In the Realm of Biomass Energy Projects in East Malaysia: Navigating Land Tenure Challenges for Sustainable Solution

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ABSTRACT

The realm of biomass energy projects in East Malaysia presents a promising avenue for sustainable energy solutions. However, navigating the intricate landscape of land tenure poses significant challenges to the successful implementation of such projects. This research paper examines the importance of biomass energy, the legal and regulatory framework governing the land tenure in East Malaysia, shedding light on pertinent policies, laws, and customary practices that influence land access and ownership rights. Drawing upon case studies, this research paper illustrates real-world examples of land tenure challenges encountered in biomass energy projects across East Malaysia. It discusses issues such as conflicting land claims, inadequate land-use planning, tenure insecurity, and socio-economic disparities, which often hinder project development and community engagement. Hence, through a comprehensive legal analysis and examination of conflict resolution strategies, this paper aims to provide insights in promoting sustainable and socially responsible biomass energy development in East Malaysia. To conclude, the abstract underscores the significance of addressing land tenure issues in the realm of biomass energy projects in East Malaysia to ensure their sustainability and positive impact on the environment, economy and society.

Keywords: Biomass Energy Projects; East Malaysia; Sustainable Energy Solutions; Regulatory Framework; Sustainability

INTRODUCTION

Biomass energy is crucial in Malaysia due to its rich natural resources and increasing energy demand. The country is well-positioned to capitalise on biomass energy, leveraging abundant agricultural residues and forestry wastes for power generation. Projects utilising biomass energy provide a sustainable and renewable energy source, lowering greenhouse gas emissions and slowing down global warming.

In East Malaysia, environmental law principles guide biomass energy projects to ensure sustainable development. The polluter pays principle holds accountable those causing environmental harm, while the principle of prevention encourages the adoption of best practices to prevent damage (OECD, 1972). The public participation principle emphasises collective action and involvement in the decision-making processes, ensuring that local communities and stakeholders are taken into account. Sustainable development principle promotes a holistic approach to environmental management, contributing to sustainable development. Furthermore, the principle emphasising the priority of remedying environmental damage at its source highlights the need for proactive and effective measures to address the primary causes rather than merely treating symptoms.

The development of biomass energy projects in East Malaysia has faced challenges, including land tenure issues and conflicts. These challenges are crucial to address for sustainable implementation. The recognition of justice and environmental justice implications is essential for ensuring the sustainability of these projects. The legal

framework for land use in Malaysia is complex and contradictory, hindering the successful implementation of biomass energy projects. To promote sustainable biomass energy solutions, it is crucial to prioritise the protection of vulnerable populations and recognize their rights and identities.

Land tenure conflicts related to oil palm expansion have been a hot topic. The existing legal framework favours plantation companies over affected communities. The lack of clear explanations regarding the 'derasah' payment (payment to the local community, which means the purchase of the people's land) enables conflicting interpretations, which plantation companies use to their advantage. These principles emphasise the importance of using biomass resources in a sustainable manner, minimising environmental impacts.

Henry Shue's concept of fundamental rights is in line with the principle of recognition of justice in the context of biomass energy projects in East Malaysia, especially when it comes to land tenure issues Payne, M. (2008).4 Shue emphasises the protection of the most vulnerable communities, ensuring their fundamental rights and livelihoods are not put at risk by any development projects. This approach is in line with recognition of justice, which demands for acknowledging and respecting the rights and identities of these vulnerable communities, and addressing historical and ongoing injustices they face. By prioritising the protection of these communities, Shue's concept provides a framework for developing sustainable biomass energy solutions that are fair and equitable.

Malaysia's recent progress with biomass energy projects is extremely encouraging. However, a number of obstacles stand in the way of realising this potential, the most significant of which is the intricate web of land tenure laws and customs. The major obstacles to the development of biomass energy projects in East Malaysia include unclear and inconsistent land tenure policies, land acquisition for biomass energy projects, competing land use interests, indigenous land rights, and environmental conservation concerns (SpringerLink, 2022).

This research investigate land tenure issues and conflicts associated with biomass energy projects in East Malaysia, analyse their impacts, and propose mitigation strategies. The objectives are to identify and characterise land tenure issues, examine their implications on biomass energy initiatives, and analyse the socio-economic and environmental impacts of unresolved land tenure issues on local communities and ecosystems.

