

## **HYBRID VEHICLES WITH ELECTRICAL MULTI ENERGY UNITS**

**M. Cacciato, A. Consoli, G. Scarcella, A. Testa**

*Department of Electrical, Electronics and System Engineering  
Viale Andrea Doria, 6 - 95125  
Catania, Italy*

Abstract: In order to evaluate electrical and hybrid vehicles performance, mathematical models of SCs, FCs, and PV modules have been implemented in Advanced Vehicle Simulator. A deep analysis about the advantages of integrate standard batteries with new storage devices, as super-capacitors, fuel-cells and photo-voltaic modules has been done.

For each electrical units described above, an accurate balance has been done. Moreover, using a multi-criteria approach a cost-benefit analysis has been performed considering in a period of ten years, in order to evaluate the economical advantages of using the additional units.

Keywords: Super-capacitors, photo-voltaic modules, ADVISOR, cost-benefit analysis.