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## Article Title

### **Challenges in Electrical Infrastructure Permitting: A Case Study of Substation Development in South Sumatra**

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## **ABSTRACT**

*Substation development plays a crucial role in supporting the enhancement of the electricity sector in Indonesia. However, the permitting process for such infrastructure development still faces several challenges. This research aims to analyze the determinant factors causing delays in permitting the Muara Enim 500 kV EHV Substation development in South Sumatra. Employing a juridical-empirical approach and a case study method, this research examines the applicable permitting regulations, namely Law Number 30 of 2009 and its implementing regulations. The results indicate that the permitting delays were caused by weak coordination among involved stakeholders, adjustments to four changes in permitting regulations during the project, and non-regulatory factors such as land acquisition and community engagement. To improve the permitting system, four strategic pillars are recommended: strengthening the regulatory framework through harmonization and simplification, accelerating the digitalization of the permitting process, enhancing human resource capacity, and strengthening cross-sectoral coordination complemented by active community engagement. Implementing this comprehensive strategy is expected to expedite substation development to support the sustainable growth and improvement of the electricity sector.*

**Keywords:** *500 kV EHV Substation; Electricity Regulations; Permitting Challenges; Substation Permitting.*

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## **INTRODUCTION**

The availability of reliable electrical infrastructure is an absolute prerequisite for economic growth and the enhancement of societal quality of life, given that electrical energy serves as the primary driving force across several sectors ([Indahwati et al., 2025](#)). Electricity plays a vital role in sustaining industrial activities, fostering technological innovation, and fulfilling the population's basic needs. In Indonesia, the demand for electrical energy continues to experience significant growth, driven by population increase, industrial expansion, and broader public access to electricity services ([Sebastian et al., 2025](#)). The Ministerial Decision Number 314.K/TL.01/MEM.L/2024, projects a national electricity consumption growth rate of 3.8% per annum, necessitating accelerated development of adequate and sustainable electrical infrastructure to meet the ever-increasing demand for electricity.

As a key element in the electrical power system, a Substation performs a crucial function in transforming and distributing electrical energy from power plants to end-users ([Hakim et al., 2021](#)). Substations alter voltage levels, connect generation sources to the transmission network, and regulate power flow to several consumer segments, including industrial, commercial, and residential sectors ([Handayani et al., 2024](#)). Therefore, the availability of reliable and adequately sized substations is essential to ensuring the stability and continuity of the power supply, which in turn supports national economic growth. Substation development must be directed towards achieving a dynamic balance between upstream power generation capacity and downstream power demand projections while considering the aspects of efficiency, reliability, and overall system sustainability.

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South Sumatra, with its abundant fossil and renewable energy resources, possesses substantial potential for developing strategic electrical infrastructure (Erdiwansyah et al., 2021). The Ministerial Decision Number 0074 K/21/MEM/2015 on the Ratification of the Electricity Supply Business Plan (ESBP) of 2015-2024 mandates the construction of a 500 kV Extra High Voltage Substation (EHV Substation) in Muara Enim as an integral part of the government's efforts to strengthen the electrical power system in the Sumatra region. This EHV Substation is projected to be a critical node connecting the 275 kV and 500 kV EHV Overhead Lines, thereby facilitating optimal power evacuation from power plants in the southern part of Sumatra to load centers in the northern part. Furthermore, the Muara Enim 500 kV EHV Substation is an integral component of the 500 kV transmission project strategically spanning from Muara Enim to Galang, encompassing New Aur Duri, Peranap, Perawang, Rantau Prapat, and Kuala Tanjung. This 500 kV interconnection will be operational in phases from 2017 to 2022 and is expected to form the backbone of a reliable and efficient East Corridor Sumatra interconnection system.

The ESBP established a target Commercial Operation Date (COD) for the Muara Enim 500 kV EHV Substation 2018. However, in reality, this national strategic project faced significant obstacles in the land acquisition process. The land acquisition process for the 64 hectares required for the construction of this EHV Substation required a much longer time than anticipated, thus hindering the overall construction process. Consequently, construction could commence on 22 April 2019, as the relevant construction contract stipulated. This delay resulted in the Muara Enim 500 kV EHV Substation becoming factually operational on 27 June 2023, representing a deviation of approximately five years from the initial target.

