

Sessions: Renewable energy

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STUDY OF A SMALL STEAM TURBINE APPLIED TO ELECTRICAL ENERGY GENERATION

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Abstract:

The use of renewable energy sources available in the Amazon region is an alternative that should be considered for isolated communities, due to their great availability of natural resources. However, it is important for developing small system projects of easy deployment and operation to adopt a model of local self-management. In this case, the proposed system consists of a cyclonic boiler that has good thermal efficiency already studied and thermodynamic results generated (CARNEIRO et al., 2017; CARNEIRO et al., 2015) with a steam turbine coupled with a permanent magnet generator of 1.0 kW (AZEVEDO et al., 2017). Thus, the present project aims to carry out a study on the steam turbine applied to electric power generation. Therefore, it is concluded that this turbine can achieve a maximum shaft power of approximately 16.5 kW, obtaining favorable results to generate electric energy with a maximum power of 10.5537 kW, and average consumption of 1.07 kWh (Tab. 1), being a good characteristic to be applied to a small group of isolated rural families commonly found in Amazon region (MACEDO et al., 2016).

Key-words: Steam Turbine, cyclonic boiler, synchronous generator of permanent magnet.

Table 1. Estimated results for: shaft rotation, efficiency, and electrical power.

Shaft power (kW)	Turbine thermal efficiency (%)	Electrical power (kW)
16.4902	74.95	10.5537
15.5555	70.70	9.9555
14.6208	66.45	9.3573
13.6862	62.21	8.7591
12.7515	57.96	8.1609
11.8168	53.71	7.5628
10.8822	49.46	6.9646
9.9475	45.21	6.3664
9.0128	40.96	5.7682
8.0782	36.71	5.1700

References:

AZEVEDO, T.P.S., Pinho, J.T., Galhardo, M.A.B., Branco, T.M.M. Bancada experimental para ensaios em geradores elétricos Utilizados em Aerogeradores de Pequeno Porte. In: Congress Latin America on Electricity Generation and Transmission, 9th, 2011, Mar del Plata, Anais do IX GLAGTEE. Mar del Prata: GLAGTEE, November 6-9, 2011.

CARNEIRO, Alan et al. Performance quantification of a cyclonic boiler using biomass sawdust. Energy Procedia. Volume 120, 7p, p. 403-409, July, 2017.

CARNEIRO, Alan. et al. Energy efficiency and emission quantification for a small cyclonic boiler running on biomass sawdust, In: COBEM/ABCM, 23rd, 2015, Rio de Janeiro, International Congress of Mechanical Engineering, Rio de Janeiro: ABCM, 2015. p.8.

MACEDO, Wilson N. et al. Biomass based microturbine system for electricity generation for isolated communities in amazon region. Renewable Energy. Volume 91, 10p., p.323-333, january, 2016.