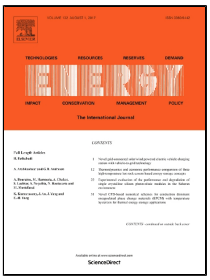
# Accepted Manuscript



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# Off-design analysis of a Hybrid Rankine-Brayton cycle used as the power block of a Solar Thermal Power Plant

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**Abstract:** This work presents a further step in the study of an unconventional thermodynamic cycle intended for integration into solar thermal power plants. The design point definition of the plant must take into account the off-design behavior in a concrete site, specifying the heat source and its maximum temperature, as well as the minimum heat sink temperature. The plant is assumed to receive the heat from a solar field of parabolic trough collectors, with a maximum temperature of the heat carrier of 670 K.

A particular aim of the study is to analyze any problems that may arise related to the cycle configuration during off-design operation, guaranteeing a supercritical heating pressure, condensation of the working fluid in the heat sink process and avoiding wet compression of the bypass fraction.

The results have verified that propane and R125 are suitable working fluids for the cycle, even under unfavorable conditions.

An annual performance analysis has also been carried out for the particular site of Almeria (Spain), considering thermal storage. Propane has been revealed as possibly the best option, with a moderate design point pressure ratio (14:1) and a satisfactory performance at off-design conditions: cycle efficiency range 41.4 - 30.2 % (yearly operation).

**Keywords**

Brayton cycle, Rankine cycle, moderate temperature heat source, regenerative cycle, supercritical organic fluid.