

Energy balanced buildings with the use of RES, active Energy Saving technologies and electric consumption predictive models

A.Kyritsis*, E.Mathas, E. Tselepis

Centre for Renewable Energy Sources and Saving

Division of Renewable Energy Sources

PV Systems and DER Department

tel. +30.210.6603371, fax +30.210.6603318

kyritsis@cres.gr, emathas@cres.gr, stselep@cres.gr

ABSTRACT

This paper presents the capability of adjusting the energy profile of conventional office buildings into energy balanced buildings. The model of an energy balanced building aims not only to produce electricity consumed during an entire year utilizing renewable energy technologies, but also seeks to optimally balance production and consumption in smaller time intervals (month, day, or even real-time), utilizing active energy saving technologies (ES) energy storage systems and forecasting models both for energy production and consumption. The results presented stem from the participation of PV Systems and Distributed Generation Dept. of CRES in the European program Smart Build "Implementing Smart Information and Communication Technology (ICT) concepts for energy efficiency in public buildings".

Since the facility which houses the PV Systems and Distributed Generation Dept. is designed in accordance to basic principles of bioclimatic architecture, passive energy saving solutions were not sought. In contrast, using systems for the collection, logging, analysis and transmission of data, the time series of electricity production and consumption were studied and hence researched the following topics: i) the correlation of the loads with the energy profile of the PV system installed in the building, ii) the repeatability and the stochastic nature of some critical energy imbalances, iii) active energy saving techniques, iv) deferred mitigation techniques between consumption and production, v) technical limitation of power peaks using energy storage systems, or redesigning the mode of consumption.

Finally, loads and energy production were modeled in order to be integrated into functions of intelligent control forecasting systems and control of energy resources and loads in real time. In this work we present results from the phase of recording and analysis of electricity production and consumption, the mathematical models developed to predict the electricity demand and generation, as well as the operation principles of intelligent energy saving controls. Finally, we present the techniques tested to smooth the power level peaks in real time. This last action, although difficult for the energy design of a building, leads into a smooth and efficient operation of the low voltage (LV) electricity network. The proposed techniques are examined both in the light of the Feed in Tariff (scheme which is available today for the electricity produced by PVs in LV network), and in the status of Net Metering, which is gaining more and more ground globally.

Keywords: Energy balanced buildings, active energy saving technologies, consumption forecasting models, RES, energy storage systems