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Comprehensive analysis of a multi-generation energy system by using an energy-exergy methodology for hot water, cooling, power and hydrogen production

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1 **Comprehensive analysis of a multi-generation energy system by using an**
2 **energy-exergy methodology for hot water, cooling, power and hydrogen**
3 **production**

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7 **Abstract**

8 In this study, an energy-exergy methodology was applied to achieve more precise conditions for
9 hot water, cooling, power and hydrogen production via a proposed multi-generation system
10 comprised of a geothermal based organic Rankine cycle, domestic water heater, absorption
11 refrigeration cycle and proton exchange membrane electrolyzer. Furthermore, for evaluation of
12 the proposed system performance, the effects of such key variables as brine temperature, turbine
13 inlet temperature, generator temperature, brine mass flow rate and electrolyzer current density on
14 the related efficiencies of energy and exergy for the whole system were investigated. For
15 specified conditions, the results show that energy and exergy efficiencies of the entire system are
16 calculated around 33.92% and 43.59%, respectively. Moreover, estimation of the exergy
17 destruction rate in each system component indicated that the highest rate of exergy destruction
18 occurred in the heat recovery steam generator (HRSG) with 16.65% of the total amount of
19 exergy input to the system. And finally, net electrical power output, mass flow rate of hot water,
20 cooling capacity and mass flow rate of hydrogen production are as follows: 816.7 kW, 7.06 kg/s,
21 1896 kW and 0.05g/s.

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