LITERATURE REVIEW

Conflicting Land Use Interests

In the context of biomass energy projects in East Malaysia, one of the main problems is the competing land use interests between parties for control over shared land resources. The forestry industry, which is important for the environment and economy, frequently clashes with biomass initiatives that need access to comparable resources like forest biomass and wood waste. The energy production industry competes with other land uses because it requires large land expenses for the collecting and processing of biomass, which comes from forestry and agriculture. The industry's goal is to use organic waste materials.

Conservation efforts, which focus on preserving unique ecosystems and protecting endangered species, can also overlap with biomass projects, creating conflicts between environmental preservation and renewable energy development. Additionally, agriculture, particularly oil palm cultivation, is a major land user, and biomass projects can compete with agricultural land, especially when agricultural residues are used as feedstock for energy production. Effective governance, clear land policies, and sustainable environmental management are crucial to address these challenges and ensure that biomass energy projects are implemented in a way that balances economic, social, and environmental considerations.

A relevant case study that highlights the conflicting land use interests is the Palm Oil Biomass Project in Sabah. The project aimed to reduce agricultural waste and promote renewable energy by turning palm oil residues into bioenergy. Although, it faced significant challenges due to competing land use interests from the forestry, conservation, and agricultural sectors (Hokkaido Electric Power Co., Inc., 2005). The project required substantial land for biomass processing, which conflicted with forested areas designated for logging and conservation, as well as with agricultural lands heavily utilised for palm oil cultivation. Conservationists raised concerns about

potential habitat destruction and biodiversity loss, while the forestry sector and agricultural activities, particularly oil palm cultivation, competed for similar land resources. Effective governance and planning were crucial to address these conflicts and ensure the project's success.

There is a relevant international case study that highlights similar conflicting land use interests in the context of biomass energy projects; the Corn Stover Biomass Project in Iowa, USA (Glassner et al., 1998). This project aimed to convert corn stover, the leftover stalks, leaves, and cobs after corn harvest, into bioenergy. It aligned with the goals of promoting renewable energy and reducing agricultural waste. However, it encountered significant challenges due to the competing land use interests of the agriculture, conservation, and energy production sectors.

The Corn Stover Biomass Project in Iowa faced significant land use conflicts involving the agricultural sector, energy production, and conservation efforts. Farmers were worried that excessive removal of corn stover for bioenergy would reduce soil quality, moisture retention, and long-term agricultural productivity. The project required extensive land for collection and processing facilities, competing with land that could be used for agriculture or conservation. Conservationists worried that large-scale stover removal could harm soil health, disrupt ecosystems, reduce wildlife habitats, and decrease soil fertility. Ensuring sustainable harvesting practices was essential to mitigate these environmental risks and balance the competing interests.

Lack of Clear Land Tenure Policies and Regulations

The obstacles faced by biomass energy projects may be made worse by unclear land tenure legislation and regulations. It may be challenging for indigenous groups to take part in projects or get just compensation if they do not have official title to their land. Conflicts over land ownership and usage rights result from the complicated and even conflicting legal structure governing land tenure.

In East Malaysia, the land tenure system is characterised by a mix of customary land rights, statutory land rights, and leasehold systems. Customary land, also known as Native Customary Rights (NCR) land, is particularly significant as it is traditionally owned and managed by indigenous communities based on ancestral and cultural practices. NCR land is often not formally documented, leading to legal ambiguities and difficulties in land transactions (Forest Research Institute Malaysia , 2008).

Private companies and government agencies, on the other hand, typically operate under statutory land rights, which are formally recognized and documented. The leasehold system, where the government leases land to private entities for specific periods and purposes, adds another layer of complexity. These different systems can overlap, leading to conflicts over land ownership and usage rights. This can result in project delays, environmental damage, and negative impacts on nearby communities (Sze, 2019).

The Bakun Dam project in Sarawak serves as a notable example of the complexities and conflicts arising from land tenure issues in East Malaysia. Although not a biomass project, it highlights the broader challenges of land governance in the region, which are equally applicable to biomass energy initiatives. The Bakun Dam, one of Southeast Asia's largest hydroelectric projects, involved the resettlement of thousands of indigenous people from their NCR land (International Rivers, 2012; Sovacool et al., 2011).

