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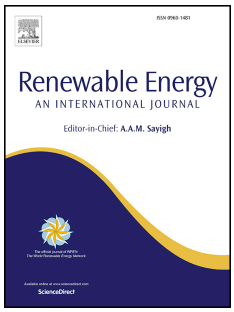


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# Thermodynamic Model of a Hybrid Brayton Thermosolar Plant

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**Abstract**

We present a thermodynamic model for the prediction of the performance records of a solar hybrid gas turbine power plant. Variable irradiance and ambient temperature conditions are considered. A serial hybridization is modeled with the aim to get an approximately constant turbine inlet temperature, and thus to deliver to the grid a stable power output. The overall thermal efficiency depends on the efficiencies of the involved subsystems and the required heat exchangers in a straightforward analytical way. Numerical values for input parameters are taken from a central tower heliostat field recently developed near Seville, Spain. Real data for irradiance and external temperature are taken in hourly terms. Curves for the evolution of plant efficiencies (solar, gas turbine, fuel conversion efficiency, overall efficiency, etc.) and solar share are presented for representative days of each season. The cases of non-recuperative and recuperative plant configurations are shown. Estimations of the hourly evolution of fuel consumption are simulated as well as savings between the hybrid solar operation model and the pure combustion mode. During summer, fuel saving can reach about 11.5% for a recuperative plant layout. In addition, plant emissions for several configurations are presented.

*Keywords:* Thermosolar gas-turbines, Hybrid plants, Thermodynamic model, Variable solar irradiance, Global plant performance, Seasonal evolution

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