Electrical infrastructure permitting in Indonesia is still confronted with several complex and interconnected problems, ranging from overlapping regulations and inconsistent implementation of rules in the field to significant variations in local policies, often not aligned with central government policies (Pambudi, 2022; Yanuar et al., 2025). Law Number 30 of 2009 and its implementing regulations, which should serve as a strong and comprehensive legal foundation, still encounter substantial obstacles (Ferdinanto et al., 2023). Febriananingsih (2019) noted that obtaining permits for electrical infrastructure development is highly complex and time-consuming, indicating the bureaucratic complexity and lengthy procedures that investors must face. Furthermore, Saphiro et al. (2021) observed that infrastructure projects in Indonesia experience significant delays due to prolonged permitting issues. This situation not only creates legal uncertainty for investors and contractors but also hampers the pace of investment in the electrical power sector, ultimately hurting the availability and reliability of the electricity supply for the general public.

Although several previous studies have discussed the obstacles to electrical infrastructure permitting (Salsabila et al., 2021; Rosmidah et al., 2023; Widyaningrum & Hamidi, 2024), this research will focus specifically and in-depth on analyzing the permitting obstacles that occurred in the development of the Muara Enim 500 kV EHV Substation. This research will employ a comprehensive juridical-empirical analysis approach by mapping the relevant laws and regulations and analyzing their implementation in the field based on valid and verified empirical data and information. This analysis is expected to provide a holistic overview of the permitting issues encountered.

Based on these problems, this research aims to comprehensively identify and analyze the obstacles encountered in the permitting process for developing the Muara Enim 500 kV EHV Substation in South Sumatra. The research will focus on examining the legal and regulatory aspects related to electrical infrastructure permitting and identifying the determinant factors that caused delays in the completion of this strategic project. Through in-depth and systematic analysis, this research is expected to formulate practical, applicable, and sustainable solution recommendations to improve the efficiency and effectiveness of the electrical infrastructure permitting system in Indonesia. Furthermore, this research is expected to make a significant contribution to the development of legal science, particularly in the fields of electricity law and permitting law, and to provide concrete and implementable policy recommendations for the government in its efforts to simplify the permitting bureaucracy and improve the investment climate in the national electrical power sector.

## **METHOD**

This research employs a qualitative research design using a juridical-empirical approach and a case study method to comprehensively examine the obstacles in the permitting process for the development of the Muara Enim 500 kV EHV Substation. The juridical-empirical approach was chosen to integrate the analysis of applicable regulations and legal norms with empirical facts found in the field (Irwansyah, 2021). Meanwhile, the case study approach is applied to specifically explore the dynamics and complexities of the permitting process within the context of the Muara Enim 500 kV EHV Substation development as a single unit of analysis. The research location is focused on the South Sumatra region, specifically in Muara Enim Regency, which is the location of the electrical infrastructure development.

The data used in this research are sourced from primary data and secondary data (Sampara & Husen, 2016). Primary data were obtained through in-depth interviews using a semi-structured interview guide. These interviews involved key stakeholders, including local government officials authorized in the permitting process, the contractor, representatives of the affected local community, and non-governmental

organizations concerned with electricity and environmental issues. Data collection through these in-depth interviews aims to obtain holistic and in-depth perspectives on the obstacles experienced in the permitting process from several points of view.

In addition to primary data, this research utilizes secondary data obtained through literature review and document analysis. The literature review was conducted by systematically examining books, scientific journals, and scholarly articles relevant to the substance of the research, particularly those related to the permitting process for electrical infrastructure development. Document analysis techniques were used to collect and analyze secondary data in the form of laws and regulations, government policies, and planning documents, such as the Regional Spatial Plan related to the Muara Enim 500 kV EHV Substation development.

The primary and secondary data were analyzed using content analysis and qualitative descriptive analysis techniques (Qamar & Rezah, 2020). Content analysis is applied to systematically identify, categorize, and interpret the substance contained in textual data, both from interviews, literature reviews, and document analysis. The researcher will identify patterns, themes, and key issues related to permitting obstacles through this analysis. Furthermore, qualitative descriptive analysis is used to present the study findings narratively and contextually, thus providing a comprehensive and in-depth description of the dynamics of the permitting process for the Muara Enim 500 kV EHV Substation, along with the factors that influence it. Thus, the results of the analysis are expected to provide an in-depth understanding of the complexity of electrical infrastructure permitting issues in Indonesia.

## **RESULTS AND DISCUSSION**

### **A. Normative Analysis of Substation Infrastructure Development Permitting**

The undertaking of the electricity supply business, including the development of substation infrastructure, is comprehensively regulated under Law Number 30 of 2009. As the primary legal basis, Law Number 30 of 2009 mandates that every electricity supply business activity must obtain a business license from the government, which aims to ensure safety, security, and environmental sustainability in the provision of electricity. This regulation affirms the strategic position of substations in ensuring the reliability and sustainability of the electrical power system, making compliance with licensing regulations an imperative. The analysis of these permitting regulations is also enriched by the findings from the Focus Group Discussion held by the Directorate of Mega Projects and Renewable Energy of the State Electricity Company (PLN) in Medan on September 1-2, 2022, which mapped four main types of permits required for substation development.