The Bakun Dam project in Sarawak illustrates key issues related to land tenure conflicts in East Malaysia (Lee, 2014). Affected communities felt that the compensation offered was insufficient and failed to adequately reflect the value of their land and the disruption to their lives. Additionally, many indigenous groups claimed they were not properly consulted or involved in the decision-making process. Legal ambiguities further complicated matters, as the courts had to navigate complex and often contradictory laws regarding Native Customary Rights (NCR) land, resulting in protracted legal battles (Sagong Tasi & Ors v Kerajaan Negeri Selangor & Ors [2002] 2 MLJ 591). This case underscores the urgent need for clear, enforceable policies and robust governance frameworks to manage land tenure issues effectively, ensuring fair compensation, adequate consultation, and legal clarity for all stakeholders.

Indigenous Land Rights

In East Malaysia, indigenous land rights represent yet another major obstacle. Deeply rooted in their ancestral lands, the Indigenous people of East Malaysia regularly face development initiatives without the communities' full consent or proper recompense. Land rights, cultural heritage, and socioeconomic well-being are among the ethical and legal issues that are brought up by the exploitation of indigenous territories for the production of biomass energy. For both project developers and politicians, striking a balance between the objectives of sustainable development and the interests of indigenous populations is a major problem.

For both project developers and politicians, striking a balance between the objectives of sustainable development and the interests of indigenous populations is a major problem (Sze, 2019). For example, developers may proceed with land acquisition and project execution in the context of biomass energy projects, without sufficiently consulting the indigenous inhabitants (United Nations, 2007). Their rights are not only being violated by this exclusion, but their traditional knowledge and experience with sustainable land management is also being disregarded. Therefore, it is morally necessary to ensure that indigenous viewpoints are acknowledged and valued throughout the whole planning and implementation process for development (International Work Group for Indigenous Affairs, 2020).

A notable legal case highlighting these issues is the landmark decision in Sagong Tasi & Ors v. Kerajaan Negeri Selangor & Ors [2002] 2 MLJ 591. This case proves that the ancestral lands of indigenous peoples cannot be taken by force for development without following the proper procedures, consulting the people, or providing compensation. It also set a standard for the recognition of native land rights (Mersat, 2003). This case also proves that the ancestral lands of indigenous peoples cannot be taken by force for development without following the proper procedures, consulting the people, or providing compensation. It also set a standard for the recognition of native land rights (Hooker, 2005).

There have been similar controversies in East Malaysia. For example, in Sarawak's Native Customary Rights (NCR) land issues, indigenous groups like the Iban, Bidayuh, and Orang Ulu have been fighting in court to protect their lands against plantation and logging operations. The conflict between governmental policies that support economic growth and the struggle of indigenous peoples to protect their culture and way of life is frequently brought to light by these situations. The fact that court challenges frequently centre on insufficient compensation and a lack of legitimate consultation highlights the need for adjustments that balance development goals with the rights and interests of indigenous people.

These land conflicts have a serious negative socioeconomic impact on indigenous people, making it impossible for them to carry out traditional activities like farming, hunting, and fishing. They also cause cultural disintegration and increased poverty among these populations (International Work Group for Indigenous Affairs, 2020). In addition, communities that were forcibly relocated as a result of these projects typically face social instability as they try to adapt to new environments and economic realities. This may worsen pre-existing vulnerabilities and have long-term negative effects on their wellbeing.

A diversified strategy is needed to balance the interests of the indigenous group with the objectives of sustainable development. The rights of indigenous people must be respected by policymakers and developers, who must also create legislative frameworks to safeguard land rights, provide equitable compensation, and promote mutually beneficial collaborations.22 The struggle in East Malaysia to reconcile development with indigenous rights is reflected in the issue of indigenous land rights. Stakeholders must adhere to moral and legal principles as biomass energy projects grow in order to safeguard indigenous territories and advance just and sustainable development.

Environmental Conservation Concerns

Issues concerning environmental conservation play a significant role in the development of biomass energy projects. These projects might significantly harm the environment, particularly if they're located in protected or environmentally sensitive areas (International Energy Agency, 2012). For this reason, it is essential to ensure that the design of biomass energy projects minimises negative environmental effects and promotes sustainable

land use practices. The establishment of biomass energy plants in East Malaysia necessitates a sustainable strategy that considers the intricate relationships between environmental preservation, indigenous rights, and land tenure.

