Abstract

In this work, we compare the technical and economic performance of a solar organic Rankine cycle (s-ORC) system with thermal energy storage (TES) and a solar photovoltaic (PV) system with battery storage at a capacity of 50 kW_e. A two-dimensional variable space, comprising solar field area and storage capacity is swept for optimum operational zones of five performance indicators, namely annual energy generation, capacity utilization factor (CUF), capital cost, levelized cost of electricity (LCOE) and energy wasted. Minimum LCOE estimated for the s-ORC system was 0.19 USD/kWh with a CUF of 0.56. For the same CUF value, the PV system incurs a LCOE of at least 0.26 USD/kWh. The minimum LCOE of the PV system yields an attractive value of 0.12 USD/kWh, but it includes no battery storage and thus delivers a significantly lower CUF of 0.27. The results indicate that for achieving minimum LCOE, the operational zones of the two technologies differ in terms of storage requirement. The s-ORC technology potentially offers improved reliability of power supply through cost-effective TES. Visualization of annual energy and costs in the form of contour maps facilitates a holistic comparison of the two technologies with their storage options.