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Thermodynamic and economic assessments of a novel CCHP cycle utilizing low-temperature heat sources for domestic applications

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1 **Thermodynamic and economic assessments of a novel CCHP cycle** 2 **utilizing low-temperature heat sources for domestic applications**

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7 **Abstract**

8 This paper presents thermo-economic analysis of a novel combined cooling, heating, and power (CCHP) cycle
9 based on the first and second laws of thermodynamics and economic point of view. The proposed CCHP cycle
10 includes an organic Rankine cycle, an ejector refrigeration cycle and a domestic water heater to produce the
11 desired electrical power, cooling and heating, simultaneously. The basic CCHP (BCCHP) system is modified by
12 regenerative method (RCCHP). Four different dry working fluids R123, R236fa, R245fa and R600a are
13 employed. Both systems are analyzed thermo-economically and their performance, total cost rate and unit
14 cost of products are compared. Moreover, parametric study is conducted to investigate the effect of key
15 parameters. Under given condition, thermodynamics analysis of proposed systems is conducted in which the
16 maximum energy and exergy efficiencies corresponded to the BCCHP system using R123 as working fluid.
17 The exergy analysis results show that, vapor generator has a major contribution in the overall exergy
18 destruction, which is followed by the domestic water heater. Also, minimum total cost rate belongs to the
19 proposed RCCHP system utilizing R123. Furthermore, a multi-objective optimization is performed for both
20 systems. The optimization results show that RCCHP system has the smaller total cost rate compare to the
21 BCCHP while their thermodynamic performances are approximately the same.

22 **Keywords:** Organic Rankine cycle; Ejector refrigeration cycle; Domestic water heater; Low-temperature
23 heat source; Thermo-economic analysis; Multi-objective Optimization.

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