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# Recurrent neural networks optimization of biomass-based solid oxide fuel cells combined with the hydrogen fuel electrolyzer and reverse osmosis water desalination

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## Highlights

- Simulation of a novel biomass based system.
- Using various biomass feedstock and its parametric study.
- Techno-economic assessment of the system for the feasibility study.
- To see the effect of economic parameters on the system performance.
- Recurrent Neural network-based optimization of the proposed system.

## Abstract

The current research study focuses on modeling solid oxide fuel cell (SOFC) power plants. For this purpose, in the research, three Integrated processes are presented to achieve the most optimal system from the perspective of energy and economics. An integrated SOFC is considered in the first model, the second model is focused on using the wasted heat from the first model as the entry of the Stirling engine, and in the third model, the excess energy of the Stirling engine is used to produce hydrogen with the help of proton exchange membrane electrolyze and also power generated by the first model turbine is used in desalination system to produce fresh water. Power generation and hydrogen production from the systems are considered the main two objective functions. Results show that in the presented system the most optimal state of energy efficiency is 39.6% and with an economic cost of 10.30 dollars per hour. The results also indicate that the presented energy system can produce 191 kW of output power, and 23 kg/s of hydrogen fuel with an economic cost of nearly 11 dollars/hour at its working point.