Restorative Justice through FABA: Inmate Rehabilitation and Sustainable Green Energy at Nusakambangan Prison

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Abstract. The issue of overcapacity in Nusakambangan Prison necessitates innovative approaches to the development of effective and sustainable inmate rehabilitation programs. This research aims to examine the use of Fly Ash and Bottom Ash (FABA) waste within rehabilitation initiatives grounded in the concepts of restorative criminal justice, as well as to analyze the environmental management implications of FABA-based rehabilitation in alignment with sustainability principles and green energy policies. Employing a juridical normative methodology, the research examines existing rehabilitation policies and the application of restorative justice concepts in addressing institutional overcapacity in Indonesia, with a specific focus on the *'Nusakambangan Berdaya'* project as a case study. The results indicate that rehabilitation programs incorporating FABA waste not only enhance inmate empowerment through vocational skills development but also promote environmentally sustainable industrial waste management consistent with national green energy goals. Furthermore, the program demonstrates potential in reducing recidivism rates, mitigating overcapacity, and advancing energy efficiency underpinned by sustainable economic principles. The integration of FABA-based innovations into inmate rehabilitation contributes to the establishment of a more equitable and sustainable criminal justice system, while significantly supporting Indonesia's green development and environmental management agendas.

1 Introduction

The issue of overcapacity in Indonesia's prisons and detention centers has emerged as a critical systemic challenge in recent years. Recent data shows that in April 2025, the number of inmates and detainees in all rehabilitation institutions reached 275,001 people, while the ideal capacity of the facilities was only 145,747 people. This indicates a national overcapacity rate approaching 100%, with the number of inmates almost double the available capacity. This condition not only heightens risks related to security and institutional order but also severely undermines the effectiveness of rehabilitation programs designed to facilitate inmates' productive and dignified reintegration into society. Excessive overcapacity

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detrimentally impacts the quality of inmate guidance, restricts access to rehabilitation services, and escalates the likelihood of conflict and recidivism [1].

To address these multifaceted challenges, the concept of restorative criminal justice has gained traction as a more humane and participatory alternative to conventional punitive systems. This approach prioritizes the collective restoration of harm experienced by victims, offenders, and communities, shifting the justice system's focus from mere punishment to the rebuilding of social relationships and the social reintegration of offenders. Implementing restorative justice is also strategically significant in alleviating pressure on rehabilitation institutions by facilitating case resolutions outside formal judicial processes, while simultaneously enhancing rehabilitation efforts [2].

In the context of rehabilitation, innovation in rehabilitation programs is essential to overcome limited resources and facilities caused by overcapacity. One notable initiative is the collaboration between PT PLN (Persero) and the Ministry of Immigration and Corrections of the Republic of Indonesia (Imipas RI) through the *'Nusakambangan Berdaya'* program. This project aims to enhance the skills and capacities of inmates at Nusakambangan Prison in Cilacap, Central Java, by establishing production facilities that use Fly Ash and Bottom Ash (FABA)—byproducts of coal combustion from power plants—as raw materials for manufacturing high-value infrastructure components. Inmates receive targeted training and support in processing FABA, integrating economic and environmental empowerment within the rehabilitation framework. The program was officially launched on February 5, 2025, through a memorandum of understanding signed by the Minister of Imipas RI, Agus Andrianto, and PLN's President Director, Darmawan Prasodjo, at the PLTU Adipala facility in Cilacap. Designed as a sustainable rehabilitation model, this initiative holds potential for replication across Indonesia's 631 prisons, detention centers, and rehabilitation centers, particularly those situated near PLN's coal-fired power plants.

The use of FABA as a raw material in inmate development not only equips participants with practical technical skills and generates economic value but also reinforces the sustainability dimension of rehabilitation programs. This approach aligns with principles of environmentally responsible waste management and supports Indonesia's national green energy transition policy. Supporting this perspective, John Ikeyi's research, "*Critical Evaluation of the Relevance of Rehabilitation Theory of Reductivism to Contemporary Criminal Justice System*," shows that the rehabilitation approach has proven to be more efficient and humane in reducing crime and recidivism rates. This is in line with the essence of the concept of restorative criminal justice which encourages social recovery through coaching based on participation and human values [3].

