

Energy and exergy analysis of mount salak geothermal power plant unit 1-2-3

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Abstrak

Excellence in skilled operation is vital for the efficiency of geothermal power plants. Mount Salak geothermal power plant unit 1-2-3 has consistently produced no less than 180 MWe to the Java-Bali grid since its first commercial operation in 1994, with an equivalent availability factor (EAF) average of 96%. Owing to this long operation period, power plant efficiency must be improved for the sustainable production of electricity. In this study, energy and exergy analysis has been undertaken to ascertain the amount of energy that is used in the power plant's current condition, and to determine the plant's overall system losses. Research was carried out by collecting data relating to temperature, pressure, and mass flow rate. Data were analyzed using the control volume to assess the thermal and mass balance and ascertain the value of exergy. Analysis was conducted theoretically and compared with results calculated by Engineering Equation Solver (EES) software. The results showed that from 1069.90 MWe in steam energy entering the system, the total amount of exergy was 302.42 MWe. Mount Salak geothermal power plant unit 1-2-3 had an overall first law efficiency of 16.75% and an overall second law efficiency of 59.27%. The greatest losses - 27.84% of the total exergy - were in the condensers. This was caused by the quality of cooling water entering condensers, which was in turn a result of cooling tower performance. Results suggest that turbine unit 1 should be investigated further to determine causes of decreased capacity.