AJEMB
AMERICAN JOURNAL OF ECONOMIC AND MANAGEMENT BUSINESS

American Journal of Business Economics and Management
e-ISSN: 2835-5199
Vol. 5 No. 7 July 2026

Identification and Evaluation of the Suitability of the Rc08 Turbo Burn Incinerator Technology as a Solution for Hazardous Waste Treatment at Diesel Power Plants in Remote Areas of Indonesia

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Keywords: Isolated Area; Cyclonic Combustion; Turbo Burn RC08; Liquid and Solid B3 Waste; Scholer Industries

Abstract

Indonesia, as an archipelagic nation with more than 17,000 islands, faces serious challenges in managing Hazardous and Toxic Waste (B3) from Diesel Power Plants (PLTD) in remote areas. This study aims to identify and evaluate the Turbo Burn RC08 Incinerator technology, manufactured by Scholer Industries Australia, as a potential solution for B3 waste treatment at remote PLTDs prior to implementation in Indonesia. The research methodology employed a literature study approach and gap analysis between waste management problems in Indonesia and the technical specifications of the technology available in Australia. The study identifies that PLTDs generate used oil (49 L/month), used filters (0.7–60 kg/month), and contaminated rags (2–3 kg/month). The Turbo Burn RC08 offers a processing capacity of 18–45 kg/hour, portable operation, EPA Australia certification, a 2-stage cyclonic method with temperatures up to 1,100°C, and over 95% waste volume reduction. Suitability analysis shows great potential to address transportation, spill, and illegal dumping problems. However, adjustments are needed to comply with Indonesian emission dispersion regulations (chimney height), island topographic conditions, and monsoon wind patterns. This study contributes to environmental technology localization literature and provides a roadmap for policymakers, technology providers, and utility companies in making informed decisions on B3 waste treatment solutions in remote areas.

INTRODUCTION

Indonesia, with more than 17,000 islands, faces extraordinary challenges in managing Hazardous and Toxic Waste (B3) from Diesel Power Plants (PLTD) in isolated regions (Aryani, 2022; Michel, 2024; Supriatna & Lenz, 2022; Susiati et al., 2024). Based on data from the Ministry of Energy and Mineral Resources, there are hundreds of PLTD units spread across various remote islands in Indonesia, operating to provide electricity to communities that have not yet been reached by the national grid. PLTDs in remote areas produce B3 waste such as used oil (49 L/month), used filters (0.7–60 kg/month), and contaminated rags (2–3 kg/month) that are cumulative, toxic, and threaten the environment and public health if not managed in accordance with regulations (Pemerintah Republik Indonesia, 2021). The increasingly stringent regulatory framework, including Government Regulation No. 22 of 2021 on the

Implementation of Environmental Protection and Management (Pemerintah Republik Indonesia, 2021) and Minister of Environment and Forestry Regulation No. 6 of 2021 on Procedures and Requirements for B3 Waste Management (Kementerian Lingkungan Hidup dan Kehutanan, 2021), demands that every waste producer, including PLTDs, manage their waste properly. However, the geographical condition of Indonesia as an archipelagic country makes transporting waste to licensed treatment facilities mostly concentrated on Java Island very difficult, resulting in high logistics costs, risk of marine spills, accumulation of waste on-site, and even illegal dumping practices ("Di Tengah Covid-19, Limbah Medis Belum Tertangani dengan Baik," 2020).

The absence of on-site waste treatment solutions in remote areas has driven various parties to seek alternative technologies that can be operated independently, are portable, and comply with applicable environmental standards (Boguniewicz-Zabłocka & Capodaglio, 2017; Capodaglio, 2017; Maczukin et al., 2026; Sharma et al., 2022). One of the technologies being considered is the Turbo Burn RC08 incinerator manufactured by Scholer Industries Australia, which is claimed to be capable of processing various types of B3 waste with emissions that meet international standards (ESI Scholer, 2025a, 2025b; Scholer Industries, 2025). This technology employs a 2-stage cyclonic method with a Programmable Logic Controller (PLC) system, reaches operating temperatures up to 1,100°C, and has been certified by the Environment Protection Authority (EPA) of Australia (ESI Scholer, 2025a, 2025b). However, before this technology can be implemented in Indonesia, a comprehensive evaluation is needed to ensure that the technology is suitable for the specific conditions in Indonesia including regulatory aspects, topographic conditions, wind patterns, and waste characteristics so that its application can provide optimal and sustainable benefits.

