Rancang-evaluasi detail engineering design vacuum siphon minihydro power plant pada saluran irigasi Lodagung = Design-evaluation of detail engineering design of vacuum siphon mini-hydro power plant at Lodagung Irrigation Channel

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Abstrak

ABSTRAK
Dalam rangka ikut serta menyukseskan Program Listrik 35000 MW untuk meningkatkan produksi energi listrik nasional dan mengembangkan sumber EBT yang ekonomis serta ramah lingkungan, menurut rencana akan dibangun Pembangkit Listrik Tenaga Mini Hidro di Desa Jegu - Kab. Blitar - Jatim, dengan memanfaatkan potensi hidro ekisting bendungan Wlingi dan saluran irigasi Lodagung. Unit pembangkit akan beroperasi dengan memanfaatkan outflow irigasi bendungan Wlingi, tepatnya debit operasional harian saluran irigasi Lodagung sebelum dialirkan untuk keperluan pengairan.
Analisa feasibility study diperlukan untuk mengidentifikasi kelayakan potensi dari segi teknis lapangan (hidrologi, geografi, geologi) dan desain perencanaan instalasi (sipil, mekanik, elektrik). Berdasarkan hasil olah data hidrologi menggunakan metode FDC, Log Pearson III, dan analisa debit rerata diperoleh debit desain minimum sebesar 7,00 m3/s; debit desain maksimum 14,22 m3/s; dan debit andalan sebesar 10,28 m3/s dengan probabilitas 87,5%. Berdasarkan data topografi dan geomorfologi lapangan didapatkan nilai tinggi jatuh asli sebesar 12,75 m. Berdasarkan analisis potensi energi pada awal tahap FS, diestimasikan daya listrik yang dibangkitkan mencapai 1,3 MW (Î·s=86% ; Î·m=90% ; Î·e=95%) dengan produksi energi listrik andalan sebesar 8,1 GWh/tahun.
Data hasil olah FS kemudian digunakan untuk mendesain Detail Engineering Design (DED). Desain PLTM menggunakan teknologi intake vacuum siphon dengan dua buah unit pembangkit, outputnya akan ditransmisikan melalui jaringan ekisting GI Wlingi. Desain PLTM yang direncanakan terdiri dari instalasi sipil (sistem vakum sipon: bangunan intake - headrace; sistem bifurikasi I, pipa pesat, sistem bifurikasi II, draft tube, dan tailrace). Instalasi mekanik yang direncanakan berupa turbin hidraulik. Instalasi elektrik yang direncanakan berupa generator dan komponen pendukung lain seperti trafo utama, kabel daya, pumpa vakum, dll).
Evaluasi DED diperlukan untuk menguji kelayakan desain yang telah dibuat, identifikasi mencakup analisis parameter kerja dari desain PLTM yang dirancang. Hasil evaluasi DED sebagai berikut: desain aman terhadap bahaya kavitasi ; efisiensi sistem rata-rata Î·PLTM = 69,15% (Î·s=80,89% ; Î·m=90% ; Î·e=95%) ; Tinggi jatuh bersih artifisial rata-rata sebesar 11,4m ; Output daya listrik maksimum sebesar 1,24 MW dan produksi energi andalan sebesar 8,7 GWh/tahun dengan probabilitas 87,5%.
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ABSTRACT
In order to participate in the succession of the 35000 MW Electricity Program to increase national electricity production and develop economical and environmentally friendly sources of EBT, planned Mini Hydro Power Plant in Jegu Village - Kab. Blitar - East Java, by utilizing the existing hydro potential of the Wlingi dam and Lodagung irrigation channel. The generating unit will operate by utilizing the Wlingi dam

irrigation outflow, precisely the daily operational outflow of the Lodagung irrigation channel before being discharged for irrigation purposes.

Analysis of the feasibility study is needed to identify the feasibility of potential in terms of technical field (hydrology, geography, geology) and design of installation planning (civil, mechanical, electrical). Based on the results of the hydrological data processing using the FDC method, Log Pearson III, and the average discharge analysis obtained a minimum design debit of 7.00 m3/s; maximum design debit of 14.22 m3/s; and the dependable debit is 10.28 m3/s with a probability of 87.5%. Based on topographic and geomorphological data from the field it was found that the value of the original fall height was 12.75 m. Based on the analysis of energy potential at the beginning of the FS stage, it is estimated that the electrical power generated reaches 1.3 MW (Î·s = 86%; Î·m = 90%; Î·e = 95%) with dependable electrical energy production of 8.1 GWh/year.

The results of the FS data are then used to design the Detail Engineering Design (DED). The design of the PLTM uses a vacuum siphon technology with two generating units, the output of which will be transmitted through the existing network of GI Wlingi. The planned PLTM design consists of a civil installation (vacuum siphon system: intake building - headrace; bifurication system I, penstock, bifurication system II, draft tube, and tailrace). Planned mechanical installation in the form of a hydraulic turbine. Planned electrical installations in the form of generators and other supporting components such as main transformers, power cables, vacuum pumps, etc.).

DED evaluation is needed to test the feasibility of the design that has been made, identification includes analysis of the working parameters of the design of the MHP designed. The results of the DED evaluation are as follows: the design is safe against the dangers of cavitation; system efficiency the average Î·PLTM = 69.15% (Î·s = 80.89%; Î·m = 90%; Î·e = 95%); Artificial net height is 11.4m; Maximum electric power output is 1.24 MW and dependable energy production is 8.7 GWh / year with a probability of 87.5%.