While the rapid development of biomass energy projects in Malaysia presents a great opportunity to meet renewable energy targets, serious concerns about environmental conservation are also raised, particularly in light of the challenges related to land tenure. Malaysia's rich biodiversity, particularly its tropical rainforests, is at risk due to the country's extensive land requirements for the production and processing of biomass. Deforestation, habitat destruction, and biodiversity loss are imminent risks if biomass projects are not managed properly. Given that biomass production can result in significant carbon emissions, the benefits biomass energy aims to provide for the climate may be compromised. Moreover, by reducing soil quality and depleting water supplies, intensive biomass farming can exacerbate environmental degradation (Majid, 1999).

Complex land tenure concerns in Malaysia exacerbate these environmental problems. The land tenure system in the nation is defined as a combination of land held by the government, the private sector, and indigenous people under native customs rights (NCRs) in accordance with customary rules. The lack of formal recognition and protection for NCR land often leads to conflicts over property ownership and usage rights. It is difficult to secure land for biomass projects without violating the rights of indigenous communities because of this legal ambiguity. Free, Prior, and Informed Consent (FPIC) from these communities is essential for preventing conflicts and guaranteeing the social acceptability of biomass projects, in addition to being required by law and ethics Holland et al., 2022).

A comprehensive approach that integrates social and environmental aspects into the development of biomass energy is required to overcome these challenges. The demands of biomass energy, environmental preservation, and community rights must all be balanced in comprehensive land use planning. By encouraging sustainable agricultural practices, biomass cultivation's detrimental environmental effects can be mitigated. Policy and regulatory changes are also necessary to define rights pertaining to land tenure and to promote sustainable land use. Communities can be involved in the planning and implementation of biomass projects, and benefits-sharing agreements can be put in place to ensure that these efforts support regional development while safeguarding Malaysia's natural heritage (Rashidi et al., 2022; Malaysia Ministry of Plantation & Commodities, 2023). At some point the resolution of land tenure concerns is essential to developing sustainable biomass energy solutions that align with social justice and environmental conservation goals (Zamri et al., 2022).

Sustainable Energy Solutions

The quest for sustainable energy solutions in the modern era has fuelled the research and development of diverse renewable energy sources worldwide (Piloto, 2023). Among these, biomass energy emerges as a promising avenue, since it leverages organic materials to generate heat, electricity, and biofuels while mitigating environmental impacts associated with fossil fuel consumption (Edmonds et al., 1996). However, achieving the biomass energy's full potential is dependent on various socio-economic, environmental, and regulatory considerations, notably among them, the complex landscape of land tenure (Marten, 1982).

Therefore, it is important to delve into the intersection of biomass energy projects and land tenure dynamics, focusing on their implications for sustainable development and community welfare (Reed, 2009). By examining the legal, regulatory, and customary frameworks governing land access and ownership rights, as well as the real-world challenges encountered in biomass energy initiatives, it aims to offer insights and recommendations for fostering socially responsible and environmentally sustainable development pathways. The objective is to promote inclusive and equitable energy transition solutions as well as add to the conversation on biomass energy governance through a multidisciplinary approach that includes policy assessment, legal analysis, and case studies. Therefore, by shedding light on the complex interactions that arise between land tenure dynamics and biomass energy projects, the project hopes to assist stakeholders, practitioners, and policymakers in their pursuit of a more sustainable energy future.

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In reference to Marten (Marten, 1982, 1988, 2001), the intricate matter of land use within the framework of planning for biomass energy, with a specific emphasis on the creation of expansive plantations of energy trees where it highlights how important it is to have a thorough biomass energy map to help policymakers and energy planners make decisions. The research highlights planting energy trees while taking land availability, environmental effects, and physical compatibility into account. It focuses on connecting appropriate land to the correct energy farm and underlines the ramifications for agricultural chemicals, human populations, and water quality. The environmental repercussions of energy farms are also covered in the text, including how they affect aquatic ecosystems, soil conservation, and agricultural chemicals by runoff (Ketzer, 2020). In order to illustrate the scope and effects of energy farms for land use, the text suggests utilising diagrams. It contrasts possible effects on different types of land and how various farming practices affect the ecosystem. In order to support national and international energy planning, it highlights the necessity of inventories as well as summaries of the potential energy resources found in biomass (Martinho et al., 2024; Ali et al., 2024).

