عنوان مقاله:

Thermo-economic analysis and optimization of a novel combination of the solar tower power plant, Stirling engine, Reverse osmosis desalination, and proton exchange membrane electrolyzer

نویسندگان:

Asadollah Arabhaghighi - *Mechanical Engineering Department, Iran University of Science and Technology, Tehran, Iran*

Mahdi Moghimi - *Mechanical Engineering Department, Iran University of Science and Technology, Tehran, Iran*

خلاصه مقاله:

This simulation study is aimed to investigate a multi-generation system including cycles of reverse osmosis (RO) desalination, Stirling engine, liquefied natural gas (LNG), a solar tower plant, and proton exchange membrane (PEM) electrolyzer to produce power, pure water, and hydrogen gas. All analyses were conducted to calculate the efficiency, exergy, energy, thermo-economic analysis, and total costs of this system. The sun radiation, liquefied gas flow rate, the temperature difference in the heat exchanger on the cold part of the Stirling engine are assumed as design parameters. Also, the effects of these parameters variation on hydrogen and pure water production were investigated. The power produced by the Stirling engine and LNG cycle of the proposed system is ۸.۱۸ MW (with the second law efficiency of ۳۹.۲%), which is used to produce ۷۲۰ m۳/h freshwater and ۱۳۰.۵ kg/h hydrogen gas. Sensitivity analysis was performed to determine the most effective variable on the operating conditions which indicated that solar radiation is the most effective design parameter. Finally, the total exergy efficiency and total cost rate were considered as two objective functions and the system was optimized by the Genetic algorithm. In optimized conditions, by the linear programming technique for multidimensional analysis of preference (LINMAP method), exergy efficiency becomes ۴۳.۲۹% and hydrogen production gets ۷.۶% increased.

کلمات کلیدی:

Desalination, Hydrogen production, Exergy Analysis, Economic Analysis, genetic algorithm

لینک ثابت مقاله در پایگاه سیویلیکا:

https://civilica.com/doc/1377353