

The Extent of Environmental Protection Regulations and Impacts of Hydropower Activities in Malaysia and China

Adam Rosli, Aiman Syafiq Rohaini, Nuryusharnanie Yusri, Mohd Haris Abdul Rani*

Faculty of Law, University Technology MARA, Malaysia

*Corresponding author

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ABSTRACT

The main issue in Malaysia concerning its environmental protection measures practised in hydropower activities is that the effectiveness and standard are being doubted due to environmental and social implications regardless of the measures taken. Hence, this comparative study aims to analyse some environmental protection measures executed in Malaysia, including EIA regulations and the impacts of hydropower activities. This study will extensively examine the efficiency of environmental protection measures in hydropower activities in Malaysia and China to determine whether these measures protect the environmental, geographical, and demographic areas. Some recommendations to reinforce a proper structure of environmental protection measures regarding hydropower development in Malaysia are also being suggested in this study, namely, to institute a key stakeholder to push, lead and manoeuvre the correct execution of EIA as one of the primary environmental protection measures. Next is to include embedding EIAs in a more comprehensive planning and assessment framework. It is also vital to have a proper evaluation to determine the sustainability of hydropower development. The potential of small hydropower plants in a country shall also be explored to minimise the negative impacts of massive hydropower development towards the environment and the people. The paper suggested that countries adhere to a structured regulation that closely reflects, follows and adopts international guidelines.

Keywords: hydropower activities environmental protection measures; EIA; Malaysia; China

INTRODUCTION

Hydropower is a vital renewable energy source that meets the increasing energy requirements in Malaysia and China (International Energy Agency, 2020; Zhang, 2021). Its development, however, causes significant environmental concerns, involving ecosystem alterations, habitat destruction and profound socio-economic impacts on its local communities. For Malaysia, hydropower is fundamental to the government's sustainable energy goals in reducing fossil fuel dependency (Malaysian Green Technology and Climate Change Corporation, 2021; Saidur, 2012). Likewise, China, becoming the world's leading hydropower producer, is desperately pursuing extensive projects to meet its massive energy requirements and reduce carbon emissions.

For both countries, growing hydropower infrastructure has incited significant controversy due to environmental impacts. Observing Malaysian projects, like the Bakun Dam and the Sarawak Corridor of Renewable Energy (SCORE), has seen strong opposition from Indigenous communities and environmentalists. Concerns over deforestation, biodiversity loss, and the forced displacement of communities are central (Tang, 2019). In China, the construction of large-scale dams along the Yangtze and other river systems, specifically the Three Gorges Dam, has impacted substantial ecological imbalances, disrupted habitats and displaced millions. Despite significant contributions to China's energy needs, the Three Gorges Dam has sparked intense debate about mega dam projects' environmental and social costs. Whenever discussing the regulatory responses to these concerns, they will differ based on the different mandates applied. As for Malaysia, due to the gaps in monitoring and enforcement, the environmental impact assessments (EIA) for such related projects have resulted in environmental degradation (Mahmud, 2022). Given that China has centralised governance, it

is known that its enforcement is instead strictly supported by corruption, bureaucratic inefficiencies, and conflicting governmental priorities that complicate effective regulation (Ho et al., 2020; Wilmsen et al., 2011).

Even though it is known that hydropower is an essential energy source for both countries, examining its impacts requires critical inspection (Ho, 2020) by comparing both regulatory frameworks through the lens of procedural justice articulated by Jurgen Habermas and examining the energy efficiency concept through the ethical framework of Plato and Aristotle. Habermas's concept of procedural justice emphasises fairness and transparency in decision-making, especially in a context involving public participation (Solum, 2005). In Malaysia and China, existing EIA provisions allow for public input, though these processes differ in accessibility and rigour. In Malaysia, transparency is enhanced by making EIA reports publicly accessible (Sahabat Alam Malaysia, 2009), facilitating informed public engagement. In contrast, China's EIA process continues to develop mechanisms for transparency and inclusivity, although further improvements are necessary (Qi, 2023).

Procedural justice in environmental governance, as described by Habermas, is achieved when decision-making processes meaningfully incorporate public involvement, ensuring regulatory accountability and trust. The EIA process, therefore, extends beyond providing a formal venue for participation; it should genuinely empower affected communities to influence project outcomes.

