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# Implementation of the Main Distribution Material Inventory Control Policy (MDU) Using the Continuous Review Method at PT PLN (Persero) UP3 Sukabumi

**Satria Achmad Hazim, Niniet Indah Arvitrida**
**Institut Teknologi Sepuluh Nopember, Indonesia**
**Email: satria.achmadhazim@gmail.com**

**ABSTRACT**

The electricity industry is a strategic sector in the Indonesian economy, with PT PLN (Persero) as the main company responsible for the distribution of electrical energy. UP3 Sukabumi serves 54,636 *New Install* (PB) customers and 26,744 *Power Change* (PD) customers during the 2022–2023 period. The achievement of the lowest *Service Quality Level* (TMP) was due to the unavailability of *Main Distribution Materials* (MDU) by 46%. This study aims to optimize the control of MDU inventory using the Continuous Review (s,S) method with a Monte Carlo simulation approach. The classification of materials based on *ADI-CV* shows smooth and erratic characteristics with an ADI value of < 1.32. The results showed an increase in service level from 78–94% to 82–97% and a decrease in total inventory costs in 9 out of 10 materials studied. The optimal parameters obtained for MCB 25A material are s = 65 and S = 150, with a service level of 96%. The implementation of this method has a positive impact in the form of improved customer service, inventory cost efficiency, and achieving the company's TMP targets.

**Keywords:** Continuous Review, Main Distribution Materials, Monte Carlo, Inventory Control, Service Level

## INTRODUCTION

The electricity industry is an important sector in the economic movement of the Indonesian people (Oktaviani & Asrol, 2022; Park & Heo, 2020; Ratinen & Lund, 2012; Vithayasrichareon et al., 2012; Wattana & Aungyut, 2022; Yousefi et al., 2017). PT PLN (Persero), as the largest electricity provider company in Indonesia, has the responsibility of distributing electricity to the end consumer. The Sukabumi Customer Service Unit (UP3) is one of the units under the auspices of the West Java Distribution Main Unit (*Unit Induk Distribusi* or UID), which is tasked with serving customers in the city and district areas of Sukabumi (Jannat Nipa & Kumar Sarkar Rajib, 2023).

During 2022–2023, UP3 Sukabumi served 54,636 customers for *New Installation* (PB) and 26,744 customers for *Power Change* (PD). The application is dominated by customers with *Household* (R) rates, which reach 92% of the total customers served. In serving the connection of PB and PD, PLN provides a service time target set in the form of a *Service Quality Level* (TMP).

The analysis of TMP achievement showed significant variation throughout the study period. The highest TMP achievement occurred in March 2022 at 98%, and the lowest in December 2022 at 72%. The identification of the causes of non-achievement of TMP shows that the main factor is the unavailability of *Main Distribution Materials* (MDU), such as KWH meters and MCBs, which amounted to 46% of the total cases of delay.

PT PLN (Persero) currently uses *System Analysis and Product* in *Data Processing* (SAP) in managing stock and material needs (Duluhalang et al., 2020; Wahyuddin & Afriani, 2018). However, the application in the implementation unit has not fully implemented the management policy in material management, such as the determination of safety stock and reorder points for each type of material (Hendrianto Husada, 2019; Prasetyo et al., 2020; Rasmini et al., 2019; Sufandi & Rahayu, 2019). This condition causes stockouts that have an impact on service delays to customers.

Previous research, such as studies by Agustina (2021) and Kurniasari (2015), has explored inventory control methods like Continuous Review (s,S), but these were limited to

smaller-scale applications or different industries. Additionally, while Syntetos & Boylan (2005) introduced demand classification using *ADI-CV*, its integration with Monte Carlo simulations for dynamic inventory scenarios in the electricity sector remains underexplored. This study addresses these gaps by combining the Continuous Review method with Monte Carlo simulations to handle demand uncertainty and applying *ADI-CV* classification specifically to PLN's fast-moving materials. The novelty of this research lies in its tailored approach to PLN's operational context, offering a practical framework for optimizing inventory policies.

Based on these problems, this study aims to optimize the control of MDU inventory using the Continuous Review (s,S) method with a Monte Carlo simulation approach. This method was chosen based on the characteristics of material demand, which is included in the fast-moving category with smooth and erratic demand patterns. The expected benefits include operational improvements, such as reduced stockouts and better TMP compliance; economic gains through lower inventory costs; and strategic advantages by providing a replicable model for other PLN units. By addressing these challenges, this research contributes to both academic literature and practical inventory management solutions in the electricity sector.

## RESEARCH METHOD

This research employs a quantitative approach combined with simulation modeling to optimize inventory control for Main Distribution Materials (MDU) at PT PLN UP3 Sukabumi. The primary method used is the Continuous Review (s,S) inventory policy, supported by Monte Carlo simulation to account for demand variability and lead time uncertainty.

