PERANCANGAN AWAL *COOLING TOWER* UNTUK PEMBANGKIT LISTRIK TENAGA BIOMASSA 20 kW (PLTBM) DI DAERAH 3T (TERDEPAN, TERPENCIL, DAN TERTINGGAL)

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INTISARI

Rasio elektrifikasi Indonesia pada tahun 2021 sudah mencapai 99,40%, tetapi masih terdapat daerah yang belum teraliri listrik sama sekali seperti daerah Terdepan, Terpencil, dan Tertinggal (3T). Daerah tersebut terkendala infrastruktur, faktor geografis, faktor demografis untuk dijangkau jaringan listrik. Pembangunan PLTBm 20 kW yang memanfaatkan potensi sumber energi lokal seperti biomassa. Namun, *heat load* tidak dapat dibuang ke sumber air karena ketersedian air yang terbatas. Perancangan menara pendingin untuk PLTBm untuk membuang *heat load* sebesar 142,81 kW ke udara dilakukan dalam penelitian ini.

Analisis siklus Rankine (kondensor) dan perancangan menara pendingin dilakukan dalam penelitian ini. Hasil Perancangan meliputi jenis menara pendingin, jenis sirip, jumlah dan panjang pipa bersirip. Perhitungan teknis dilakukan dengan Microsoft Excel 2010 dan desain tiga dimensi turbin dibuat dengan Autodesk Inventor Professional 2017 serta Autodesk Fusion 360.

Desain menara pendingin kering memiliki konfigurasi A-*frame* dengan dimensi 6,53 × 3,52 × 5,7 m. Pipa bersirip yang digunakan berjenis L-fin dengan jumlah sebesar 208 pipa. Panjang pipa bersirip masing-masing sebesar 5,93 m dengan pola penempatan berupa *pitch* segitiga sama sisi. Kipas yang digunakan berjenis HVLS fan dengan diameter sebesar 3 m. Daya total menara pendingin sebesar 1,2 kW.

Kata kunci:menara pendingin, penukar kalor berpendingin udara, energi terbarukan, biomassa

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PRE DESIGN OF COOLING TOWER FOR 20 KW BIOMASS POWER PLANT (PLTBM) IN THE 3T (LEADING, REMOTE, & LEFT BEHIND) REGION

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ABSTRACT

The electrification ratio in Indonesia reached 99.40% in 2021, but there are still areas that have not been electrified at all, such as the Leading, Remote, and Left Behind (3T). These areas face challenges in terms of infrastructure, geographical factors, and demographic factors that make it difficult to access the electricity network. The development of a 20 kW biomass power plant is being carried out to utilize local energy sources. However, the heat load cannot be discharged to a water source due to limited water availability. In this study, the design of a cooling tower for the biomass power plant to dissipate a heat load of 142.81 kW to the air was conducted.

The analysis of the Rankine cycle (condenser) and the design of the cooling tower were performed in this study. The design results include the type of cooling tower, fin type, and the number and length of finned pipes. Technical calculations were carried out using Microsoft Excel 2010, and a three-dimensional design of the turbine was created using Autodesk Inventor Professional 2017 and Autodesk Fusion 360.

The dry cooling tower design features an A-frame configuration with dimensions of 6.53 × 3.52 × 5.7 m. L-fin type finned pipes were used with a total of 208 pipes. Each finned pipe has a length of 5.93 m, arranged in an equilateral triangle pitch pattern. HVLS fans with a diameter of 3 m were used. The total power of the cooling tower is 1.2 kW.

Keywords: cooling tower, air cooled heat exchanger, renewable energy, biomass

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