Several previous studies have examined B3 waste management in remote areas and incineration technology. Studies on PLTD waste management have generally focused on waste volume inventory and logistical constraints (Pemerintah Republik Indonesia, 2021; "Di Tengah Covid-19, Limbah Medis Belum Tertangani dengan Baik," 2020), while incineration technology studies have focused on the technical performance of conventional incinerators without specifically evaluating cyclonic technologies such as the Turbo Burn RC08 (Kementerian Lingkungan Hidup dan Kehutanan, 2016; ESI Scholer, 2025a). Research on technology localization in Indonesia has not yet considered the integration of regulatory, topographic, and climatic aspects holistically. This study addresses these gaps by providing a comprehensive evaluation of the Turbo Burn RC08 technology, integrating waste characteristics, technology specifications, regulatory compliance, geographic suitability, and adoption challenges.

This research identifies and evaluates the Turbo Burn RC08 as a B3 waste treatment solution for PLTDs in remote areas, with a focus on suitability analysis and pre-implementation adoption/localization challenges. The novelty lies in the early evaluation approach that considers Indonesia's regulatory gaps, topographic data from the National Geospatial Information Agency (BIG) DEMNAS (Badan Informasi Geospasial, 2025), and wind patterns from the Meteorology, Climatology, and Geophysics Agency (BMKG) [5], to support technology localization prior to investment and implementation.

This research aims to identify and evaluate the Turbo Burn RC08 incinerator technology as a potential B3 waste treatment solution for remote PLTDs in Indonesia, focusing on waste characteristics, technology specifications, suitability for Indonesian conditions, and adoption challenges. The research addresses the volume and types of B3 waste generated, the technical specifications and regulatory compliance of the technology, its suitability for Indonesia's geographic and regulatory context, and localization challenges. Theoretically, this research contributes to environmental technology localization literature and provides a framework for evaluating foreign technology suitability, while practically offering objective evaluations for PT XYZ and PLN, actionable recommendations for technology adoption, inputs for policymakers, and a foundation for developing B3 waste solutions in other remote Indonesian locations.

METHOD

Research Approach

This study used a literature study and gap analysis approach to identify and evaluate the Turbo Burn RC08 Incinerator technology as a potential solution for B3 waste treatment at remote PLTDs in Indonesia. This approach was chosen because the research is at an early identification and evaluation stage before implementation, focusing on the collection and analysis of secondary data from various sources.

Types and Sources of Data

All data used in this study are secondary data obtained from:

1. Indonesian waste management problem data: reports and news on B3 waste disposal cases in remote areas, B3 waste generation data from PLTDs.
2. Regulatory data: Government Regulation No. 22 of 2021 on the Implementation of Environmental Protection and Management (Pemerintah Republik Indonesia, 2021) and Minister of Environment and Forestry Regulation No. 6 of 2021 (Kementerian Lingkungan Hidup dan Kehutanan, 2021).
3. Geospatial data: DEMNAS from the National Geospatial Information Agency (BIG) (Badan Informasi Geospasial, 2025).
4. Wind pattern data from the Meteorology, Climatology, and Geophysics Agency (BMKG) (Badan Meteorologi, Klimatologi, dan Geofisika, 2025).
5. Turbo Burn RC08 technology data: product brochures, technical specifications from ESI Scholer Industries (ESI Scholer, 2025a, 2025b, 2025c), emission test and EPA Australia certification data (ESI Scholer, 2025a).
6. Australian waste treatment regulations: Protection of the Environment Operations (Clean Air) Regulation 2022 (NSW) (NSW Government, 2022).

Data Collection Techniques

1. Literature study: academic literature, technical reports, product brochures, and news related to B3 waste problems and Turbo Burn RC08 technology.
2. Documentary study: collection of Turbo Burn RC08 technical product documents and related regulations.
3. Comparative regulatory analysis: comparison of Australian and Indonesian regulatory frameworks.

Data Analysis

Data analysis was conducted qualitatively through the following stages:

1. Problem identification: mapping B3 waste management problems at remote PLTDs.
2. Technology identification: collection of Turbo Burn RC08 technical information from Scholer Industries.
3. Suitability analysis: evaluation of technological suitability against problems and regulations.
4. Challenge identification: mapping of technology adoption and localization challenges.

