Investigation of hydrofluoroolefins as potential working fluids in organic Rankine cycle for geothermal power generation

Abstract:
Recently, HFOs (hydrofluoroolefins) are presented as a group of the fourth generation refrigerants with zero ODP (Ozone Depletion Potential) and a very low GWP (Global Warming Potential). This paper presents a study on eight different HFOs and their potential applications in ORC (Organic Rankine Cycle) for geothermal power generation. The thermodynamic properties are calculated based on Peng-Robinson equation of state, and are used for simulating a standard ORC for geothermal heat sources with different temperatures. System efficiency, which involves both heat transfer efficiency and thermal efficiency, is considered to be the main criterion to evaluate the ORC system performance. An innovative term, i.e. the optimal heat source temperature is proposed for the determination of thermodynamic performances of each investigated working fluid in combination with the pinch point analysis. Based on the system efficiencies of all HFOs, some of them are selected in a series of case studies for comparison with other relevant ORC fluids. As a conclusion, some of the presented HFOs show promising performances in terms of system efficiency especially for low-to medium temperature geothermal ORC power generation (120°C < ths < 150 °C).

Stichworte:
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