Therefore, this research aims to comprehensively examine innovations in the use of FABA waste in the rehabilitation program at the Nusakambangan Prison, emphasizing their alignment with restorative criminal justice principles. This research is grounded in the mandates of Law No. 12 of 1995 on Corrections and Supreme Court Regulation No. 1 of 2024 on Guidelines for Adjudicating Criminal Cases Based on Restorative Justice (PERMA No. 1/2024), which emphasizes the significance of humanistic and participatory approaches in inmate rehabilitation and social reintegration. Furthermore, this research also examines the environmental management implications of FABA-based rehabilitation within the framework of sustainability, referencing Government Regulation No. 22 of 2021 on Environmental Protection and Management. This research offers a new approach to addressing prison overcapacity by combining restorative criminal justice concepts with FABA-based rehabilitation through the *'Nusakambangan Berdaya'* project which is highlighted as a pilot project to be replicated nationally.

This research uses a juridical normative methodology with a descriptive-qualitative approach, which aims to examine rehabilitation policy and the application of the concept of restorative criminal justice in the context of overcapacity of prisons in Indonesia through a

case study of the *'Nusakambangan Berdaya'* project. A normative juridical approach is used to analyze relevant laws and regulations, such as Law No. 12 of 1995 on Corrections, Supreme Court Regulation No. 1 of 2024 on Guidelines for Adjudicating Criminal Cases Based on Restorative Justice, and Government Regulation No. 22 of 2021 on the Implementation of Environmental Protection and Management. This research emphasizes the interrelationship between the legal framework, public policies, and innovations in inmate rehabilitation based on the use of FABA industrial waste carried out through a partnership between PT PLN and the Indonesian Ministry of Immigration and Corrections.

The type of data used is secondary data, which is obtained through documentation study techniques and literature analysis. Data sources include national regulations, policy documents, official reports of related institutions, memorandum of understanding, media publications, and scientific articles that discuss the concepts of restorative criminal justice, rehabilitation, and green energy. The data were analyzed in a juridical qualitative manner using systematic and conceptual legal interpretation techniques, to identify the compatibility between legal principles and the implementation of the *'Nusakambangan Berdaya'* project as a sustainable rehabilitation model.

2 The Use of FABA Innovation in the Inmate Rehabilitation Based on the Concept of Restorative Criminal Justice in the Nusakambangan Prison

The restorative criminal justice approach is a new paradigm in the criminal justice system that emphasizes restoring the original state through the active involvement of all relevant parties, namely victims, perpetrators, families, and communities. This concept aims to repair the harm caused by criminal offenses and rebuild disrupted social relations, instead of focusing solely on retaliation or punishment. Supreme Court Regulation No. 1 of 2024 on Guidelines for Adjudicating Criminal Cases Based on Restorative Justice (PERMA No. 1/2024) provides the juridical basis for the application of this approach, emphasizing key principles such as restoration of circumstances, fulfillment of victims' rights and needs, perpetrator responsibility, ultimum remedium, consensuality, and transparency and accountability [4]. In the rehabilitation context, the restorative approach shifts the paradigm from a punitive orientation to a humanist and participatory rehabilitation process. Rehabilitation is positioned as an important instrument in supporting the effective and sustainable social reintegration of inmates. This is in line with the mandate of Law No. 12 of 1995 on Corrections, which emphasizes that the main objective of inmate development is to make them good, responsible, and productive individuals in social life [5].

Inmate rehabilitation as a key element in restorative criminal justice adopts a forward-looking approach based on utilitarianism. In this approach, inmates can be taught to become 'normal' law-abiding citizens and punishment can be carried out in such a way that a person will not repeat the offense or crime. Rehabilitation involves more planned, regulated and enforced treatment, perhaps in the form of a supervisor who oversees inmates undergoing training or employment programs and monitors their progress. The implementation of rehabilitation is carried out through planned and structured treatment, such as skills training, intensive supervision, and the assignment of relevant responsibilities. Thus, inmates are encouraged to develop positive attitudes, work skills, and social capacity in order to return to society as more useful individuals. PERMA No. 1/2024 explicitly underlines the importance of victim recovery and offender accountability as part of the rehabilitation process, as well as the use of punishment as a last resort [6]. In practice, several prisons have adopted these principles, including the Nusakambangan prison, which is one example of the implementation of sustainable rehabilitation based on a restorative approach.

Nusakambangan prison has organized various coaching programs, ranging from technical skills training, economic independence, spiritual and social development, to assimilation and parole programs based on the results of community research assessments [7]. However, challenges still arise, especially related to the complexity of cases and the need for more intensive and effective coaching programs. As of July 2025, Nusakambangan manages 11 prisons with a total population of 2,992 people, almost touching the maximum capacity of 3,088 people. Data up to June 2025 shows that around 900 inmates from various regions in Indonesia were transferred to Nusakambangan to ease the overcapacity problem in other prisons, emphasizing the need for innovative and adaptive rehabilitation strategies.