Analytical Framework

Table 1. Analytical Framework

Dimension	Evaluation Parameters
Problem	Waste characteristics, transportation costs, environmental risks
Technology	Functional specifications, processing capacity, regulatory compliance
Suitability	Waste compatibility, regulatory compliance, geographic suitability

Source: Developed by researcher based on literature review and gap analysis (2025).

RESULTS AND DISCUSSION

A. B3 Waste Management Problems at Remote PLTDs

Characteristics and Volume of B3 Waste

B3 waste generated by PLTDs in remote areas consists of:

Table 2. Waste Types, Sources, Characteristics, and Waste Codes

Waste Type	Source	Characteristics	Waste Code (PP 22/2021)
Used oil	Diesel engine maintenance, leaks, filter washing	Toxic, flammable	B105d
Used filters	Air pollution control	Contains metals, oil	B109d
Used rags	Equipment maintenance	Impregnated with oil/grease	B110d
Used B3 packaging	Oil/filter packaging	Contaminated with B3	B3-related

Source: Government Regulation No. 22 of 2021 on the Implementation of Environmental Protection and Management (Pemerintah Republik Indonesia, 2021), processed by researcher.

The volume of B3 waste from various PLTDs in remote areas shows a relatively consistent pattern:

Table 2. B3 Waste Volumes from PLTDs in Remote Areas

Location	Used Oil (L/month)	Used Filters (kg/month)	Used Rags (kg/month)
PLTD Tarempa	49	60	—
PLTD Musai	49	31.2	—
PLTD Setajam	49	60	2.5
PLTD Lemang	49	0.7	—
PLTD S. Guntung	49	9.6	2
PLTD Selat Lampa	49	50	—
PLTD Komodo	49	5	2
PLTD Semau	49	60	3

Source: PLN operational data and B3 waste reports from various remote PLTD locations, compiled by researcher (2025).

The data shows that waste volumes are relatively small per month but are cumulative in nature and require proper management.

Transportation Challenges and Logistical Problems

- Long distances: Remote PLTD locations require transportation via long overland and sea routes.
- Limited access: Many PLTDs are located on small islands with limited port access.
- High logistics costs: Transportation cost per unit volume becomes highly uneconomical for relatively small waste volumes.
- Spill risk: Transporting B3 waste by sea carries the risk of spills that could contaminate aquatic ecosystems.

Risk of Illegal Dumping

The absence of local waste treatment solutions in remote areas risks encouraging illegal dumping practices. B3 waste is often managed outside proper mechanisms, causing pollution in the sea, rivers, and on land. This has prompted the government to seek B3 waste treatment solutions in remote areas to eliminate improper management of both liquid and solid B3 waste.

B. Identification of Turbo Burn RC08 Technology

Company Profile of Scholer Industries

Scholer Industries is the largest incinerator manufacturing company in Australia, based at 33 Hogarth Street, Cannington, Western Australia (Scholer Industries, 2025). The company has a long history in the incineration industry dating back to 1927, when Harry A. Scholer founded "Goodrid Incinerator Company Pty Ltd" (Scholer Industries, 2025).

Following Harry A. Scholer, the next generation his sons Phil & Paul Scholer took over the family business and expanded operations to become Australia's largest incinerator manufacturer, actively exporting worldwide (Scholer Industries, 2025). Neal Scholer has been actively involved in incineration technology since starting his career in the family business in 1970 (Scholer Industries, 2025).

In early 2019, Scholer Industries formed a strategic partnership with Engineering Solutions International Co. Ltd. (ESI) and rebranded as ESI Scholer (ESI Scholer, 2025b). The partnership resulted in a stronger corporate structure to meet increased demand for incinerators and environmentally friendly energy products such as Refuse Derived Fuel (RDF) plants (ESI Scholer, 2025b).

Technical Specifications of the Turbo Burn RC08 Incinerator

Table 3. Turbo Burn RC08 Incinerator Specifications

Parameter	Specification
Combustion capacity	18–45 kg per hour
Drum capacity	200L steel drum container (drum not included)
Control system	Insulated stainless steel panel with color touchscreen and PLC
Electrical	220–240V, 10A, 50Hz, 1 phase
Trolley & housing material	Powder-coated steel frame (grey) & 304 rolled stainless steel
Dimensions & weight	Without drum: 78×105×68 cm, 82 kg; With drum: 78×110×100 cm, 100 kg

Operating temperature	Up to 1,100°C
Pollution control system	Wet scrubber (optional)
Waste volume reduction	>95%
Warranty	1 year for workmanship and materials