A study by Sulaiman et al. (2012) explores the potential of using waste biomass for cogeneration to generate energy in Malaysia. It highlights the environmental benefits and significance of renewable energy production, while also discussing challenges such as financial viability, biomass fuel supply uncertainties, and lack of government support.34 The paper highlights the need for government policies, financial backing, and capacity building to promote sustainable biomass energy development in Malaysia. It emphasises the importance of integrating biomass energy data into databases, networking between countries, and establishing favourable legislation and policies for biomass energy growth. Hence, the study by Sulaiman et al. (2012) underscores the critical need for government support, financial backing, and capacity building to promote sustainable biomass energy development in Malaysia, emphasising the importance of integrating biomass energy data, networking, and favourable policies for successful implementation of waste-based biomass cogeneration in the country (Wang, 2022).

Furthermore, a study by Nor Adilla (2022) offers a thorough analysis of the present state, regulations, and implementation difficulties of biomass energy in Malaysia. It talks about how Malaysia's energy needs are growing and how, in light of depleting fossil fuel supplies and detrimental environmental effects, we must switch to sustainable renewable energy sources. The review study concentrates on the potential of biomass energy and how it might help reduce greenhouse gas emissions, specifically, it looks at biomass from oil palm.36 Successful bioenergy frameworks in Finland, Sweden, Thailand, and Indonesia are contrasted with Malaysia's policies, bringing to light the difficulties encountered in implementing bioenergy on a large scale, including institutional problems, market acceptance, technical obstacles, high capital costs, and environmental effects. The paper highlights that in order to propel the expansion of biomass energy in the nation, concerted efforts, coherent policies, and sustainable practices are key. In order to foster the expansion of biomass energy in Malaysia, the research by Nor Adilla (2022) highlights the necessity of concerted efforts, coherent policies, and sustainable practices. It also addresses important issues and highlights the potential of biomass energy to successfully satisfy energy demands and decrease greenhouse gas emissions.

Furthermore, a research by Jåstad et al. (2023) uses a model to evaluate the consequences of commercial biomass energy on carbon emissions while discussing the effects on land use and agriculture. It notes that while biomass energy may lead to increased land-use change emissions by expanding production, it overall reduces anthropogenic carbon emissions. Higher biomass energy productivity correlates with lower net emissions despite increasing land-use change emissions. The introduction of efficient and affordable biomass technologies can significantly lower total carbon emissions, although it may incentivize deforestation due to raised land rental rates. A study long ago has already recognized the effect of biomass energy projects will cause deforestation on our nature.

To conclude, biomass energy projects must be approached holistically, considering land tenure dynamics, environmental impacts, socio-economic implications, and supportive policies and technologies. By tackling these intricate problems, biomass energy may support inclusive and equitable development routes and help create a more sustainable energy future.

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FINDINGS AND RECOMMENDATIONS

The research reveals that biomass energy projects in East Malaysia face complex challenges due to intricate land tenure dynamics, conflicting land use interests, significant environmental impacts, and socio-economic implications for local communities. Successful projects hinge on inclusive and transparent governance, effective land-use planning, and thorough environmental impact assessments. Engaging local communities and recognizing indigenous land rights are crucial, as is ensuring fair compensation and benefit-sharing. Transparent governance and independent monitoring, foster trust and accountability. The findings emphasise the need for coordinated policies, supportive legislation, and further research to promote sustainable and equitable biomass energy development (Ministry of Plantation and Commodities, 2023).

Hence, in order to guarantee that the requirements and concerns of the local community are met, biomass energy projects must interact with them and include them in the decision-making process. In order to balance economic, social, and environmental concerns, effective land governance and planning are essential. Environmental sustainability requires comprehensive environmental impact assessments (EIAs) that analyse alternative energy sources and take long-term effects into account. Ensuring social and environmental responsibility also requires accountability and transparency in operations and decision-making processes.

In Sabah, a biomass energy project was initiated using oil palm residues. The project faced significant resistance from indigenous communities due to fears of land appropriation and environmental degradation. Learning from past conflicts, project developers took a different approach by actively engaging with the local communities from the outset. They conducted numerous town hall meetings, focus group discussions, and participatory mapping exercises to identify community concerns and expectations (World Rainforest Movement, 2004).

The project also established a community liaison office to facilitate ongoing dialogue and address grievances promptly. This approach led to several positive outcomes: the community's traditional knowledge was integrated into the project design, alternative sites were identified that minimised environmental impact, and a benefit-sharing agreement was developed to ensure that the communities received a fair share of the economic benefits (New South Wales Department of Primary Industries, 2019). The project also committed to rigorous environmental standards, including conducting a comprehensive EIA that evaluated long-term impacts and considered alternative energy sources (Reed, 2009). The success of this project highlights the importance of genuine community engagement and transparent decision-making processes.

