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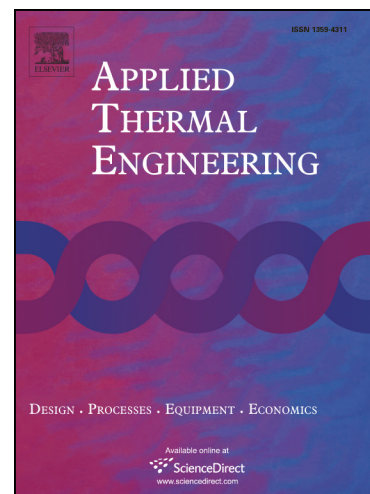
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A review of concentrated solar power hybrid technologies

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Abstract

This paper reviews the hybrid power generation technologies of concentrated solar power (CSP) and other renewable and non-renewable resources such as biomass, wind, geothermal, coal, and natural gas. The technologies have been categorized into high, medium, and low-renewable hybrids based on their renewable energy component. The high-renewable hybrids report the least specific CO₂ emissions (< 100 kg/MWh), followed by the medium (< 200 kg/MWh) and low-renewable hybrids (> 200 kg/MWh). The hybrids have been compared based on their plant characteristics and performance metrics using data from the literature and of actual hybrid power plants. The low-renewable hybrids such as ISCC, solar-Brayton, and solar-aided coal Rankine power systems are technologically mature and offer superior performance over the high and medium-renewable hybrids. The medium renewable hybrids such as solar plants with natural gas backup offer high solar share but suffer mostly from low efficiency and high cost that hinders their market penetration. The high-renewable hybrids such as CSP-wind, CSP-biomass, and CSP-geothermal have minimum negative impact on the environment. However, several parameters such as energy efficiency, solar-to-electricity efficiency, capacity factor, and cost effectiveness need to improve for these systems to be competitive.

Keywords: Concentrated solar power, hybrid, biomass, wind, geothermal, coal, natural gas

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