

Title:

Reduction of the specific cost of autonomous Photovoltaic-Diesel-Hybrid systems by the use of variable speed diesel generators

Presentation modus :

Poster

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Abstract:

Conventional diesel and gasoline generators have very low efficiency, especially when they do not work at the point of their nominal power. New variable speed generators have a much higher efficiency and lower fuel consumption especially at low electric load. As the diesel generator of a PV-Diesel system usually operates at low electric load, there is a high potential for the reduction of fuel consumption (and system cost) by the use of such generators. A variable speed generator consists of a diesel (or gasoline) motor, a synchronous generator and a frequency converter which enables the generator to work with variable speed and at the same time keeps the output frequency constant at 50 Hz. The specific cost of a PV-Diesel system is being further reduced through the longer life span of the variable speed machine.

The fuel consumption and the efficiency of two motor-generators with the same nominal power (one with constant and the other with variable speed) from the same manufacturer was measured at the laboratories of the University of Kassel. The variable speed generator was in fact more efficient. The conventional generator consumes at 20% of the nominal load ca 35% more fuel than the variable speed generator.

Mathematical models of batteries, chargers, photovoltaic modules, inverters, MPP-trackers, generators and many different energy management strategies were implemented in a new energy flow simulation software-tool. Many scenarios with different weather conditions, load profiles, energy management and PV-diesel system configurations were tested by the software tool, followed by an economical calculation. A reduction of the fuel consumption was the result of most of the simulated cases. A reduction of the specific system [€/kWh] can also be achieved at many different system configurations under some prerequisites.