

Title : Photovoltaic Hybrid System modelling at Genec

Author : H. COLIN

Affiliation : GENECE - CEA

Address : CE Cadarache 13108 St-Paul-lez-Durance FRANCE

Phone/fax/e-mail : 33 (0)4 42 25 75 34/ 33 (0)4 42 25 73 65/ herve.colin@cea.fr

Co-authors :

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Summary:

Purpose

Due to the diversity of hybrid systems, composed of different renewable energy sources, conventional energy sources, storage devices, converters and miscellaneous loads, connected or not to a mini-grid or the national grid, centralised or not, and the variety of regulation strategies, it is very hard to find the best combination of components adapted to a given application (solar resource, consumption). Modelling allows to have a good idea of the performance of a system at least cost.

Methods

A review of existing softwares in the field of renewable energies was conducted in order to determine the possibilities of calculation and limits. It showed for most of them a simplicity of models, a limited access to parameters and above all a lack of flexibility (component description, control strategy definition). Thus the first studies have dealt with the development of a simulation software in the Matlab/Simulink environment. The objective was to build a library of miscellaneous components that may be found in a hybrid system (PV module, windmill, genset, battery, inverter, electric load, regulator, battery charger, etc) with several models for each component when possible.

Approach

A hybrid system (photovoltaic modules + diesel generator) has been installed in GENECE testing facilities in Cadarache since 1998 and has been operating for several months. It is the prototype system of four systems installed in Indonesia for mini-grid power supply. For the simulation of its operating, meteorological and technical data have been measured in Cadarache and Indonesia, and the load profile is a typical Indonesian daily profile. These data are compared to the results of the simulation in order to validate the models.

Results

Data of simulation are compared to experimental measures over several days of operation so as to validate the different means of genset start-up (every day, every three days, low state of charge, manual), the modes of battery charge (equalisation, absorption, floating) and the energy flows getting in and out of the battery. Results are usually in good accordance with real values, but some discrepancies may be due to a bad knowledge of the battery "history", a rather rough battery model or a drift of the local genset starting time .

Conclusions

This paper presents the GENECE studies in modelling and simulating PV hybrid systems operation. The development of a tool enables to run numerous predictive calculations; this will improve the performance of systems in three main directions: design (choice of components, system architecture), energy management (higher solar fraction, fewer load disconnections, battery in good state) and costs (engineering, operation).