Source: Scholer Industries / ESI Scholer product brochure and technical specifications (ESI Scholer, 2025a, 2025b, 2025c), processed by researcher

2-Stage Cyclonic Operating Principle

The Turbo Burn RC08 operates using a 2-stage cyclonic method based on a PLC control system to ensure efficient combustion with minimal smoke emissions:

- First stage (primary chamber): Excess air entering the primary combustion chamber creates a cyclonic wind rotation, causing fire and smoke to swirl from bottom to top, creating high turbulence that increases contact between oxygen and waste fuel.
- Second stage (secondary chamber): Exhaust gases from the primary chamber are circulated into the high-temperature-resistant stainless steel secondary combustion chamber to refine exhaust emissions before release through the chimney, at temperatures reaching up to 1,100°C.

Advantages of the 2-stage cyclonic method include: complete combustion through the cyclonic effect; no additional fuel required (self-sustaining); portability for remote locations; and high volume reduction of >95%, producing clean inert ash free of smoke emissions.

Suitable Waste Types

- Paper and cardboard packaging
- Solid fuels such as wood/timber
- Certain plastics and polymers (packaging materials)
- Cloths/rags contaminated with oil/grease and used oil absorbents
- Oil filter cartridges
- Hydrocarbon waste (e.g., used oil, diesel, and grease)
- Narcotics and some pharmaceutical products
- Small animal carcasses (poultry, birds, cats, marine animals, etc.)
- Hospital, medical, and biomedical waste
- Confidential documents

EPA Certification

The Turbo Burn RC08 has undergone emission testing and is certified by the Environment Protection Authority (EPA) of Australia for hazardous waste destruction, including oil waste, solid hydrocarbons, medical waste, and general and industrial waste (ESI Scholer, 2025a, 2025). The unit has also been approved for compliance with international emission standards for Indonesia with a certificate of compliance issued for the complete package (ESI Scholer, 2025a).

Support Services

- Initial consultation and waste management process analysis.
- Customization: adapting units to specific client needs, including engineering, design, and fabrication into integrated handling systems.

- Installation and commissioning.
- Service, maintenance, and refurbishment of installed incinerators.
- Customer staff training in daily use and maintenance.
- Technical support and project management.

C. Suitability Analysis for Indonesia

Capacity Compatibility

Table 4. Comparison of Turbo Burn RC08 Capacity with PLTD Waste Volumes

Parameter	PLTD Waste Volume	Turbo Burn RC08 Capacity	Compatibility
Solid waste	0.7–60 kg/month	18–45 kg/hour	✓ Compatible
Liquid waste	49 L/month	Can be processed with solid waste	✓ Compatible

Source: Processed by researcher based on PLTD waste data and Turbo Burn RC08 technical specifications (ESI Scholer, 2025a, 2025b, 2025c).

Waste Type Compatibility

The waste types that can be processed by the Turbo Burn RC08 — including used oil, used filters, contaminated rags, hydrocarbon waste, and medical waste — are consistent with the B3 waste categories regulated in Annex IX of Government Regulation No. 22 of 2021 (Pemerintah Republik Indonesia, 2021). The Turbo Burn RC08's ability to handle various types of B3 waste makes it a comprehensive solution for PLTD waste problems.

Portability Advantage

- Multi-location mobility: A single unit can serve several PLTDs in rotation.
- No permanent construction required: Does not need costly permanent facilities.
- Simple operation: Can be operated by one person after basic training.
- Easy transportation: Lightweight and easy to transport to remote locations.

Operational Economic Advantage

The Turbo Burn RC08 operates without additional fuel by utilizing the calorific value of the waste itself. This is critical for remote areas with limited and expensive fuel access. Its ability to reduce waste volume by >95% produces clean, inert ash that is easier to manage.

Regulatory Compliance

EPA Australia certification provides assurance that the technology meets rigorous international environmental standards. The Turbo Burn RC08 has also been approved for compliance with international emission standards for Indonesia, with a full package certificate of compliance (ESI Scholer, 2025a).

D. Gap Analysis

Table 5. Gap Analysis: Problems vs. Turbo Burn RC08 Solutions

Problem	Turbo Burn RC08 Solution	Gap
High transportation costs	On-site processing	Closed
Transportation spill risk	No transportation needed	Closed

Waste accumulation	Periodic combustion	Closed
Illegal dumping	Legal on-site solution	Closed
Limited expert personnel	Simple PLC-based operation	Closed

Source: Developed by researcher based on gap analysis between problem identification and technology specifications (2025)

The analysis shows that the Turbo Burn RC08 can, in principle, address all major B3 waste management problems in remote areas.

