

### **A) General Information**



<b>Acronym:</b>	<b>EVOLVE-MAS - 20110131-01</b>
<b>Title of the User-Project:</b>	<b>Electric Vehicle Operated Low Voltage Electricity networks with Multi- Agent Systems</b>
<b>TA Call:</b>	<b>3<sup>rd</sup> CALL - 31-01-2011</b>
<b>Host Research Infrastructure:</b>	<b>TECNALIA-LAB (TA8)</b>
<b>Starting Date:</b>	<b>15-04-2011</b>
<b>End Date:</b>	<b>15-06-2011</b>
<b>Lead User :</b>	<b>Panagiotis Papadopoulos, Cardiff University, UK</b>
<b>Additional Users:</b>	<b>Iñaki Grau Unda, Cardiff University, UK</b>

### **B) Summary of the User-Project**

The purpose of this project was to test the operation of a Multi-Agent System (MAS) developed at Cardiff University, using the infrastructure provided by Tecnalia-Lab. The design of the multi-agent system is based on the structure proposed by the EU project Mobile Energy Resources in Grids of Electricity (MERGE). Two entities were considered in the MAS: The Electric Vehicle Aggregator (EVA) and the Distribution System Operator (DSO). The EVA is responsible for the market participation and is composed of hierarchical agents: (i) the Regional Aggregation Unit (RAU) agent, (ii) the MicroGrid Aggregation Unit (MGAU), (iii) the Clusters of Vehicle Controllers (CVC) agents, and (iv) the EV agent. The DSO agent is named Central Autonomous Management controller (CAMC) agent. The CAMC agent is responsible for the technical operation of the system.

### **C) Main Achievements**

The proposed Multi-Agent-System was able to operate under real conditions. It was proven that the management of EV battery charging/discharging is possible, by implementing a hierarchical agent based control.

The application of two aggregator policies was evaluated; the economic optimisation policy and the demand reduction policy. Both policies were successfully implemented showing the capability of the MAS to generate the most economical schedules possible to the EV owners, delivering the EV load demand to the owners within network technical constraints limits. Finally the system showed its capability to react to a technical constraint violation, restoring the normal operating conditions by curtailing EV loads.

### **D) Dissemination of the Results**

An abstract has been accepted to the conference organised by OTTI named 3rd European Smart Grids and E-Mobility conference. The full paper is entitled "Analysis of an Electric Vehicle Agent Based Management Model" and will be submitted for review until August 2011. The paper describes the Multi-Agent System operation, together with simulation results and experimental validation obtained at TECNALIA research infrastructure.

### **E) Use of the Resources**

<b>Nr. of Users involved:</b>	<b>2</b>
<b>Access Days/Units (TECNALIA):</b>	<b>30</b>
<b>Stay Days (TECNALIA):</b>	<b>60</b>