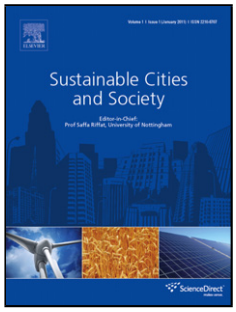

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Two heuristic approaches for the optimization of grid-connected hybrid solar–hydrogen systems to supply residential thermal and electrical loads

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Highlights:

- A grid-connected hybrid solar–hydrogen system for supplying residential electrical and thermal loads is developed.
- Two improved particle swarm optimization (PSO) algorithms are proposed for optimization.
- The results of two modified heuristic approaches are compared to three other well-known meta-heuristic optimization techniques.
- The PSO algorithm with adaptive inertia weight produces better results than other algorithms.
- The hybrid solar–hydrogen based CHP system is cost-effective and reliable.

Abstract

Two heuristic approaches based on particle swarm optimization (PSO), i.e., a PSO algorithm with adaptive inertia weight (PSOAIW) and a PSO algorithm with a constriction factor (PSOCF), are applied to the optimization of a hybrid system consisting of photovoltaic panels, a fuel cell, natural gas and the electrical grid to supply residential thermal and electrical loads. An economic model is developed and an economic analysis carried out for the grid-connected hybrid solar–hydrogen combined heat and power systems. The optimization seeks to achieve the minimum cost of the system with relevant