In response to this need, on January 2, 2025, the Ministry of Immigration and Corrections of the Republic of Indonesia (Imipas RI) established a strategic partnership with PT PLN (Persero) to launch an innovative rehabilitation program in the form of the establishment of a joint task force and the construction of an integrated Vocational Training Center (BLK) in Nusakambangan which includes training in the agriculture, livestock, fisheries, garment industry, and construction sectors based on Fly Ash and Bottom Ash (FABA) materials. This collaboration is outlined in a Memorandum of Understanding signed on February 5, 2025, at PLTU Adipala, Cilacap. The two main objectives of this collaboration are: (1) construction of FABA production and utilization facilities; and (2) development of an integrated BLK as an inmate training center, particularly in the processing of FABA into building materials such as paving, bricks, concrete, and planting media.

The President Director of PLN stated that over the past two years, efforts to treat FABA waste have not made a significant contribution to reducing construction costs. One of the main obstacles is the high cost of labor. Therefore, collaboration with the Indonesian Ministry of Corrections, which has a productive workforce of 95% of the population in prisons, detention centers, and correctional centers, is considered a win-win solution. In this partnership, PLN will provide technical training and mentoring to inmates, while the training and production facilities are prepared by the prison. The long-term goal is to increase inmates' economic independence, equip them with practical skills, and improve their post-rehabilitation job readiness.

The active involvement of inmates in productive activities based on FABA waste processing reflects the implementation of the principle of participation in restorative justice as mandated by PERMA No. 1/2024. Inmates are not only objects of rehabilitation, but also active subjects who play a role in the process of social recovery and economic development. The program not only facilitates the formation of technical skills, but also instills a sense of social responsibility and increases the confidence of inmates in facing life after release [8]. Furthermore, the use of the FABA program has a strategic contribution in addressing the challenge of overcapacity of prisons, which is projected to reach 82% by 2025. The government has formulated long-term policies to address this issue, including the construction of new prisons, capacity building, and the development of skills-based rehabilitation programs and productive work.

Within the larger framework of restorative justice, the FABA program innovation is a concrete instrument that supports the implementation of PERMA No. 1/2024. Through this activity, inmates are given the opportunity to make amends through positive contributions to society and the environment. Meaningful activities such as these have been shown to reduce recidivism rates, as inmates who feel valued and have a role to play are less likely to reoffend. In addition, this approach strengthens the humanist and participatory aspects of rehabilitation, while equipping inmates with competencies that are relevant to the direction of national development towards a green and sustainable economy. Therefore, the integration of restorative justice in the rehabilitation system through innovative approaches such as the use of FABA waste not only strengthens the effectiveness of coaching but also becomes an

important milestone in the development of a more just, inclusive, and recovery-oriented criminal justice system [9].

3 Implications of FABA Waste-based Rehabilitation from the Perspective of Sustainability and Green Energy Policy

The use of Fly Ash and Bottom Ash (FABA) waste in inmate rehabilitation programs is a strategic innovation that integrates aspects of environmental sustainability into the national rehabilitation system. FABA is solid waste from coal combustion in steam power plants (PLTU), which is divided into two types: *Fly Ash*, in the form of fine particles carried by flue gas and captured by the filter system; and *Bottom Ash*, in the form of heavy residue left at the bottom of the furnace. The proportion between the two varies depending on the type of boiler used - in dry bottom boilers, about 80% of the ash becomes Fly Ash and the rest Bottom Ash, while in wet bottom boilers, the distribution tends to be balanced [10].

Historically, FABA waste was categorized as hazardous and toxic waste (B3) because it contains heavy metals and chemical residues that have the potential to pollute the environment if not managed properly. However, through Government Regulation No. 22 of 2021 on the Implementation of Environmental Protection and Management, FABA is reclassified as non-B3 waste, provided that its management must meet strict technical standards and environmental requirements. This opens up great opportunities to utilize the waste as raw materials in the construction and infrastructure sectors, such as paving blocks, concrete blocks, lightweight concrete, and other fillers. The content of minerals such as quartz and mullite crystals in FABA is known to provide mechanical strength and resistance to extreme weather and environmental stresses. However, the use of FABA still faces challenges, especially in terms of controlling the content of heavy metals and toxic compounds that can remain due to incomplete combustion processes. Therefore, validation processes and laboratory testing such as X-Ray Fluorescence (XRF) analysis are essential to ensure that the final product is safe to use and does not harm human health or the ecosystem [11].

