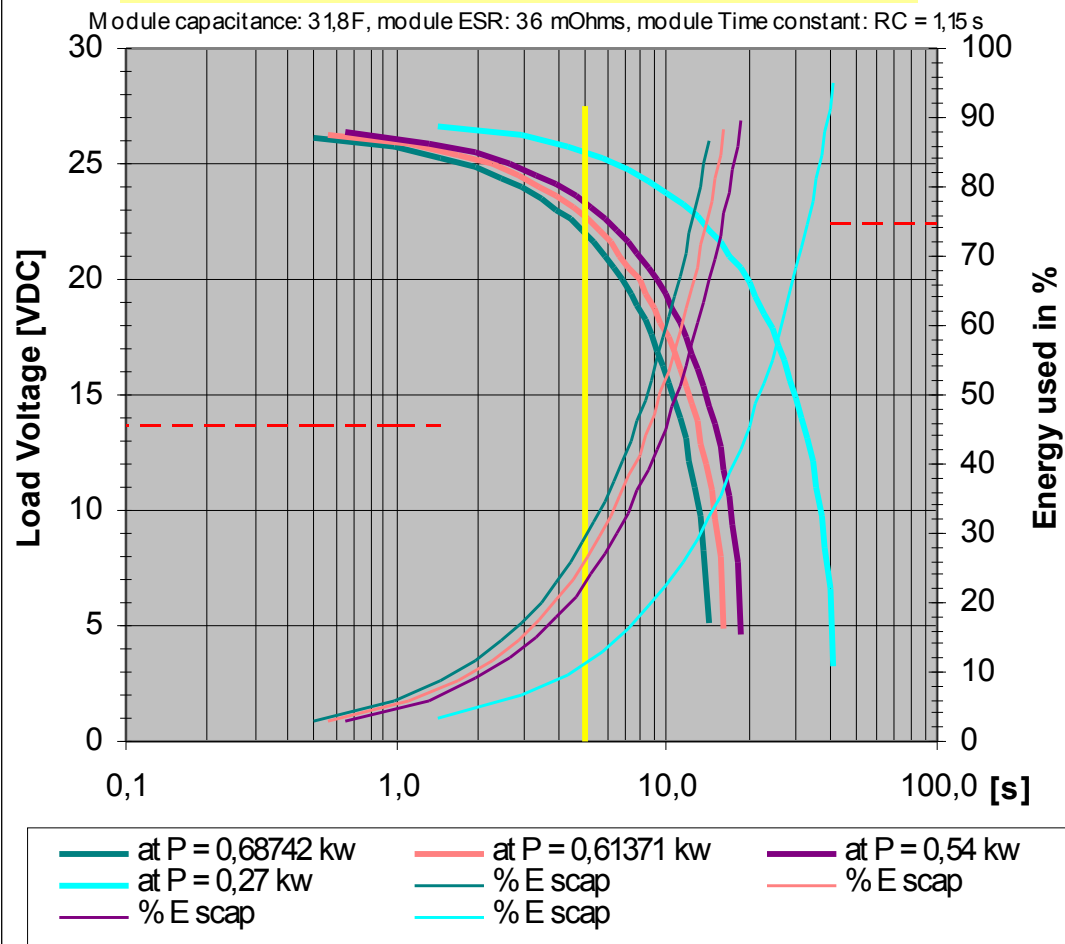


Fig 3

Discharge duration at constant Power

Module with 1 Stacks of 11 BCAP0350 Cells of 350 F charged at 27,5 VDC



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HYDRA Turbo Boost for Light Electric Vehicle

Vehicle Improvement

TURBO

This command sets over current to a programmable value, but never lets over nominal capacity, to give more cruise speed.

BOOST

This command over charge ultracapacitors, not exceeds maximum value, to climb a steep.

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HYDRA Turbo Boost for Light Electric Vehicle