The data collected includes PB and PD demand data for the 2022-2023 Household tariff period, Bill of Quantity Material, lead time data, and inventory cost components. Demand data is converted into MDU needs based on PLN's construction standards.

Materials are classified based on ADI-CV analysis to determine demand patterns. In addition, classification is carried out based on the Decree of the Board of Directors of PT PLN Number 717.K/DIR/2010 which considers the level of criticality, availability, and usage.

Inventory parameters are calculated using the iterative Hadley-Within method to determine the optimal q* (order quantity) and r* (reorder point) values. Next, safety stock (SS) and maximum inventory level (S) are calculated.

The Monte Carlo simulation was carried out with 100 replications for each material using randomly generated demand data. Data validation is carried out using t-tests to ensure that the data from the simulation results do not differ significantly from historical data.

Various scenarios of the s and S parameters are evaluated to achieve the set service level targets. The selection of the optimal scenario is based on the combination of the highest service level and the lowest total cost.

## RESULTS AND DISCUSSION

### Classification of Materials

The results of the classification of 10 types of MDU based on ADI-CV analysis showed that all materials were in the fast-moving category with an ADI value of < 1.32. MCB 2A, MCB 35A, and MCB 50A materials show erratic demand patterns, while other materials show smooth demand patterns.

**Table 1. Material Classification Results Based on ADI-CV**

| Material | ADI | CV | Category |
|---|---|---|---|
| MCB 2A | 1,000 | 1,149 | Erratic |
| MCB 4A | 1,000 | 0,026 | Smooth |
| MCB 6A | 1,000 | 0,098 | Smooth |
| MCB 10A | 1,000 | 0,203 | Smooth |

| Material | ADI | CV | Category |
|---|---|---|---|
| MCB 16A | 1,000 | 0,399 | Smooth |
| MCB 20A | 1,000 | 0,317 | Smooth |
| MCB 25A | 1,000 | 0,407 | Smooth |
| MCB 35A | 1,043 | 1,131 | Erratic |
| MCB 50A | 1,263 | 1,292 | Erratic |
| KWH METER | 1,000 | 0,032 | Smooth |

Source: Processed primary data from PT PLN UP3 Sukabumi (2022-2023)

**Existing Conditions**

Analysis of existing conditions shows service levels that vary between 78-94%. MCB 2A material has the lowest service level of 78% with a total inventory cost of IDR 292,239,306. The highest total inventory cost occurred at the KWH Meter of IDR 23,439,846,392.

**Optimal Parameters of Continuous Review**

The calculation of the optimal parameters using the Hadley-Within method yields s and S values for each material. For example, for MCB 25A material, the parameters s s = 55 and S = 166 were obtained using the basic method.

**Table 2. Optimal Parameters Continuous Review**

| Material | s | S | Service Level | Total Cost (Rp) |
|---|---|---|---|---|
| MCB 2A | 400 | 850 | 82% | 272.264.707 |
| MCB 4A | 2000 | 4407 | 96% | 2.259.405.767 |
| MCB 6A | 500 | 1000 | 96% | 451.692.294 |
| MCB 10A | 258 | 450 | 95% | 231.353.926 |
| MCB 16A | 70 | 170 | 95% | 69.264.994 |
| MCB 20A | 25 | 86 | 96% | 30.677.355 |
| MCB 25A | 65 | 150 | 96% | 60.069.681 |
| MCB 35A | 10 | 50 | 94% | 14.480.532 |
| MCB 50A | 5 | 19 | 97% | 7.251.189 |
| KWH Meter | 2400 | 6080 | 96% | 24.681.542.008 |

Source: Calculation results using Hadley-Within iterative method (Silver et al., 2017), applied to PT PLN UP3 Sukabumi demand data (2022-2023)

**Monte Carlo Simulation Validation**

Validation of random number generation data using t-test showed that all replications had a t-stat of t-critical < (1.67866), so the simulated data did not differ significantly from the historical data and could be used for further analysis.

**Scenario Optimization**

Evaluation of various scenarios of parameters s and s is carried out to achieve the optimal service level target. For MCB 25A material, out of 20 scenarios evaluated, scenarios with s = 65 and S = 150 provide the best results with a service level of 96% and a total cost of Rp 60,069,681.

**Comparison of Existing Conditions vs Proposals**

The implementation of the Continuous Review method showed a significant increase in service level on all materials. Six materials achieved a service level above 95%, with MCB 50A material achieving the highest service level of 97%. Total inventory costs decreased in 9 out of 10 materials, with only KWH Meters seeing a 5.3% increase in costs but with a significant increase in service levels.

**Sensitivity Analysis**

Testing the sensitivity to changes in demand showed a positive relationship between the level of demand and the total cost of inventory. Conversely, increased demand tends to lead to a decrease in service levels due to increased stockout risk.

