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Hydrokinetic turbine blades: Design and local construction techniques for remote communities

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Abstract

The design and construction of a hydrokinetic turbine intended for off-grid remote communities in Sarawak, Malaysia, are demonstrated and explained in this paper. By estimating the power required by a single remote home, knowing the average velocity of a nearby river, and making reasonable assumptions for the efficiency of the turbine, transmission and generator, the turbine diameter and hence blade length can be calculated using standard formulae. Having determined the length of the blades the blade profiles (twist angles and chord lengths) at ten selected sections along the blade can be calculated. The profile coordinates x, y are then plotted and printed in Excel or they can be exported to Solidworks CAD software. The printed profiles are traced on thin pieces of softwood and are cut and shaped manually using common tools to form section templates. These templates are then arranged in order, given the right twist

angles, glued and screwed to form a whole blade template. This template is copied using a simple, easily constructed copy router in order to produce three identical wooden blades which will be used in a turbine system. Since the construction of optimum blades has been simplified and demonstrated, turbine blades can be made in remote villages near to where the turbine will be used and maintained. This gives village people a sense of ownership and reduces cost, avoiding importation of ready-made systems where an unfavorable currency exchange rate has made almost everything too expensive for underprivileged people in developing countries.

Research highlights

• The design of a complicated optimum hydrokinetic turbine blade is demonstrated. • A practical way of constructing blade templates is demonstrated. • The construction of wooden blades is simplified and was demonstrated so that off-grid people can construct their turbine blades themselves. • Tapping energy from renewable source help ease life in remote area, especially in developing country.



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Keywords

Hydrokinetic turbine; Remote communities; Solidworks; Turbine blade design and construction; Sarawak Malaysia; Wooden blade copy jigs

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