From an ecological perspective, optimizing the use of FABA waste has great potential to reduce the accumulation of waste in the PLTU area, which has been a serious threat to soil and water pollution. The transformation of waste into construction products with economic value supports the principles of circular economy and sustainable development. However, the implementation of this program requires strict supervision of the entire production process, from processing to final product use, to prevent the potential release of fine particles into the air or other environmental contamination. Nationally, the increase in FABA waste production is a strategic issue that needs to be anticipated, given the significant growth in coal-based energy consumption. It is estimated that the amount of FABA waste generated by PLTU in Indonesia reaches millions of tons per year and will continue to increase until 2027 [12]. In this context, the development of the use of FABA technology is not only an environmental solution, but also supports the transition towards national green energy policies.

Within the framework of inmate rehabilitation, the use of FABA into construction materials presents an innovative approach that brings together social, economic and environmental dimensions. The program will be implemented in prisons such as Nusakambangan, with promising results. Inmates are actively involved in the training and production process, not only gaining technical skills that will be useful after their sentence, but also contributing to reducing dependence on new natural resources. The program directly supports the sustainable economy agenda and accelerates the transition from a fossil-based energy system to cleaner and more sustainable new and renewable energy. These strategic goals are reflected in the National Energy General Plan (RUEN), which targets a renewable

energy mix of 23% by 2025 and increasing to 31% by 2030. In addition, the policy of phasing out coal-fired power plants by 2040 is part of Indonesia's commitment to climate change mitigation efforts, as stated in the Nationally Determined Contribution (NDC) to the United Nations Framework Convention on Climate Change (UNFCCC) [13].

On the other hand, the implementation of FABA-based rehabilitation programs presents complexities that must be carefully managed. Positively, these programs contribute to the reduction of recidivism by providing inmates with a sense of responsibility, social engagement, and economic hope. However, potential risks remain, such as exposure to hazardous substances if management is not carried out according to standards, as well as challenges in maintaining consistency in supervision and compliance with environmental standards in the field. Article 450 paragraph (1) of PP No. 22/2021 explicitly states that every generator of non-B3 waste must include a waste management plan in the environmental approval document, which is legally binding [14].

Although the regulatory framework is in place, the gap between policy and practice in the field remains a real obstacle. Issues such as limited processing technology, lack of human resource capacity, and weak inter-agency coordination are implementation challenges that need to be addressed immediately. Therefore, the FABA-based prison rehabilitation program is not only an innovative step in industrial waste management, but also an integral part of the national strategy to support the achievement of green energy targets and sustainable development.

In the context of a just and inclusive energy transition, as emphasized in the Just Energy Transition Partnership (JETP) framework, the integration between social empowerment, waste management, and energy policy is becoming increasingly important [15]. FABA-based inmate rehabilitation in prisons can be a model of cross-sector collaboration that reflects synergies between the social (inmate empowerment), economic (value-added production from waste), and environmental (emission and waste reduction) dimensions, which overall supports the vision of national green energy development.

4 Conclusion

The innovative use of Fly Ash and Bottom Ash (FABA) waste in the rehabilitation program for inmates at the Nusakambangan prison effectively integrates the principles of restorative criminal justice, which emphasizes recovery and social reintegration. Based on Law No. 12 of 1995 on Corrections and Supreme Court Regulation No. 1 of 2024 on Guidelines for Adjudicating Criminal Cases Based on Restorative Justice, the program provides space for inmates to actively participate in the rehabilitation process through empowering productive activities, such as processing FABA waste into high-value construction materials. This approach not only helps inmates improve their attitudes and skills but also strengthens their social responsibility, which has significant potential to reduce recidivism rates and accelerate reintegration into society. In addition, the program contributes to the reduction of overcapacity in prisons by providing more effective and sustainable coaching alternatives.

From a sustainability and green energy policy perspective, FABA waste-based rehabilitation is in line with Government Regulation No. 22 of 2021 and the national agenda in the National Energy General Plan (RUEN). The use of FABA waste supports the principles of a sustainable economy and friendly environmental management, while reducing potentially polluting industrial waste. The program also supports energy efficiency and the transition to clean energy by making productive use of coal plant waste. The practical implications strengthen the development of a more sustainable criminal justice and rehabilitation system, combining social, economic, and environmental aspects in one innovative rehabilitation framework. Therefore, the FABA waste-based rehabilitation

program is not only a strategic solution to overcapacity and recidivism, but also a model of social empowerment that supports national green energy and sustainability policies.

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