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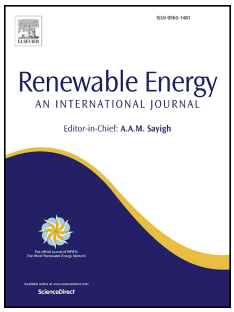

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Design and off-design models of a hybrid geothermal-solar power plant enhanced by a thermal storage

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Abstract

Geothermal resources are subject to thermal depletion during the lifetime of geothermal power plants. The decline of the geofluid temperature significantly affects both the magnitude and quality of the thermal energy available for electrical conversion and, in turn, plant efficiency and power output. Furthermore, the performance of geothermal power plants based on air-cooled Organic Rankine Cycle systems (ORCs) markedly decreases at warm ambient temperatures because of the higher turbine exhaust pressures. In this study a new hybrid Geothermal - Concentrating Solar Power (GEO-CSP) plant is modelled, which enables a better utilization of geothermal energy and improves the performance of the geothermal ORC system during the whole lifetime of the power plant. Solar energy is used to heat up the geothermal fluid entering the heat exchanger of the ORC. The CSP plant is equipped with a thermal energy storage (TES) unit which accumulates the surplus of solar thermal energy available during daytime, while releasing it during night-time when the efficiency of the power system is higher. The integration of the storage unit in the parabolic trough CSP system enables a 19% gain in the incremental annual energy production from solar, which