E. Technology Adoption and Localization Challenges

Emission Dispersion Regulations

Permanent incinerators in Indonesia are typically equipped with chimneys at least 14 meters high. As a portable unit, the Turbo Burn RC08 has limited chimney height, which may not yet meet Indonesia's minimum chimney height requirements. Required actions include:

- Careful dispersion modeling to ensure emissions do not exceed ambient air quality standards.
- Potential chimney height additions or design modifications.
- A dispersion technical approval process from KLHK requiring in-depth technical studies.

However, the Turbo Burn RC08 has already undergone the KLHK registration process and received a Technology Approval, and isokinetic emission tests have been conducted at a KLHK-accredited laboratory (ESI Scholer, 2025a).

Topographic Conditions

Indonesia's highly varied topography significantly affects emission dispersion patterns. DEMNAS data from BIG (Badan Informasi Geospasial, 2025) shows topographic diversity that must be considered in:

- Selecting the optimal placement location for emission dispersion.
- Dispersion modeling that accounts for local topographic effects.
- Determining safe distances from settlements.

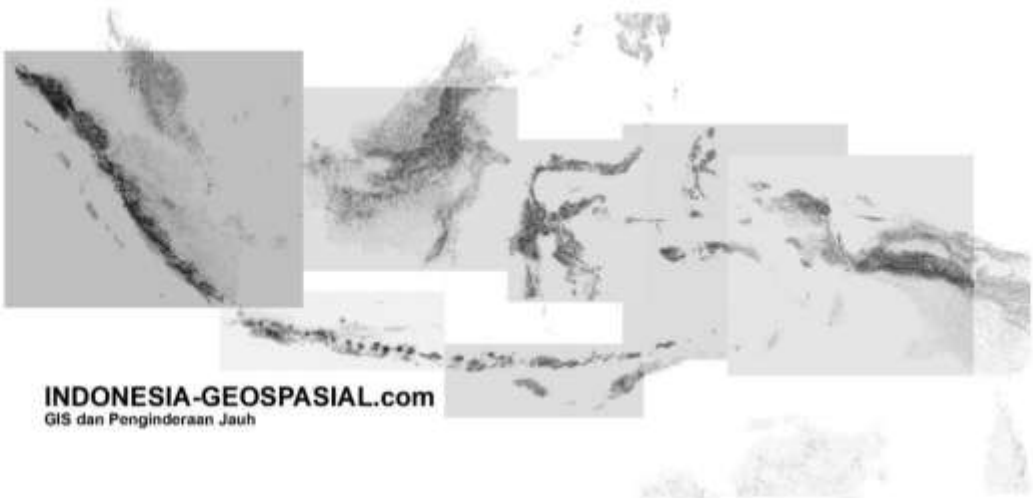

Figure 1. DEMNAS Topographic Map of Archipelagic Region

Source: Badan Informasi Geospasial (BIG), DEMNAS (Digital Elevation Model Nasional) (Badan Informasi Geospasial, 2025), accessed 2025.

Monsoon Wind Patterns

Indonesia has a monsoon wind pattern that changes twice a year the West Monsoon (December–March) and East Monsoon (June–September) (Badan Meteorologi, Klimatologi, dan Geofisika, 2025). Seasonal wind direction changes affect:

- Predicting emission dispersion directions that differ between wet and dry seasons.
- Determining safe placement locations relative to settlements in all seasons.
- The need for adeuate historical wind data for dispersion modeling.

