ASEC 2025 Conference

The 6th International Electronic Conference on Applied Sciences

09–11 December 2025 | Online

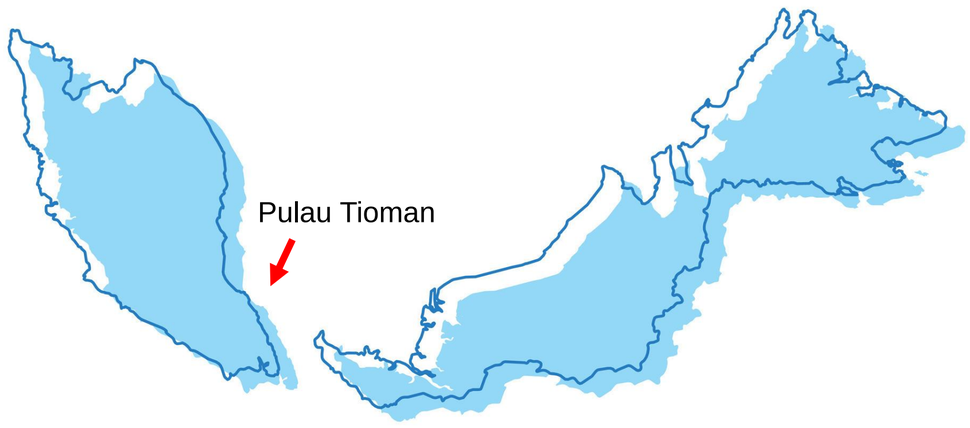
MDPI

Site-Specific Challenges for VAWT Installation in Remote Island Environments: A Case Study in Pulau Tioman

Ali Jamaludin, Mohd Azimin Elias, Mohd Azwan Rashid
Tenaga Nasional, Malaysia

INTRODUCTION & AIM

Remote islands like Pulau Tioman face energy access challenges due to reliance on costly diesel generation. Vertical Axis Wind Turbines (VAWTs) offer a sustainable alternative, suitable for turbulent coastal winds and limited space.



This study explores site-specific challenges and solutions for installing a 1kW VAWT system in Pulau Tioman.

METHOD

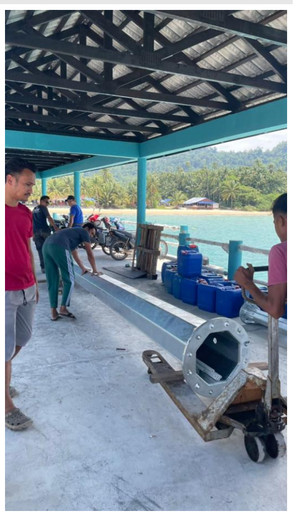
Site Description

Pulau Tioman is a remote island off the east coast of Peninsular Malaysia, characterized by tropical conditions with high humidity, frequent rainfall, and variable wind patterns. The installation site was located near a coastal area with sandy soil and proximity to an existing feeder pillar for grid connection.

System Specifications		
Turbine	:	1kW Grid-Connected Vertical Axis Wind Turbine with Permanent Magnet Generator (PMG)
Tower	:	9-meter in height, divided into two sections
Foundation	:	Reinforced concrete base G25 with J-bolts
Electrical Components	:	Control cabinet, underground LV cables and monitoring panel

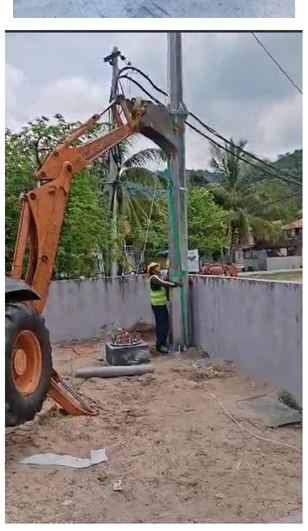
Transportation and Handling

All components were transported to Pulau Tioman by boat. From the jetty to the installation site, the 9-meter pole were moved using pallet jacks while large components such as wind turbine unit, electrical cabinet, J-bolts and civil foundation materials were transported using three-wheel motorcycles. Upon arrival, all components were stored securely before assembly.



