

# LAMPO: QUESTIONS & ANSWERS

## What is the aim of LAMPO?

The main goal is to develop a fully functional showcar that can convince passive and even skeptic decision makers that modern electric vehicles allow the greatest driving pleasure, and showing that battery driven vehicles represent the most suitable short-term solution. This conviction simply ought to be generated by the EXPERIENCE OF DRIVING the prototype.

Through LAMPO, Protoscar and its partners aim to be able to demonstrate the innovative technology which includes absolute innovations like „intelligent charging“ or interactive GPS-based „range estimator“.

## Why is Protoscar unique in its line?

For over 20 years the COMBINATION of design background & CleanCar market experience has been our uniqueness. Our CleanCar experience started in 1987 with the design and realization of solar&electric racing cars using lightweight composite structures and body styles optimized by intensive wind-tunnel testing. During the nineties our experience was put into service of the VEL1 project in Mendrisio (Europe's biggest EV demo project so far, carried out in Mendrisio - approximately 7'500 inhabitants - where over 400 EVs - equivalent to nearly 8% of market share - were introduced, mostly to private users): this project was managed by Marco Piffaretti from 1994 to 2001. Moreover, our CleanCar competences were and are continuously updated by attending the most important events like EVS (since the 11th edition, 1992, Florence) where dozens of papers have been presented, and by the continuously growing worldwide network of experts collaborating with Protoscar.

## Which are the main services that Protoscar offers?

The great experience and the holistic approach allow us to know how to MATCH offer and demand for CleanCars, and are based on:

- our automotive cultural and educational background,
- 20 years of specific CleanCar vehicle layout and design competence,
- real EV-market experience (Mendrisio VEL-1 program),
- knowledge of the relevant legislation (particularly for Europe) as demonstrated by the loyalty of our long-term clients such as Daimler, Nissan, Esoro-Rinspeed, General Motors, etc.

Thanks to the above mentioned unique capabilities, we have done, and are doing:

- definitions of strategies and specifications - from a European user point of view - for new generation EVs and PHEVs, on behalf of OEM (also based on a very deep WtW-knowledge in terms of efficiency and CO<sub>2</sub> emissions of nearly 1'000 feasible energy paths),
- EV market-planning, also based on interviews of real long-term private Evdrivers asking them about their habits, experiences and goals in order to apply them to the “next-gen” Evs,
- design (engineering and styling) of CleanCars in terms of component selection, layout, exterior and interior design and digital 3D make-up,
- keep contact with all major European EV promoters in terms of associations, regions, cities, major events (e.g. World Exhibit 2015 in Milano) and power utilities, in order to be able to suggest what “potential pilot market” is most suitable for which “potential pilot offer / type of car”, in terms of CleanCars,
- assist OEMs planning to introduce EVs in the European market (for instance introducing battery-rental systems or potential car-sharing partners),
- development of concepts, software and hardware for public charging infrastructure (over 150 public charging systems made by Protoscar installed in central Europe, so far),
- elaboration and implementation of communication concepts (mainly for special events and motorshows) in order to explain and demonstrate new CleanCar related technologies and fuels.

### **Why did EVs so far not succeed?**

“The battery!” is probably the most common answer – but we think that this is neither the only, nor the main reason.

But in fact, with the exception of the Toyota Prius, to date car manufacturers have not yet reached a commercial success (=earn money!) in terms of CleanCars. One important reason is the lack of emotional, sexy aesthetics of these cars: the declared goal of the OEMs is to build EVs as similar as possible compared to conventional cars (in order not to change the user’s habits and to keep investments under control). A second reason is the strategy referred to vehicle types. It would have been very surprising (and a first time event in history) if a new technology such as electric drive had been successful pursuing a bottom-up strategy, starting with small city cars (e.g. as “second” vehicles “for the wife”). In fact, throughout automobile history, new technologies always have been introduced top-down, starting from small niche productions and exclusive, as well as rather expensive, products such as luxury and sports cars.

