



UNIVERSITI  
TEKNOLOGI  
MARA

# PROCEEDING FOR INTERNATIONAL COLLOQUIUM ON NEXTGEN CONSTRUCTION

# 2025

*Future-Ready Construction and Facility Management:  
Driving Research and Innovation for a Smart Built Environment*

**PROCEEDING FOR  
INTERNATIONAL COLLOQUIUM ON  
NEXTGEN CONSTRUCTION  
2025**

**Organiser:**

Universitas Pamulang (UNPAM)

**Co-organiser:**

Department of Built Environment Studies and Technology,  
Faculty of Built Environment,  
UiTM Perak Branch

Faculty of Built Environment, UiTM Sarawak Branch

**Colloquium Date:**

6 May 2025

**Unit Penerbitan UiTM Perak, 2025**

All rights reserved. No part of this publication may be reproduced, copied, stored in any retrieval system, or transmitted in any form or by any means; electronic, mechanical, photocopying, recording, or otherwise; without permission on writing from the director of Unit Penerbitan UiTM Perak, Universiti Teknologi MARA, Perak Branch, 32610 Seri Iskandar Perak, Malaysia.

Perpustakaan Negara Malaysia

Cataloging in Publication Data

No e- ISBN: 978-967-2776-60-4

*Cover Design : Nur'Ain Ismail*

*Typesetting : Nur'Ain Ismail*

# DEVELOPMENT OF A MICROHYDRO POWER GENERATION SYSTEM AS A RENEWABLE ENERGY SOURCE FOR REMOTE AREAS

Department of Electrical Engineering\*, Faculty of Engineering,  
Universitas Pamulang, Indonesia

\*Corresponding author: elektropamulang@unpam.ac.id

## Abstract

This study presents the development of a small-scale microhydro power generation system designed to supply electricity to remote and rural communities. The system utilizes natural water flow from rivers or small waterfalls to rotate a turbine that drives an electrical generator. The research aims to promote renewable energy technologies that are low-cost, environmentally friendly, and easily maintained. The prototype produces an electrical output of up to 500 watts at 24V AC, sufficient to power lighting and small household appliances. Key advantages of the system include ease of construction, minimal environmental impact, and suitability for areas without access to the national grid. This project demonstrates the feasibility of implementing microhydro systems as sustainable solutions for decentralized rural electrification in Indonesia.

**Keywords:** Microhydro, renewable energy, rural electrification, turbine, sustainable power.

## 1. INTRODUCTION

Renewable energy technologies have become increasingly important as global energy demands rise and environmental concerns intensify. Indonesia, with its abundant rivers and streams, has significant potential for microhydro power generation. Many rural areas still lack access to reliable electricity, making microhydro systems a viable alternative energy source. This project focuses on developing a small-scale microhydro power system that utilizes natural water flow to generate electricity efficiently and sustainably.

## 2. LITERATURE REVIEW

Previous studies highlight that microhydro systems can be implemented in regions with consistent water flow to produce clean and continuous electricity. According to Rahardjo et al. (2021), microhydro systems with capacities between 100–1000 watts can significantly improve energy access in isolated communities. Research by Nugroho and Hidayat (2022) also emphasizes the economic and environmental benefits of microhydro systems, particularly for off-grid areas. However, there is limited application of affordable and portable prototypes suitable for small-scale local use. This study aims to address this gap by designing a compact and easy-to-maintain system for educational and community purposes.

### 3. METHODOLOGY

The prototype system (Figure 1) comprises a water turbine, a mechanical shaft, and an electrical generator, all integrated with a control panel. Flowing water from a river or natural stream is directed toward the turbine blades, causing rotation that drives the generator through a coupling mechanism. The generated electricity is regulated and distributed as a 24V AC output. Testing was conducted under varying water flow conditions to measure the output voltage, current, and efficiency. Data were analyzed to evaluate system performance and potential scalability.



Figure 1: The prototype system

### 4. FINDING AND DISCUSSION

Experimental testing demonstrated that the microhydro system consistently produced an output of approximately 500 watts under optimal water flow conditions. The turbine rotation speed and generator output were directly influenced by water velocity. The system was able to power multiple lighting units simultaneously, confirming its effectiveness for basic household energy needs. Maintenance requirements were minimal, involving only periodic cleaning of the turbine intake. The results validate the practicality of using microhydro technology for small-scale renewable power generation in rural Indonesia.

## **5. CONCLUSION**

The developed microhydro power generation system successfully converts the kinetic energy of water flow into electrical energy with an output capacity of up to 500 watts. Its simple construction, low maintenance, and environmental friendliness make it ideal for deployment in remote and rural communities. This innovation contributes to sustainable energy development and supports Indonesia's goal of expanding renewable energy access. Future research will focus on optimizing efficiency and integrating energy storage systems to enhance reliability.

## **6. REFERENCES**

- Rahardjo, A., et al. (2021). Design and implementation of small-scale microhydro systems for rural communities. *Renewable Energy Journal*, 17(3), 142–150.
- Nugroho, F., & Hidayat, R. (2022). Application of microhydro power plants for sustainable rural electrification. *Energy and Environment Review*, 8(2), 65–74.
- Pamulang University Electrical Engineering Team. (2025). Renewable energy project: Microhydro power generator. Department of Electrical Engineering, Universitas Pamulang.



UNIVERSITI  
TEKNOLOGI  
MARA

# PROCEEDING FOR INTERNATIONAL COLLOQUIUM ON NEXTGEN CONSTRUCTION 2025

*Future-Ready Construction and Facility Management:  
Driving Research and Innovation for a Smart Built Environment*

eISBN 978-967-2776-60-4