Pb Battery Performance Impact

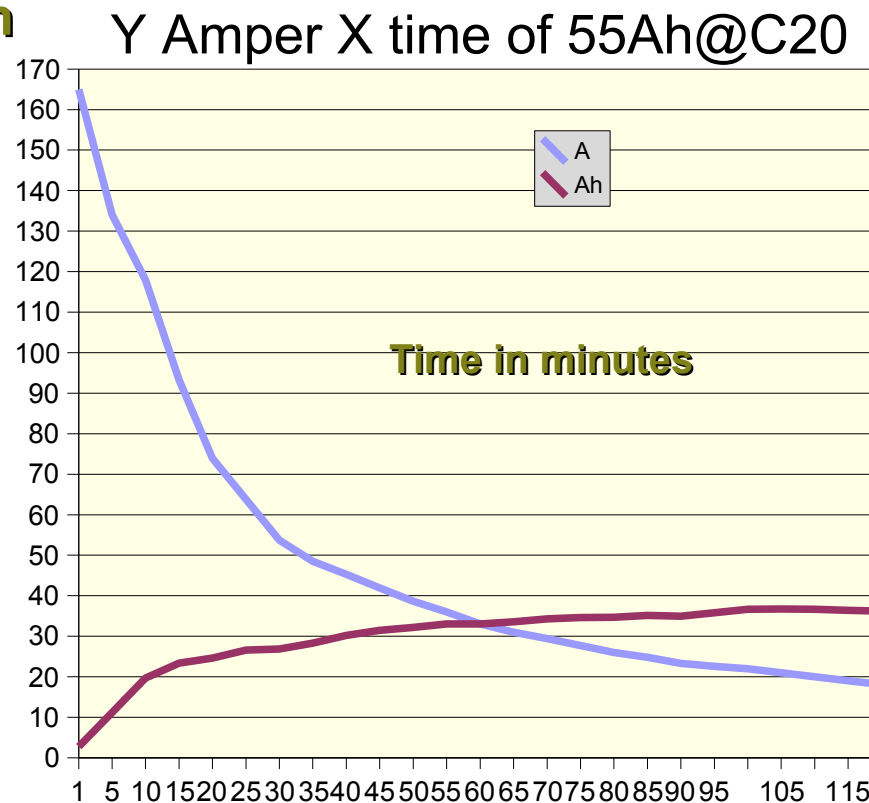
The diagrams show the dramatic reduction of battery capacity when the current exceeds 60% of nominal capacity.

This current is the typical value in vehicle cruise speed, on climb too.

Our TBLEV module is capable to limit current from battery under a programmable value.

All the energy peaks, some seconds normally, required from engine are supplied from BOOSTCAP. In urban area the stop&go drive is common and can reduce until 50% of battery capacity.

With TBLEV, battery capacity is preserved and range increased!



Typical battery time of discharge versus current.

HYDRA Turbo Boost for Light Electric Vehicle

Next Steps

- Test completing and Design Fine tuning
- Commercialization of TBLEV
- Combine w/ Zinc Air Technology

Lead-Acid Battery
Total 62 lbs 920 Wh
----- / 2 batteries
→ 31 miles
(50 km)



NiMH Battery
Total 53 lbs 960 Wh
----- / 2 batteries
→ 38 miles
(60 km)



131 miles
(210 km)

1x DQFC-24-3200 (36lbs), 3270 Wh,

- Scale up Model for other vehicles City Car & BUS

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HYDRA Turbo Boost for Light Electric Vehicle

Metallic Fuel Cell 1/3

Our interest in UCaps is for an application that will be used in conjunction with Fuel Cell.

Hydra is involved in introducing MFC in Italy.

This is a good solution to replace current battery systems in EV.



This energy storage technology is now available in small and large devices.

It is usable in small vehicle such as bicycles, scooters and heavy such as cars, transportations and buses.



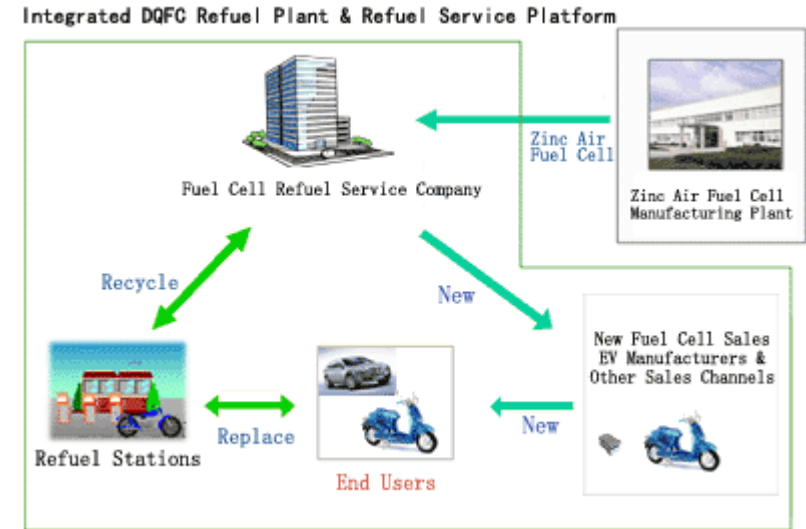
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HYDRA Turbo Boost for Light Electric Vehicle

Metallic Fuel Cell 2/3

This technology is very interested in many aspects:

- Clean. Nothing to recycle.
- Ready (in China).
- Not expensive.
- High density of energy. Near 200 Wh/Kg.
- Vehicle ready in a few minutes (mechanical refuel).
- Good energy storage from energy producer. Recover night energy.



Bus 300Km range 80Kmh

Scooter 250Km range 70Kmh



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HYDRA Turbo Boost for Light Electric Vehicle

Metallic Fuel Cell 3/3

To use FC with EV, BOOSTCAP are a good solution to solve some technical aspects.

The Ultracapacitors solutions are:

- Peak power. Fuel cells have a very good energy density but they are not good suppliers for the peaks. BOOSTCAP can supply this.
- Fuel cells cannot recover energy in reverse conditions (braking and down hill). UCaps can make it.

We are looking for partners in this program.

email program: pzinc@hydra.it

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