In addition, the Bakun Dam project in Sarawak involved the resettlement of over thousands of indigenous people to the Sungai Asap resettlement area (Reuters, 2007). While not a biomass project, it offers critical lessons for community engagement and environmental governance. The resettlement process faced substantial criticism due to inadequate compensation, lack of proper consultation, and significant disruptions to the resettled communities' livelihoods and cultural practices (Durin et al., 2022). The resettlement area lacked sufficient infrastructure, and many residents struggled with new agricultural practices unsuited to their skills and the local soil conditions.

In response to these challenges, several measures were later implemented to improve the situation. These included enhanced community participation in planning and decision-making, additional compensation packages, and investment in local infrastructure and services. Moreover, environmental and social impact assessments were revisited to address the shortcomings in the initial planning phase. This case underscores the critical need for thorough EIAs that include long-term social and environmental impacts, as well as transparent and accountable governance frameworks.

In Sarawak, a biomass energy project utilising timber waste from logging operations aimed to provide a sustainable energy source while reducing waste. The project developers engaged extensively with local communities and stakeholders, conducting workshops and consultations to ensure all voices were heard (Oki, 2024). They implemented a participatory land-use planning process, which helped in identifying areas suitable for biomass production without encroaching on community lands or protected forests.

The project also established an independent monitoring committee comprising community representatives, environmental NGOs, and government officials to ensure transparency and accountability. Regular reports on

the project's environmental and social impacts were made publicly available, fostering trust and collaboration among stakeholders. Additionally, the EIA conducted for the project was thorough, considering not only immediate impacts but also long-term sustainability and alternative energy options. The project's success in balancing economic, social, and environmental considerations demonstrates the effectiveness of inclusive and transparent governance practices.

Moreover, the investigation into indigenous land rights in East Malaysia reveals critical findings regarding the challenges faced by indigenous communities. Firstly, these communities often experience exclusion from decision-making processes concerning development projects on their ancestral lands, violating the principle of Free, Prior, and Informed Consent (FPIC) (Anderson, 2010). This exclusion undermines their traditional knowledge and sustainable land management practices. Legal precedents like Sagong Tasi & Ors v. Kerajaan Negeri Selangor & Ors underscore the need to recognize and protect indigenous land rights. However, ongoing disputes in East Malaysia, such as the Native Customary Rights (NCR) land cases in Sarawak, highlight persistent conflicts between economic development policies and indigenous rights, characterised by inadequate compensation and insufficient consultation.

The socioeconomic impacts of these land disputes are profound, contributing to the loss of livelihoods, cultural disintegration, and increased poverty among indigenous populations. Activities crucial to their way of life, such as farming and fishing, become unsustainable, leading to social upheaval and long-term detriments to their well-being. Addressing these challenges requires a multifaceted approach. Recommendations include strengthening legal frameworks to enforce FPIC , enhancing inclusive decision-making processes that respect indigenous voices, ensuring fair compensation reflective of cultural and economic values, promoting sustainable development partnerships, implementing robust monitoring mechanisms, and fostering awareness and capacity-building among all stakeholders (United Nations Permanent Forum on Indigenous Issues, 2005). These efforts are crucial for balancing development goals with the protection of indigenous land rights, promoting equitable outcomes, and fostering a more resilient society in East Malaysia.

These case studies highlight how crucial it is for biomass energy projects to successfully integrate community involvement, comprehensive environmental impact evaluations, and open government. Projects can strike a balance between economic, social, and environmental aspects by including local populations in decision-making processes and making sure that their concerns are taken into consideration. For biomass energy projects to be long-term sustainable and socially responsible, effective land governance and planning, together with accountability and openness, are crucial.

CONCLUSION

Laws only work if they are consistently and fairly enforced. In the case of East Malaysia's biomass energy projects, this can assist reduce issues related to land tenure. One may get important insights and guide policy changes by contrasting Malaysia's energy regulations with those of other nations, such the United States and Germany. Although the National Biomass Action Plan 2023–2030 and other current laws in Malaysia are intended to promote the expansion of biomass energy, they are not very effective in settling land title disputes.53 The laws must be broader and address the underlying causes of the problems in order to be more successful. In order to help policymakers and stakeholders navigate these complexities and create a more sustainable energy future for the region, this research aims to understand the challenges associated with land tenure and identify potential solutions that can support the growth of biomass energy in East Malaysia.

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