

Research project description

Optimization of hybrid electrical storage systems based on life cycle study (PHC-Utique 15G1134)

Project Directors:

SURNAME/First name/Title	Job Title, Institute and Address	Country
Amine LAHYANI/ Associate. Pr.	INSAT Carthage University	Tunisia
Abdessattar GUERMAZI/ Pr.	ENIS University of Sfax	Tunisia
Ali SARI/ Dr.	UCBL University of Lyon	France
Pascal VENET/ Pr.	UCBL University of Lyon	France

Objectives:

This project aims to make a comparative study based on the life cycle criteria of the use of different hybrid electrical energy storage systems (HESS) for specific applications (in the field of transport, stationary storage, distributed electrical storage in high voltage grid,...). Convergence towards an optimal choice of hybridization source of electrical energy combining batteries and/or supercapacitors, is the expected result. The project was started with a systemic approach taking into account the control of converters as well as power management strategies between the different sources when optimizing the system in order to obtain an increase in its service life. The different types of power management to be developed were validated by simulations with Matlab / Simulink. In parallel, an experimental bench was implemented for validation. Finally, accelerated aging tests on batteries, supercapacitors, at different temperatures and different load profiles will be carried out to observe the impact of hybridization on the lifetime of the overall system. The cost effectiveness of the hybrid will be also an important issue to be studied.

Ph.D student and Post-doc:

Khaled Elloumi/ Dr. Post doc, Electrical Engineering, Tunisia
 Riadh Abdelhedi/ Ph.D student, Electrical Engineering, Tunisia
 Ahmed Rouissi/ Ph.D student, Electrical Engineering, Tunisia
 Imène Ben Amira/ Ph.D student, Electrical Engineering, Tunisia

Results :

A. Lahyani, A. Sari, I. Lahbib, P. Venet, "Optimal Hybridization and Amortized Cost Study of Battery/Supercapacitors System under Pulsed Loads," *Journal of Energy Storage, Elsevier*, vol. 6, pp. 222-231, Mai 2016.
 I. Ben Amira, A. Lahyani, A. Guermazi, "Fuel Cell/Supercapacitors Combination in Uninterruptible Power Supply (UPS)," *16th International conference on Sciences and Techniques of Automatic control & computer engineering, STA'2015*, Dec. 2015.
 R. Abdelhedi, A. C. Ammari, A. Lahyani, A. Sari, P. Venet, "Optimal power sharing between batteries and supercapacitors in electric vehicles," *The Seventh International Conference SETIT 2016*, Hammamet 18-20 Dec. 2016 Tunisia.
 R. Abdelhedi, A. Lahyani, A. C. Ammari, A. Sari, P. Venet, "Design of power management system for batteries and supercapacitors combination in electric vehicles," submitted in *International Review on Modelling and Simulations (IREMOS)*, Oct. 2016.