## CONCLUSION

This research succeeded in optimizing the inventory control of Main Distribution Materials at PT PLN UP3 Sukabumi using the Continuous Review (s,S) method. The implementation of this method resulted in an increase in service levels from the range of 78-94% to 82-97% and a reduction in the total cost of inventory on most materials. The optimal parameters obtained provide a balanced solution between high level of service and cost efficiency. MCB 25A material for example reaches a service level of 96% with parameters s = 65 and S = 150. This method has proven to be effective in overcoming stockout problems which are the main cause of non-achievement of Service Quality Levels. For further research, it is recommended to consider a multi-echelon inventory model that involves relationships between warehouses and develop a periodic evaluation system of inventory parameters to anticipate changes in future demand patterns.

## REFERENSI

Agustina, T. W. (2021). *Control of Main Distribution Material Inventory (MDU) at PT PLN UP3 Ponorogo*. Repository ITS, Surabaya.

Duluhalang, R., Saman, S., & Tamsil. (2020). Analisis audit manajemen atas fungsi pemasaran pada PT. PLN (Persero) ULP Namrole Kabupaten Buru Selatan. *Jurnal Nusamba, 01*(04).

Hendrianto Husada, E. (2019). Aplikasi fungsi manajemen dalam pengelolaan sampah terpadu STT-PLN. *KREATIF: Jurnal Ilmiah Prodi Manajemen Universitas Pamulang, 7*(1). https://doi.org/10.32493/jk.v7i1.y2019.p1-17

Jannat Nipa, N., & Kumar Sarkar Rajib, D. (2023). Success in generating and distributing electricity power throughout Bangladesh: A overview of NESCO (Northern Electricity Supply Company). *American Journal of Energy Engineering*. https://doi.org/10.11648/j.ajee.20231102.12

Kurniasari, A. R. D. (2015). *Analysis of raw material inventory control using the continuous review (S,S) method with component commonality considerations* [Thesis, Sepuluh Nopember Institute of Technology, Surabaya].

Oktaviani, M., & Asrol, M. (2022). Supply chain performance analysis and improvement for electricity industry. *International Journal of Emerging Technology and Advanced Engineering, 12*(7). https://doi.org/10.46338/ijetae0722_14

Park, C., & Heo, W. G. (2020). Review of the changing electricity industry value chain in the ICT convergence era. *Journal of Cleaner Production, 258*. https://doi.org/10.1016/j.jclepro.2020.120743

Prasetyo, B. E., Hayuhardhika, W., Putra, N., Syauqy, D., & Bhawiyuga, A. (2020). Sistem monitoring trafo distribusi PT. PLN (Persero) berbasis IoT. *JTiik, 7*(1).

Rasmini, N. W., Ta, I. K., Mudiana, I. N., & Parti, I. K. (2019). Rancang bangun automatic transfer switch (ATS) PLN - Genset 3 Phasa 10 kVA. *Matrix: Jurnal Manajemen Teknologi dan Informatika, 9*(2). https://doi.org/10.31940/matrix.v9i2.1344

Ratinen, M., & Lund, P. (2012). Analysing changes in electricity industries against actors and technologies: Utility to business transformations in Denmark, Germany, Finland and

Spain. *Journal of Technology Management and Innovation, 7*(2). https://doi.org/10.4067/s0718-27242012000200008

Sufandi, M. R., & Rahayu, W. I. (2019). Pengembangan sistem pengisian baterai dengan kombinasi sumber listrik dari PLN dan energi surya. *ELKHA, 10*(1). https://doi.org/10.26418/elkha.v10i1.25280

Syntetos, A. A., & Boylan, J. E. (2005). The accuracy of intermittent demand estimates. *International Journal of Forecasting, 21*(2), 303–314.

Vithayasrichareon, P., MacGill, I. F., & Nakawiro, T. (2012). Assessing the sustainability challenges for electricity industries in ASEAN newly industrialising countries. *Renewable and Sustainable Energy Reviews, 16*(4). https://doi.org/10.1016/j.rser.2012.01.019

Wahyuddin, W., & Afriani, M. (2018). Pengaruh penggunaan software akuntansi System Application and Product (SAP) dan kualitas nilai informasi pelaporan keuangan terhadap kepuasan pengguna software akuntansi (Studi kasus pada PT. PLN (Persero) Kantor Wilayah Aceh-Kota Banda Aceh). *Jurnal Akuntansi dan Keuangan, 6*(2). https://doi.org/10.29103/jak.v6i2.1830

Wattana, B., & Aungyut, P. (2022). Impacts of solar electricity generation on the Thai electricity industry. *International Journal of Renewable Energy Development, 11*(1). https://doi.org/10.14710/ijred.2022.41059

Yousefi, G. R., Kaviri, S. M., Latify, M. A., & Rahmati, I. (2017). Electricity industry restructuring in Iran. *Energy Policy, 108*. https://doi.org/10.1016/j.enpol.2017.05.018