A) General Information

Acronym: **SEM-BAD – 20110131-04**
Title of the User-Project: Smart Energy Management for Buildings and Districts
TA Call: 3rd CALL - 31-01-2011
Host Research Infrastructure: RISØ DTU - Syslab
Starting Date: August, 15th 2011
End Date: December 2nd 2011

Lead User : Luca Ferrarini – Politecnico di Milano - Italy
Additional Users: Giuseppe Tommaso Costanzo – Politecnico di Milano - Italy

B) Summary of the User-Project

The experiments was designed to assess the Home Energy Manager (HEM) performances with respect to peak-load shaving and load balancing in a real dwelling (FlexHouse at DTU Electrical Engineering, RISØ campus). To cope with this, different kind of appliances in the FlexHouse are interfaced with the SYSLAB control system which, using already built Java libraries and sensors/actuators interfaces, offers the means for running the Home Energy Manager developed in Matlab®. The objectives of the project include:

- Asses the HEM capabilities to handle consumption requests with respect to the constraints on the consumption;

- Comply with a satisfactory level of tenants' comfort;

- Obtain a proof of concept of the proposed framework for demand-side load optimization problem;

- Troubleshoot major problems related to the implementation of appliances control and energy management in Smart Homes.

C) Main Achievements

In the experiment, the Admission Control was given a constant capacity limit of 3 kW. The DSM system schedules loads in order to limit the consumption to the given capacity.

We has observed that the temperature is kept in the comfort zone in all the rooms with AC and the overheating in the rooms without AC is natural during daytime. The refrigerator internal temperature is kept in the comfort zone as well, while the peak load is reduced even if the capacity limit of 3 kW is not always respected. In fact the highest peak is measured to be 4.5 kW and it is caused by different factors, such as the uncertainty on appliances' model (which is based on nominal power consumption) and baseline consumption variations. For instance the heaters and air conditioning consumption is not constant and there is no such a way to predict the baseline consumption, given its stochastic nature. Such disturbances have a negative impact on the performance of DSM with respect to the capacity limit compliance, as it is shown in the deviation from nominal consumption. Nevertheless, the DSM system shows its benefits in terms of the reduction of peak consumptions by 62% of the maximum nominal consumption, by 55% in the experimental worst case consumption, and by the 37% during steady state operation.

D) Dissemination of the Results

Giuseppe Tommaso Costanzo; Guchuan Zhu; IEEE, Luca Ferrarini; Miguel F. Anjos; Gilles Savard: "An Experimental Study on Load-Peak Shaving in Smart Homes by Means of Online Admission Control" - IEEE-ISGT conference - Berlin - October 2012

E) Use of the Resources

Nr. of Users involved: 1
Access Days: 10
Stay Days: 14