### **Why shall CleanCars be attractive?**

CleanCars (battery EVs, hybrids, FC-vehicles) offer some new and very unique opportunities in terms of features, but they also require very different packages and therefore lay-outs due to their specific components. Volume, weight, position, cooling requirement of the components are in fact very different from those of conventional cars thus the only reason to “squeeze” and “adapt” these components into a conventional platform obviously is to limit investments/costs. At Protoscar we believe that the drivetrain characteristics shall directly influence the styling and design of a CleanCar, which also will include some innovations in terms of driving pleasure and fun, such as the 7 recent showcars Protoscar designed for Rinspeed. All of these are Biogas-powered,

demonstrating that sporty performances and fun are compatible with renewable fuels and sustainable individual mobility.

### **How shall the next generation of CleanCars look like?**

Only recently - and in our opinion still not often enough – has the production of CleanCars started to be packed into emotional styling: in the next years vehicles such as Tesla Roadster will very likely demonstrate that this can be a profitable and successful way to commercialize CleanCars. Zero - or low - emissions will certainly not be the only drive. Rational, bottom-up concepts are too dull and “dry” to warrant an easy commercial success. Thus the conclusion that whichever CleanCar is developed, the emotional styling and the innovative added values for the users have to be at least as carefully implemented as the modern traction system itself. Possibly into a dedicated - and not a carryover - platform.

### **What are the environmental benefits of LAMPO connected to a remote solar plant?**

Thanks to a lightweight Lithium-Ion battery pack with a capacity of 33,6kWh, over 200km of range are possible between recharges: those can be done using every standard EU plug. The on-board charger also recognizes automatically if an accelerated 7kW “booster” charge can be supplied by the electric network. A remote 16kWp photovoltaic plant (using amorphous silicon solar cells) produces 16’800 kWh/year, which ends up in enough clean energy for covering over 108’000 km/year. This means about 8 times the yearly average european mileage of 12’800 km and would result in a saving of 3,2 tons of CO<sub>2</sub> if compared to a similar size gasoline car.

### **Why did you choose solar energy as a primary energy source?**

We want to use exclusively renewable energies for powering our cars. Compared to wind, hydro or geothermic plants, the photovoltaic plant is more modular in terms of dimension and installation, has no impact in terms of visibility and noise (wind) and doesn’t depend on the difference of level (hydro). Furthermore, existing infrastructures (such as the roof of the cow shed of the holiday farm Vitabella-Palazzetto in Seggiano ([www.vitabella-palazzetto.com](http://www.vitabella-palazzetto.com)), can very easily be used as a base for such plants.

The extremely high energy efficiency of the whole system allows to transform over 80% of each kWh produced by this photovoltaic plant into driven km: 3 times better (see: [www.optiresource.org](http://www.optiresource.org)) than the best internal combustion cars can do with diesel fuel! Never before such ultimate zero-emission performances have been demonstrated at such excellent level of overall Well-to-Wheel efficiency – and on top of it without any drop of oil!

### **Does LAMPO have solar panels on its roof?**

No, actually LAMPO is not provided with solar panels on the car itself. The main reason is that on one side we optimize the solar plant in order to produce energy, and on the other we optimize the car for driving: the car roof would not allow to install big enough panels for supplying sufficient energy for its remarkable range, and furthermore it would sometimes suffer from shadow or bad exposure to light, reducing the electricity production.

Protoscar knows this by personal experience: it has contributed to build such direct-solar cars (where solar panels are installed on the car itself) as well: first experiences date back to 1986, when Protoscar participated in building the "Pegaso", the first solar racing car for "Tour de sol" competitions realized by the TTVS (TeamTicinoVeicoloSolare). By the way, some members of that pioneering Team, namely Giorgio Städler Claudio Rusca and Alfio Ghidossi, have also offered their precious help for the LAMPO project.

### **Which kind of photovoltaic plant do you use and where is it located?**

The 260 m<sup>2</sup> of thin film photovoltaic plant (amorphous silicon), which has a peak power of 16kW and an average production of 16'800 kWh/year is installed on the roof of an existing cow shed in Tuscany.

The manufacturer of the photovoltaic laminate, United Solar Ovonic, is the world's leader in thin film solar technologies and the manufacture of thin film solar electric laminates. Distributed globally under the UNI-SOLAR® brand, the company's products are ideally suited for cost-effective solar roofing solutions because they are lightweight, durable, flexible, can be integrated directly with building materials, and generate more energy in real-world conditions. The solar plant located at our partner's site in Seggiano ([www.vitabella-palazzetto.com](http://www.vitabella-palazzetto.com)) is installed by the Grosseto-based company TECNA. This plant is under construction and will be fully operational by May 2009.

