ANALISIS PERFORMA KONDENSOR UNIT 1 TERHADAP TURBIN HEAT RATE DI PLTU LONTAR

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ABSTRAK

Sistem kondensasi pada Pembangkit Listrik Tenaga Uap (PLTU) Lontar berfungsi untuk mendinginkan uap bekas hasil ekspansi turbin menjadi air kondensat melalui media air pendingin. Dalam siklus tersebut, kondensor tipe surface digunakan sebagai penukar kalor utama yang krusial untuk menciptakan kondisi vakum guna memaksimalkan kerja turbin uap. Kondensor merupakan komponen vital yang banyak digunakan di industri pembangkitan karena kemampuannya dalam menjaga efisiensi siklus Rankine secara kontinu. Penelitian ini bertujuan untuk mengevaluasi performa kondensor berdasarkan parameter operasional lapangan dan membandingkannya dengan spesifikasi desain pabrikan (manual book/design data sheet), serta mengidentifikasi faktor-faktor yang memengaruhi penurunan tekanan vakum.

Evaluasi performa dilakukan dengan menganalisis temperatur air pendingin masuk dan keluar, tekanan vakum (Hg), dan laju alir uap untuk menentukan nilai efektivitas dan koefisien perpindahan panas menyeluruh sebagai indikator kinerja kondensor. Hasil analisis menunjukkan bahwa performa kondensor memengaruhi efisiensi termal turbin uap secara signifikan, di mana Analisis sensitivitas menunjukkan bahwa setiap penurunan vakum sebesar 1 kPa mengakibatkan kenaikan Heat Rate sekitar 13-14 kCal/kWh. Hasil penelitian ini diharapkan dapat menjadi referensi teknis bagi mahasiswa Teknik Mesin dalam memahami analisis performa mesin, efisiensi energi, serta penerapan pengoperasian dan perawatan sistem kondensasi di industri pembangkit listrik.

Kata Kunci: Efisiensi Termal, Fouling, Kondensor, Korelasi, Tekanan Vakum, Turbin Uap.

Analysis of Condenser Performance Unit 1 on Heat Rate Turbine Efficiency at PLTU Lontar

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ABSTRACT

The condensation system at the Lontar Steam Power Plant (PLTU) functions to cool the exhaust steam resulting from turbine expansion into condensate water through a cooling water medium. In this cycle, a surface-type condenser is used as the primary heat exchanger, which is crucial for creating vacuum conditions to maximize steam turbine work. The condenser is a vital component widely used in the power generation industry due to its ability to continuously maintain the efficiency of the Rankine cycle. This study aims to evaluate condenser performance based on field operational parameters and compare them with manufacturer design specifications (manual book/design data sheet), as well as to identify the factors affecting vacuum pressure reduction.

Performance evaluation was conducted by analyzing inlet and outlet cooling water temperatures, vacuum pressure (Hg), and steam flow rate to determine the effectiveness and overall heat transfer coefficient as condenser performance indicators. The analysis results show that condenser performance significantly affects the thermal efficiency of the steam turbine. Sensitivity analysis indicates that every 1 kPa decrease in vacuum results in an increase in Heat Rate of approximately 13-14 kCal/kWh. The results of this study are expected to serve as a technical reference for Mechanical Engineering students in understanding machine performance analysis, energy efficiency, and the application of operation and maintenance of condensation systems in the power generation industry.

Keywords: Condenser, Correlation, Fouling, Steam Turbine, Thermal Efficiency, Vacuum Pressure, Fouling.