

ITALY DAY

ABSTRACT TABLE OF PROJECT PROPOSAL

PROJECT Nr. 24

SECTOR: Sustainable Transportation / Energy

PROJECT IDEA IN A HEADLINE: This project focuses on the development of a conversion kit (equipments, along with associated techniques and methodologies), aimed at converting conventional cars into hybrid solar vehicles (Mild-Solar-Hybrid).

INNOVATIVE POINTS: The project represents the commercial evolution of a European patent recently filed by the team members.

Patent: WIPO Patent Application
KIT FOR TRANSFORMING A CONVENTIONAL MOTOR VEHICLE INTO A SOLAR HYBRID VEHICLE.

The hybridizing equipment is installed on a conventional car (two front wheels drive), in which the front wheels are propelled by the Internal Combustion Engine (ICE) controlled by an Engine Control Unit (ECU). The vehicle is also equipped with an EOBD gate (On Board Diagnostics protocol), which allows accessing data such as pedal position, vehicle speed, engine speed, manifold pressure and other variables.

A mild parallel hybrid structure is obtained by substituting/integrating the rear wheels with in-wheel motors.

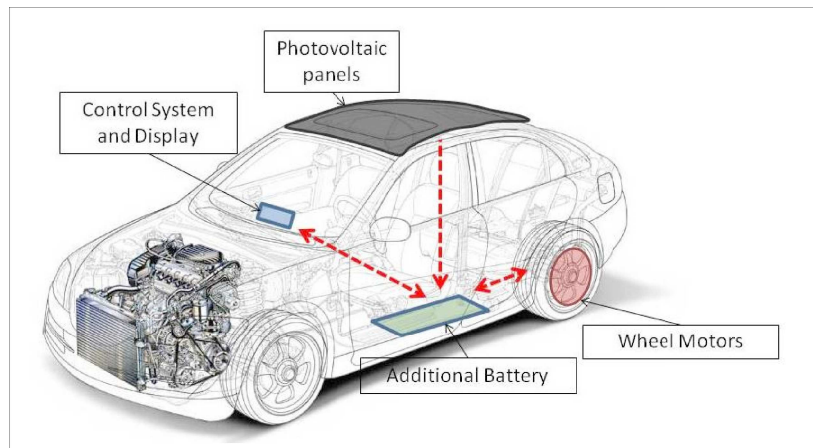


Figure 1- schematics

In that way, the vehicle can operate in pure electric mode (when ICE is switched off or disconnected by the front wheels) or in hybrid mode (when the ICE drives the front wheels and the rear in-wheel motors operate in traction mode or in generation mode, corresponding to a positive or negative torque). The battery can be recharged both by rear wheels, when operating in generation mode, and by photovoltaic panels. The Vehicle Management Unit (VMU), which is part of the invention and implements control logics compatible with typical drive styles of conventional-car users, receives the data from OBD gate,

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from battery (SOC estimation) and drives in-wheel motors by properly acting on the electric node EN. A display on the dashboard may advice the driver about the actual operation of the system.

The proposed product has original and innovative characteristics in the idea of combining photovoltaic recharge with the hybridization kit. Currently, there are not such products in the market, and similar devices are still in the development phases, thus it is quite difficult to assess its performance with respect to competitive products. However, a preliminary market analysis has emphasized that:

- most of the hybridization kits do not offer photovoltaic recharge and use smaller electric machines, thus are not able to provide the same range in pure electric mode.
- Conversion kits currently available in the market have different goals, and are usually vehicle-specific (i.e. Toyota Prius or other hybrid electric vehicles) and do not offer the same flexibility.

**POTENTIAL BUSINESSES AND
APPLICATION FIELDS:**

We expect to collaborate with industrial partners and/or consultants involved in the diverse technologies and methodologies that are needed to drive our project from the prototype phase to commercialization.

Also, it is expected to establish an university spin-off to keep research and innovation as key factors of this project.

The project will aim at after-market opportunities, with typical customers being owners of conventional vehicles, who look for options to reduce fuel consumption. It can be installed on most vehicles with front wheel drive and powered by any fuel (gasoline, diesel, LPG, CNG, etc) since it is not connected to the engine itself, but provides additional propulsion by means of an external device.



Figure 2 - proof-of-concept prototype developed.

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In the short-term, our project aims at the Italian automotive market, while in the medium-long term it is foreseeable to approach the European and International market.

- If we focus just on the Italian market, in 2010 there were about 36.7 million vehicles (about 0.6 vehicles per inhabitant).
- In 2008 the European market counted about 256 million vehicles (about 0.46 per inhabitant)
- The World vehicle fleet counted about 681 million vehicles

It is mostly convenient for users who drive mainly in urban areas and less than 1-2 hours per day (more than 50% of drivers). Even with a quite low market penetration, sale volumes would be impressive. In fact, a mere 1% of market penetration would result in:

- 360.000 vehicles – Italian market
- 2.56 million vehicles – EU market
- 6.81 million vehicles – Global market

CHARACTERISTICS OF POTENTIAL PARTNERS:

The team is currently discussing partnership opportunities with Italian companies involved in the broad fields of sustainable mobility and renewable energy, and is also interested in identifying partners within the EU. Potential partners are represented by:

- Automotive OEMs
- Companies involved in vehicle conversions, such as conversion into methane or LPG fuels
- Companies involved in production of vehicle components
- Companies involved in production of standard and ad-hoc photovoltaic panels
- Companies involved in electric vehicle electric research and development.

EU PROGRAMMES TO PARTECIPATE:

Potential opportunities for EU Programmes/Calls are represented by the Seventh Framework Programme (FP7), specifically:

- FP7-ENERGY-2013-1 Energy Call - Part 1
- FP7-ENERGY-2013-IRP Energy Call - Integrated Research Programmes
- FP7-ENERGY-2013-2 Energy Call part 2
- FP7-SST-2013-RTD-1 Sustainable Surface Transport (SST) including European Cars Initiative

BRIEF PROJECT DESCRIPTION

The project proposes the development of a of a conversion kit (equipments, along with associated techniques and methodologies), aimed at converting conventional cars into hybrid solar vehicles (Mild-Solar-Hybrid), with specifics that make it viable for commercialization.

The main aspect of the projects consists into the integration of state-of-the-art components currently available in the market (in-wheel motors, photovoltaic panels, batteries), and into the development of an optimal controller for the power management.

The proposed kit reduces fuel consumption and emissions, thus allowing the vehicle to be driven in ZTL (limited traffic area), with

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limited investment cost and without invalidating performance and safety.

The hybridizing equipment is installed on a conventional car (two front wheels drive), in which the front wheels are propelled by the Internal Combustion Engine (ICE) controlled by an Engine Control Unit (ECU). The proposed solar-hybridization kit is protected by an Italian and EU patent.