Spatial Plan Conformity Confirmation (SPCC) is a permit issued by the Ministry of Agrarian Affairs and Spatial Planning/National Land Agency (NLA) based on Government Regulation Number 21 of 2021. SPCC ensures that the substation development plan is aligned with the established Regional Spatial Plan, thereby minimizing the potential for future spatial conflicts. In the SPCC application process, the Construction Division of the PLN Head Office applies the NLA and coordinates intensively, while the Renewable Energy Division of the PLN Head Office provides comprehensive project technical data, including the design and coordinates of the development site. Through the Regency/Municipal Land Office, the NLA issues a Technical Land Consideration as the basis for SPCC issuance. Government Regulation Number 21 of 2021 mandates the issuance of SPCC within 20 working days, indicating the government's efforts to expedite the permitting process.

Environmental aspects in substation development are accommodated through the obligation to obtain Environmental Approval, as stipulated in Government Regulation Number 22 of 2021. The Ministry of Environment and Forestry (MoEF) has the authority to issue such Environmental Approval. The Security, Safety, Health, and Environment Division of the PLN Head Office is important in coordinating with the MoEF to process the Environmental Approval application, which should normatively be issued within 270 working days. This process involves several parties, including the Ministry of Transportation, which issues the Technical Approval of the Traffic Impact Analysis, as well as environmental consultants and laboratories tasked with analyzing the environmental impacts of the substation development. Compared to SPCC, the long issuance duration suggests the complexity and caution in ensuring compliance with environmental sustainability aspects.

Before commencing physical construction, substation development must also obtain Site Determination from the Local Government, per the mandate of Government Regulation Number 19 of 2021. This regulation stipulates that the Local Government, either at the Provincial or Regency/Municipal level, establishes and delegates tasks to a Preparation Team tasked with conducting socialization and public consultations, ultimately issuing a Site Determination Decree within 125 working days. The involvement of several agencies, such as the Office of Public Works and Housing, the Office of Energy and Mineral Resources, the Environmental Agency, and the Regional Development Planning Agency, in verifying the Land Acquisition Planning Document demonstrates the importance of cross-sectoral coordination. Furthermore, the involvement of the TNI/POLRI, the Prosecutor's Office, NGOs, and the community in this process reflects the principles of transparency and accountability in land acquisition for public interest.

The final permitting stage that must be fulfilled is obtaining Building Approval, which is the authority of the Local Government based on Government Regulation Number 16 of 2021. Building Approval ensures that erecting the substation building meets the technical and safety standards. Relevant agencies, such as the Office of Public Works and Housing and the Investment and One-Stop Integrated Services Agency, have the authority to verify documents and assess the technical feasibility of the building before issuing Building Approval, which, according to regulations, should be obtainable within 25 working days. The involvement of the Subdistrict and Urban-Village/Village governments in providing Building Approval recommendations indicates the engagement of local governments to ensure the conformity of development with the local context and needs.

As described above, the complexity of permitting substation development indicates the need for harmonization and synchronization of regulations at several levels, from laws to regional regulations. Although normatively, these regulations have stipulated completion times for each type of permit, their implementation in the field still leaves room for improvement. Coordination among agencies, both at the central and regional levels, is key to ensuring the effectiveness and efficiency of the permitting process. An in-depth analysis of the determinant factors hindering the acceleration of permitting, particularly in the Muara Enim 500 kV EHV Substation development context, will be further discussed to provide a more comprehensive picture of the dynamics of electrical infrastructure permitting in Indonesia.

## **B. Determinant Factors of Permitting Delays in the Development of the Muara Enim 500 kV EHV Substation**

The Muara Enim 500 kV EHV Substation development project experienced significant delays, missing the COD target set in the ESBP of 2015–2024 by approximately five years. The 2018 COD target was not met; construction began on April 22, 2019, and the EHV Substation became factually operational on June 27, 2023. This deviation indicates fundamental problems in the permitting process. An analysis of the determinant factors causing this delay focuses on three crucial aspects: the complexity and fragmentation of regulations, legal uncertainty due to regulatory changes, and non-regulatory factors related to land acquisition issues and social resistance.