Assembly Process

PMG and turbine blades were assembled on the ground. Manual rotation was performed to check for anomalies. Two pole sections were joined to form a single 9-meter tower. The assembled tower was lifted using a backhoe, with safety lines attached to control movement during lifting. The tower was secured to the reinforced concrete foundation using J-bolts.



Electrical Integration

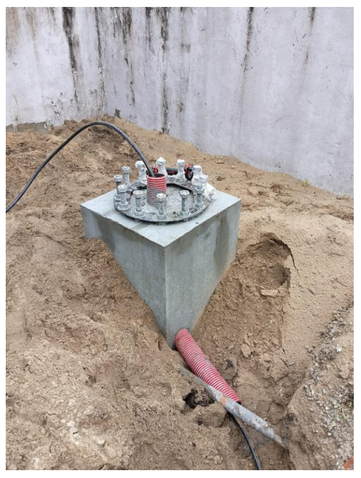
The system was connected to the local grid via an existing feeder pillar. Power cables were buried underground in compliance with LV cable standards, considering the sandy beach soil conditions. All operational data were transmitted to a dedicated local monitoring panel for performance tracking.

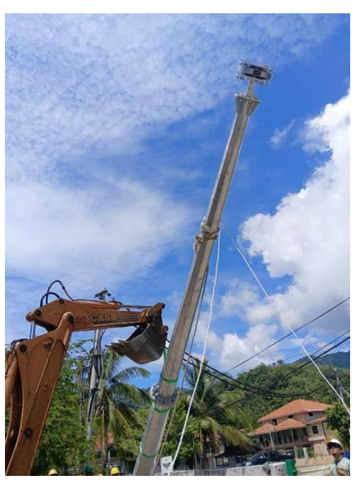
Community Engagement

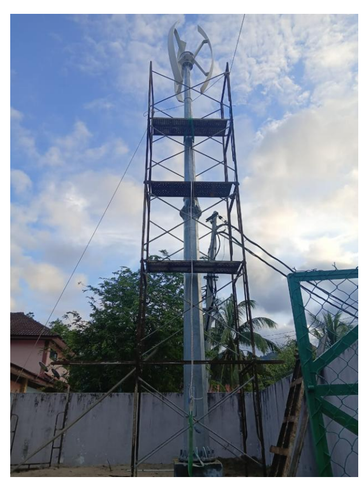
To ensure smooth execution, the project team engaged with the village leader for coordination and support. Local community members assisted in transporting materials and providing labor, which was critical for overcoming logistical challenges.

CHALLENGES AND SOLUTIONS

Category	Challenge	Solution
Logistical Constraints	Remote island and limited infrastructure posed significant transportation challenges. Heavy lifting equipment was unavailable, and access roads were narrow and uneven.	Boat transport, pallet jacks, 3-wheel motorcycles, modular assembly techniques were adopted to allow manual handling and minimize reliance on heavy machinery
Regulatory Compliance	Total height of the system should not exceed 3-sotrey building, no flight path interference, minimum clearance of 6 meters from the nearest building	Design adjustments ensured the tower height remained within limits, site selection avoided proximity to structures and clearance from aviation routes was verified with authorities
Stakeholder Coordination	Scheduling and coordination among multiple parties delayed the work	Engagement with the village leader facilitated local labor support and improved logistical coordination, ensuring smoother execution







RESULTS AND DISCUSSION

- The turbine was successfully connected to the local grind via the existing feeder pillar.
- Underground LV cables were installed in compliance with standards, considering the sandy soil conditions.
- The system demonstrated structural stability, with no anomalies detected during manual rotation checks or post-installation inspections.
- Electrical performance was consistent with design specifications.

LESSONS LEARNED

Early identification of logistical and regulatory constraints is critical for remote installations. Breaking down components for manual handling significantly reduced dependency on heavy machinery. Collaboration with local stakeholders, including the village leader, improved project efficiency. Height restrictions and clearance requirement must be addressed during site selection and design phases.

CONCLUSION

The installation of a 1kW Vertical Axis Wind Turbine (VAWT) in Pulau Tioman demonstrates the technical and logistical feasibility of deploying small-scale renewable energy systems in remote island environments. Despite challenges related to transportation, environmental conditions, regulatory compliance and stakeholder coordination, the project was successfully completed and integrated with the local grid. The case study highlights the importance of adaptive engineering solutions and community engagement in overcoming site-specific constraints.