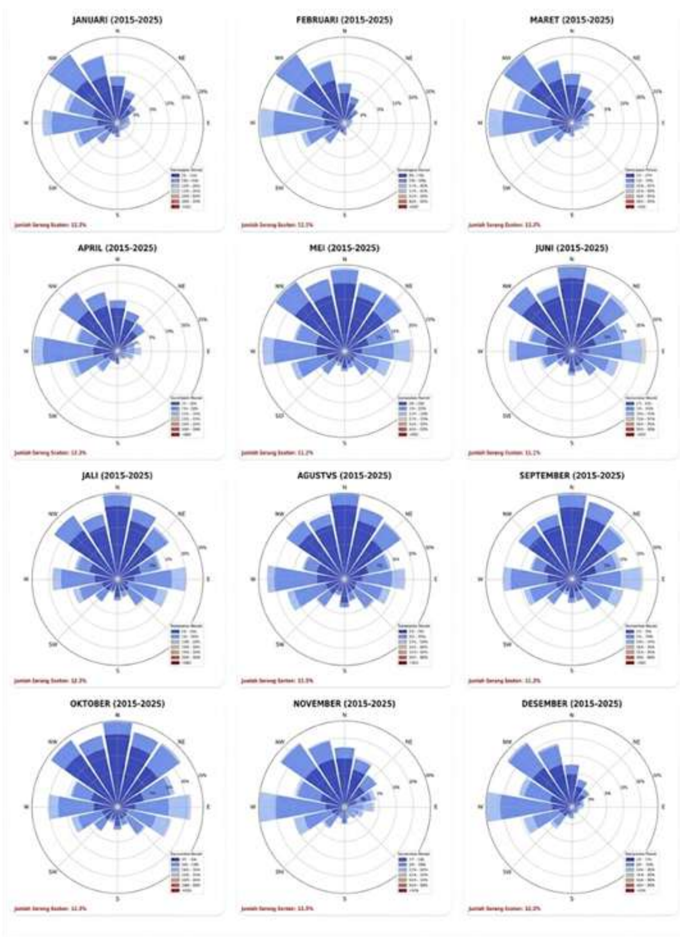

Figure 2. Windrose Data Amgom BMKG

Source: Badan Meteorologi, Klimatologi, dan Geofisika (BMKG), wind pattern data for the NTT region (Badan Meteorologi, Klimatologi, dan Geofisika, 2025), accessed 2025

F. Technology Adoption Roadmap

Stage 1 – Identification and Evaluation (This Study)

- Identification of waste management problems in Indonesia.
- Identification of Turbo Burn RC08 technology from Australia.
- Initial suitability evaluation.

Stage 2 – Feasibility Study

- Visit to Scholer Industries facilities in Cannington, Australia.
- Direct unit demonstration and cost-benefit analysis.

Stage 3 – Adaptation and Modification

- Chimney design adjustment to meet Indonesian regulations.
- Modification for Indonesian topographic and climatic conditions.
- Development of additional pollution control systems if necessary.

Stage 4 – Pilot Testing and Verification

- Import of a trial unit.
- Emission testing by KAN-accredited laboratories.
- Technical verification by KLHK.

Stage 5 – Licensing

- Application for Technical Approval (PERTEK).
- Application for Operational Feasibility Certificate (SLO).
- Eco-friendly product registration.

Stage 6 – Implementation

- Installation at a pilot location (e.g., PLTD Semau, NTT).
- Operator training by the Scholer Industries team.
- Ongoing monitoring and evaluation.

CONCLUSION

The Cilacap Regency SPAM project, under a BOT scheme between Perumdam Tirta Wijaya and PT XYZ, has been declared feasible for development. Over 15 years, the project is projected to generate cumulative revenue of IDR 278.14 billion with free cash flow of IDR 94.81 billion. This feasibility is supported by positive financial indicators, including an NPV of IDR 10.5 billion (discount rate of 9.93%), an IRR of 12.72% above the WACC, a PI of 1.19, and a Payback Period of 7.32 years. However, the project faces significant risks, particularly revenue uncertainty due to fluctuations in water prices and production volume. Monte Carlo simulations indicate an average NPV of IDR 2.63 billion, with a negative NPV probability of approximately 39%. Therefore, active risk management and mitigation are key to the project's success. Based on these findings, several recommendations are proposed. For PT XYZ, it is recommended to strengthen revenue risk mitigation strategies by securing long-term bulk water purchase agreements with Perumdam Tirta Wijaya, conducting regular renegotiations on tariff escalation clauses, and diversifying revenue sources through value-added services. For PLN and Perumdam Tirta Wijaya, it is recommended to provide clear and consistent bulk water demand projections, ensure timely payment mechanisms, and establish joint monitoring teams to oversee project performance. For policymakers, it is recommended to provide regulatory certainty regarding tariff adjustments, streamline the permitting process for PPP projects in the water sector, and offer fiscal incentives for infrastructure projects that serve underserved communities. For future researchers, it is recommended to expand the analysis to include non-financial aspects such as social and environmental impacts, extend the observation period to capture long-term trends, incorporate additional risk variables such as climate change and regulatory changes, and conduct comparative studies with similar SPAM projects in other regions to benchmark best practices.

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