The complexity and fragmentation of permitting regulations became a significant obstacle to accelerating the Muara Enim 500 kV EHV Substation development. As described in the previous discussion, substation development requires at least four main types of permits with different legal bases, issuing

agencies, procedures, and requirements. Ineffective coordination among identified stakeholders, both at the internal PLN level, among ministries/institutions, local governments, communities, contractors, and lenders, created a long and convoluted permitting process. For example, the issuance of the Building Construction Permit by the Muara Enim Regency Government on June 28, 2021, and the Revised SPCC by the NLA in 2022, obtained long after the start of physical construction, indicates obstacles in synchronization and harmonization among relevant agencies. Meanwhile, the Environmental Approval from the MoEF is even still in process to this day. The slow issuance of these permits contributed directly to the postponement of the established COD target.

Regulatory changes during permitting also contributed to legal uncertainty and hampered project completion. The facts on the ground show that the four main types of permits for the development of the Muara Enim 500 kV EHV Substation all experienced changes in their legal basis. The SPCC, based initially on Government Regulation Number 15 of 2010, was replaced by Government Regulation Number 21 of 2021. The Environmental Approval, previously based on Government Regulation Number 27 of 2012, was replaced by Government Regulation Number 22 of 2021. Similarly, the Site Determination, initially regulated in Presidential Regulation Number 71 of 2012, was replaced by Government Regulation Number 19 of 2021. The Building Approval, based initially on Government Regulation Number 36 of 2005, now refers to Government Regulation Number 16 of 2021. These changes in the legal basis required the project owner and contractors to adjust permits amid the project completion process. This condition created legal uncertainty and added to the administrative burden, ultimately slowing the permitting process.

The dynamics in the field show that non-regulatory factors, particularly land acquisition and community resistance, also became crucial obstacles in developing the Muara Enim 500 kV EHV Substation. Acquiring 64 hectares of land for the project site faced obstacles because it intersected with community agricultural and plantation activities. Conditions in the field, particularly in Muara Enim, showed that land acquisition for the EHV Substation development intersected with community rights over land and natural resources utilized for agricultural and plantation activities. The lack of comprehensive and transparent socialization regarding the project's benefits to the community led to residents' resistance and rejection, which hampered the project's progress. Ineffective dispute resolution mechanisms and lengthy and non-transparent negotiation processes among PLN, the Government (particularly the NLA), contractors, and the community further exacerbated the conflict. This condition temporarily halted the project.

Recognizing that conflict with the community was a significant obstacle, PLN, the Government, and the Contractor changed their approach strategy.



Efforts to resolve conflicts and rebuild trust in the community became crucial for the smooth running of the project. A more inclusive approach involving local communities in every project stage became the primary key. PLN, the Government, and the Contractor finally began implementing open and transparent dialogue with the community. Although requiring significant time and resources, these efforts proved to minimize tensions, build mutual understanding, and encourage more effective problem-solving so that the community could accept and support the continuation of the Muara Enim 500 kV EHV Substation development.

### **C. Strategies and Solution Recommendations to Overcome Permitting Obstacles**

The complexity and fragmentation of permitting regulations, as identified in the Muara Enim 500 kV EHV Substation development case, necessitate the formulation of comprehensive strategies and breakthrough solution recommendations. These strategies must be based on an in-depth analysis of the root causes of the problems and consider legal, technical, social, and institutional aspects (Simamora et al., 2023). The four pillars proposed as a solution framework include regulatory reform, digitalization of the permitting process, human resource capacity building, and strengthening coordination among stakeholders, complemented by active community engagement.

Regulatory reform is a fundamental step to revamp the existing permitting system. In this case, the government must conduct a comprehensive regulatory review of Law Number 30 of 2009 and all its implementing regulations for permitting substation infrastructure development. This review should focus on simplifying and harmonizing regulations to cut through lengthy and overlapping bureaucratic processes. In the context of construction law, this regulatory simplification will contribute to the efficiency of time performance and cost performance, as a more straightforward and integrated permitting process will reduce the risk of delays and project cost escalation (Shaktawat & Vadhera, 2021). This regulatory harmonization needs to be carried out inclusively by involving all relevant stakeholders, including PLN, related Ministries/Institutions, Local Governments, and community representatives, to ensure that the resulting regulations are not only practical and efficient but also implementable and accommodative to the interests of all parties.

