

ANALISIS POTENSI PEMBANGKIT LISTRIK TENAGA AIR SUNGAI TUK BENING KEBUN KALIGUA BREBES

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Abstrak

Pabrik Teh Hitam (PTH) Kaligua memiliki masalah dalam memenuhi kebutuhan listriknya. Sungai dan mata air Tuk Bening yang berlokasi di Kebun Kaligua berpotensi dijadikan sebagai sumber Pembangkit Listrik Tenaga Air (PLTA) untuk PTH Kaligua. Dalam tugas akhir ini, penulis menganalisis potensi PLTA Kaligua dengan melakukan analisis debit andalan, perencanaan pipa pesat, tinggi energi bersih, daya PLTA, dan perencanaan turbin.

Debit andalan ditentukan berdasarkan kurva aliran-durasi sungai Tuk Bening yang dibuat dari data debit rerata simulasi Mock. Dimensi penampang pipa pesat dipilih dari ASME B36.10M, di mana tebal dinding ditentukan berdasarkan tekanan rencana dengan mengacu pada ASME B31.1. Tinggi energi bersih ditentukan dengan mempertimbangkan kehilangan tinggi energi mayor dan minor dalam pipa pesat rencana. Daya PLTA ditentukan dengan mempertimbangkan perkiraan efisiensi dan turbin direncanakan berdasarkan debit rencana dan tinggi energi bersih.

Debit rencana dengan keandalan 80% adalah 0,174 m³/s. Pipa pesat direncanakan dengan tinggi energi kotor 88,23 m, panjang 513 m, diameter dalam 388,92 mm, dan tebal dinding 8,74 mm. Total kehilangan tinggi energi dalam pipa pesat rencana adalah 3,39 m sehingga tinggi energi bersih adalah 84,84 m. PLTA Kaligua dapat membangkitkan daya 122,23 kW dengan perkiraan efisiensi 0,846. Turbin direncanakan sebagai turbin Pelton dengan kecepatan sepesifik 0,022, kecepatan rotasional 500 rpm, dan diameter lingkaran pitch 0,71 m.

Kata Kunci: *Daya PLTA; debit andalan; pipa pesat; tinggi energi bersih, turbin Pelton*

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ANALYSIS OF THE HYDROELECTRIC POTENTIAL OF TUK BENING STREAM, KEBUN KALIGUA, BREBES REGENCY

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Abstract

The Kaligua Black Tea Factory (Pabrik Teh Hitam Kaligua/PTH Kaligua) is having problems in meeting its electrical demand. Tuk Bening spring and stream located in the Kaligua Plantation (Kebun Kaligua) potentially can be utilized as hydroelectric source for PTH Kaligua. In this final project, the authors analyzed the potential of Kaligua hydroelectric by conducting the analysis of dependable discharge, penstock design, hydraulic net head, hydroelectric power, and turbine design.

The dependable discharge was determined based on the flow-duration curve of Tuk Bening stream which was created from the average discharge data of Mock simulation. Cross section dimension of penstock was chosen from ASME B36.10M, which the wall thickness was determined based on the design pressure by referring to ASME B31.1. Hydraulic net head was determined by considering the major and minor head losses in the design penstock. Hydroelectric power was determined by considering the estimated efficiency and the turbine was designed based on the design discharge and hydraulic net head.

The design discharge with 80% time exceeded is $0.174 \text{ m}^3/\text{s}$. Penstock was designed with 88.23 m hydraulic gross head, 513 m length, 388.92 mm inner diameter, and 8.74 mm wall thickness. The total head loss in the design penstock is 3.39 m so that the hydraulic net head is 84.84 m. Kaligua hydroelectric is able to generate 122.23 kW power with 0.846 estimated efficiency. The turbine was designed as Pelton turbine with 0.022 specific speed, 500 rpm rotational speed, and 0.71 m pitch circle diameter.

Keywords: *Dependable discharge; hydraulic net head; hydroelectric power; penstock; Pelton turbine*

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