### **What are Lithium batteries?**

Lithium batteries are batteries that use lithium metal or lithium compounds as an anode. Depending on the design and chemical compounds used, lithium cells can produce voltages from 1.5 V to about 3.7 V, twice the voltage of an ordinary zinc-carbon battery or alkaline cell. Lithium batteries are widely used in products such as portable consumer electronic devices. The term "lithium battery" refers to a family of different chemistries, comprising many types of cathodes and electrolytes. The most common type of lithium cell used in consumer applications employs metallic lithium as anode and manganese dioxide as cathode, with a salt of lithium dissolved in an organic solvent. Lithium batteries find application in many long-life, critical devices, such as artificial pacemakers and other electronic medical devices to be implanted. These devices use specialized lithium-iodide batteries designed to last 15 or more years.

[source: [http://en.wikipedia.org/wiki/Lithium\\_battery](http://en.wikipedia.org/wiki/Lithium_battery)]

### **What are the differences between the LAMPO batteries and other lithium-ion systems?**

Cells sold today as polymer batteries – such as used in LAMPO - have a different design from the older lithium-ion cells. Unlike lithium-ion cylindrical, or prismatic cells, which have a rigid metal case, polymer cells have a flexible, foil-type (polymer laminate) case, but they still contain organic solvent. The main difference between commercial polymer and lithium-ion cells is that in the latter the rigid case presses the electrodes and the separator onto each other, whereas in polymer cells this external pressure is not required because the electrode sheets and the separator sheets are laminated onto each other.

As no metal battery cell casing is needed, the battery can be lighter. Moreover it can be specifically shaped to fit the device that the battery will power. Because of the denser

packaging without intercell spacing between cylindrical cells and the lack of metal casing, the energy density of Li-poly batteries is over 20% higher than the one of a classical Li-ion battery.

### **How does the public charging system work?**

The concept "Park & Charge" is based on a mere lump-sum (yearly flat rate) energy imputation, i.e. no exact energy calculation per charge but average yearly cost: exactly the same system, used since years for paying the toll sticker for using Swiss highways.

This system is finding more and more interest all over Switzerland. Until today, some 100 charging stations of this type have been installed, particularly in the Ticino area (home of Protoscar, and where the Mendrisio-VEL-1 demo project has been carried out between 1994 and 2001). The growing number of users has allowed to lower the price for each participant (actually 40 CHF/year). Drivers of electric vehicles, which are organized in the so called "Electromobile Club of Switzerland" (ECS) are becoming increasingly involved in periodically controlling these charging facilities and to organize maintenance, if required (lemnet.org). The success of the Park & Charge-system in Switzerland has led to its introduction also in Germany. Further expansion is planned all over Europe.

To meet the proposed goals, E-TOTEM ([www.protoscar.com/e-totem](http://www.protoscar.com/e-totem)) chargers have been developed. It typically consists of a resistant polyethylene housing containing essentially 3 sockets, fed by 240V tension, 10, 16 or 32A protected, with a FI-leakage protective switch. The user can obtain access to the recharging outlet with a special key, which is the same for all Park & Charge installations.

### **How do you carry luggage on the LAMPO as there isn't any trunk on it?**

Since (because of time and budget limitations) we were unable to develop a specific chassis for building the LAMPO, we had to adapt ourselves to a carry-over platform. Therefore we had to accept several compromises in accommodating all the new powertrain components where it was possible. Of course, for a production car this would be different, since layout would had to be optimized both in terms of weight distribution and more rational use of available volumes. Under the front hood, as well as under the trunk hood of the LAMPO, the volume is therefore fully dedicated to the components of the electric powertrain. Thus right now we do not in fact offer any space for luggage. But we are working on an inflatable, extensible luggage compartment (as well as on other inflatable lightweight applications for cars) to be placed on top of the rear trunk, and we intend to present this innovative solution during the 2010 Geneva Motor Show.

### **How much does LAMPO cost?**

LAMPO is a technology demonstrator - a concept car - realized in a unique piece. This car is therefore not for sale. But its cost (including the photovoltaic plant able to produce all the electricity needed to drive it for its entire life!) would be less than the price for a new Bugatti Veyron...