In addition to regulatory reform, the digitalization of the permitting process is also a key to overcoming permitting obstacles (Ajayi et al., 2024). The government needs to optimize the utilization of the Online Single Submission Risk-Based Approach system for all types of permits required for substation development, including SPCC, Environmental Approval, Site Determination, and Building

Approval. The integration of this online permitting system needs to be supported by the standardization of requirements and procedures, as well as providing a real-time tracking mechanism so that applicants can monitor the progress of their permit applications. For comparison, Indonesia can learn from and adopt best practices from countries that have successfully implemented integrated and efficient online permitting systems, such as Singapore with its CORENET system or Estonia with its X-Road, which enables seamless and paperless data exchange between agencies (Pöhn et al., 2021; Ullah et al., 2022). From a civil and contract law perspective, this digitalization will minimize information asymmetry between the applicant and the permit issuer, ultimately increasing legal certainty and reducing the potential for disputes.

Human resource capacity building, both in government agencies and on the part of contractors, is a key factor in the successful implementation of this strategy (Anwar et al., 2021). Government officials involved in the permitting process at all levels must be equipped with a comprehensive understanding of permitting regulations, administrative procedures, and technical substances related to the development of electrical power infrastructure. Sustainable capacity-building programs, through training, workshops, and comparative studies, need to be implemented to improve the competence and professionalism of officials in providing fast, precise, and accountable permitting services. In addition, project developers, including PLN, need to strengthen the capacity of their internal teams responsible for managing permits so that they can effectively oversee the permitting process and adapt to regulatory dynamics (Aritonang et al., 2022).

Strengthening inter-agency coordination and active community engagement is the final pillar in the strategy to overcome permitting obstacles (Wisatrioda et al., 2025). The government needs to establish and facilitate cross-sectoral coordination forums involving all substation development stakeholders to align perceptions, synergize steps, and collectively resolve permitting issues. This forum must have an effective debottlenecking mechanism to overcome deadlocks and expedite decision-making. Furthermore, the involvement of local communities, as the parties most affected by development, must be carried out transparently and participatively from the planning stage. The empirical experience from the Muara Enim 500 kV EHV Substation case shows that active community involvement in dialogue and decision-making can build trust and mitigate the potential for conflict, which will ultimately facilitate the permitting process and ensure the sustainability of electrical infrastructure development.

## **CONCLUSIONS AND SUGGESTIONS**

Based on the results and discussion, it can be concluded that substation infrastructure development in Indonesia needs to be supported by an effective and efficient permitting system. Normative analysis of Law Number 30 of 2009 and its implementing regulations, enriched by the results of the Focus Group Discussion from the PLN Directorate of Mega Projects and Renewable Energy, shows that the existing regulatory framework provides a strong legal basis for the undertaking of electricity supply businesses, including substation development. Regulations such as SPCC, Environmental Approval, Site Determination, and Building Approval are intended to ensure that infrastructure development is aligned with spatial planning, considers environmental aspects, and meets technical and building safety standards. However, implementing these regulations still requires further improvement, especially in simplifying procedures and strengthening coordination among the stakeholders involved. The case study of permitting delays in the Muara Enim 500 kV EHV Substation development shows that several factors pose challenges in accelerating permitting. These factors include the dynamics in the coordination process among stakeholders, adjustments to regulatory changes, and non-regulatory factors such as land acquisition and community engagement. A comprehensive strategy and concrete steps are needed to improve the existing permitting system and align it with the needs in the field.

Based on the above conclusions, several strategic steps are recommended, encompassing four main pillars, to improve the permitting system for substation infrastructure development in Indonesia. The first pillar is the strengthening of the regulatory framework. In this regard, the Government, especially the MEMR, NLA, MoEF, and the Ministry of Public Works and Housing need to work together to review, harmonize, and simplify regulations related to permitting. These efforts can be focused on simplifying permitting procedures while still paying attention to transparency, effectiveness, and efficiency so that the targets for electricity infrastructure development set out in the ESBP can be achieved.

The second pillar is the acceleration of the digitalization of the permitting process. Implementing the Online Single Submission Risk-Based Approach system needs to be evaluated and optimized, especially regarding system integration, user-friendliness, and the reliability of information technology infrastructure. The third pillar is increasing human resources capacity, both for government officials and the permitting teams at PLN and contractors. Their competence and professionalism must be improved so the permitting process can run more smoothly and accountable. The fourth pillar is strengthening cross-sectoral coordination, complemented by active community engagement. Effective coordination forums, also equipped with a problem-solving (debottlenecking) mechanism, must be institutionalized and optimally

functioning. In addition, active community engagement through open and transparent dialogue, prioritizing the principles of public participation, is key to building trust and minimizing the potential for conflict. With these four strategic pillars, it is hoped that the development of substations can be accelerated to support sustainable growth and improvement of the electricity sector.

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