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Development of a 3D-printed Archimedean screw turbine workflow for Pico hydropower generation at low water flow rate

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Abstract

In Malaysia, rural communities rely on fossil fuel-powered generators for electrification. A small-scale Archimedean screw turbine (AST) can be utilized to generate pico-hydropower for potential clean energy generation. Currently, there is no standard workflow that has been discussed to develop a small-scale 3D-printed AST to operate at a low water flow rate. Hence this work starts with investigating the strength of 3D-printed polyethylene terephthalate glycol polymer by conducting ultimate tensile strength test. Hence, the experimental test was developed to study the feasibility of 3D printed AST in generating the torque output utilizing a low water flow rate. The results obtained, it shows the highest tensile strength is 37.10MPa, and the optimum torque generated through the

AST experimental test is 0.0195 Nm. The experimental outcome also indicates that the maximum power mechanical generated is 0.36W. Thus a small-scale 3D-printed AST can be applied for pico-hydro energy generation for rural electrification in Malaysia. Overall, a novel workflow to develop a 3D printed AST utilizing a low water flow rate of a river in generating clean energy was achieved. © 2026 Elsevier Inc. All rights reserved.

Author keywords

3D printing; Archimedean screw turbine (AST) workflow; pico hydropower; polyethylene terephthalate glycol (PETG); tensile strength; torque generation

Indexed keywords

Engineering controlled terms

Electric utilities; Electrification; Flow of water; Flow rate; Fossil fuels; Hydraulic turbines; Hydraulics; Hydro energy; Hydroelectric generators; Hydroelectric power plants; Plastic bottles; Rural areas

Engineering uncontrolled terms

3-D printing; 3D-printing; Archimedean screw turbine workflow; Low water; Pico hydropower; Polyethylene terephthalate glycol; Polyethylene terephthalate glycols; Torque generation; Water flow rate; Work-flows

Engineering main heading

Tensile strength

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