

# **Modelling of a thermo-electric energy management system including heat pumps for an off-grid system**

E. Lobato Miguélez; I. Saboya Bautista; J.M. Fernández de Bobadilla Navarrete; L. Díez Maroto; L. Rouco Rodríguez; L. Sigrist

## **Abstract-**

**This paper presents a thermo-electric model to implement the energy management system (EMS) of an off-grid system. The EMS is formulated as a unit commitment problem where thermal and electrical components are dispatched simultaneously to minimize system operation costs. Particular attention is paid to the operation of heat pumps. The model contemplates a variable coefficient of performance (COP) of heat pumps. COP is different for the cold water and hot water circuit and depends on the output temperatures of the heat pump and the heat pump operation mode. Furthermore, the heat pumps' ability to switch operation modes is also considered as well as the limitation of heat pumps to operate when hot water thermal energy storage is nearly full. The developed model has been successfully applied to an existing off-grid system at Norvento Enerxia's headquarters in Spain by simulating its operation during a winter week. The impact of modelling multi-mode operation of heat pumps with variable COP has been compared with single-mode operations with either fixed or variable COP. The proposed, integrated approach of solving the electrical and thermal dispatch simultaneously has been also compared with a sequential resolution of first the thermal and then the electrical dispatch.**

**Index Terms-** energy management systems, heat pumps, power generation dispatch, power generation scheduling, thermal energy storage

Due to copyright restriction we cannot distribute this content on the web. However, clicking on the next link, authors will be able to distribute to you the full version of the paper:

[Request full paper to the authors](#)

If your institution has an electronic subscription to IET Renewable Power Generation, you can download the paper from the journal website:

[Access to the Journal website](#)

## **Citation:**

*Díez Maroto, L.; Fernández de Bobadilla Navarrete, J.M.; Lobato, E.; Rouco, L.; Saboya, I.; Sigrist, L. "Modelling of a thermo-electric energy management system including heat pumps for an off-grid system", IET Renewable Power Generation,*