The ethical foundations of energy efficiency are achieved through proper energy management. Plato emphasises virtues, wisdom, justice, courage, and moderation as essential for ethical governance and individual behaviour (Frede, 2017; Nietlong, 2020). In energy, wisdom lines up with the ability to use resources prudently, justice when ensuring fair energy distribution without compromising environmental integrity, courage to adopt sustainable practices despite ever going challenges, and moderation is achieved through restrained energy consumption. Aristotle's concept of the Golden Mean, advocating for balance and moderation, aligns well with sustainable energy practices, suggesting a careful equilibrium between energy use and conservation. Aristotle's principle of *phronesis*, or practical wisdom, emphasises the necessity of ethical, informed decision-making in energy production and consumption.

Applying these ethical frameworks within the hydropower regulation management in Malaysia and China by integrating procedural justice and virtue ethics to promote transparency and public accountability in environmental protection. This approach enables a balanced energy development strategy that embraces conservation and sustainability, as it is known that the current emphasis towards environmental protection measures is most important to safeguard environmental quality by conducting rigorous monitoring, prediction, and implementation of mitigation strategies (Cooke, 2017). EIA has become an important tool towards ensuring and assessing potential environmental impacts. EIA can cover many factors, from pollution to social effects (Makmor, 2016). However, the inconsistency of EIAs in Malaysia raises questions about their efficacy (Turan, 2018). Despite stringent guidelines, their practical impact has been questioned, with projects such as the Bakun Dam illustrating significant deficiencies. In this case, the EIA process inadequately addressed the rights and interests of over 10,000 Indigenous people who were forcefully relocated. This demonstrates the procedural shortcomings of EIA applications, where a genuine consultation process and informed consent were not achieved (Makmor et al., 2020).

This study aims to critically examine the effectiveness of EIAs and other environmental standards by ensuring the protection of ecosystems and communities affected by hydropower projects in Malaysia and China. By focusing primarily on procedural justice, it will use EIAs as the foundational tools for environmental protection in both countries. Besides relying on EIAs, a review of national and international standards reinforces regulatory frameworks, promoting transparency and accountability in decision-making related to hydropower projects are taken up (Cheng, 2021; Rahim, 2020). In both countries, however, procedural justice in environmental regulation faces several challenges. In Malaysia, regulatory capture, inconsistent enforcement, and bureaucratic hurdles often compromise procedural fairness. Even though environmental protection laws exist, their effectiveness fluctuates, and influential developers may exert undue influence over the regulatory process. Moreover, bureaucratic issues persist within the EIA decision-making framework, hindering consistent and practical application (Ahmad, 2020; Lee & Abdullah, 2018).

Although a robust regulatory framework exists in China, bureaucratic inefficiencies and corruption have been shown to hamper proper implementation (Zhang, 2022). Additionally, a prevailing focus on economic growth often overshadows environmental considerations, with environmental bureaucrats sometimes prioritising development over ecological protection (Liu, 2021). This preference for growth-oriented policies challenges procedural justice in China's environmental governance, highlighting the need for strengthened oversight mechanisms and impartial enforcement.

Therefore, the complex interplay between procedural justice and virtue ethics within the hydropower regulation in Malaysia and China has showcased the need for a balanced approach integrating public accountability, environmental protection, and ethical resource management. Comparing the regulatory frameworks of both countries would enable us to highlight some critical areas for improvement that could foster sustainable and ethically grounded hydropower development that continues to respect the environment and addresses the social needs of affected communities.

Environmental Protection Measures in EIA Execution for Hydropower in Malaysia and China

EIA has and will continue to play a vital role in environmental protection for hydropower projects in Malaysia and China, aiming to mitigate adverse impacts on ecosystems and communities. In Malaysia, EIA regulations are guided by the Environmental Quality Act 1974 and have evolved significantly since their inception, with a strong focus on assessing environmental, geographical, and social impacts (Mahmud, 2022). Despite its potential, the EIA framework in Malaysia encounters several limitations, including challenges related to public participation, political interests, and constitutional jurisdiction, as state governments control land and water management (Ahmad, 2022).

Public participation remains an issue in Malaysia's EIA process, as authorities often inadequately address community needs, leading to public dissatisfaction, especially regarding relocation (Loh, 2023). Case studies reveal that 41.7% of relocated community members, such as those impacted by the Bakun Dam, sought compensation without receiving adequate consideration. The Bakun Dam exemplifies the political and economic priorities that overshadow environmental and social concerns, revealing limitations in EIA enforcement, especially in Sabah and Sarawak, where projects fall outside federal oversight, weakening the enforcement of EIA standards.

Additionally, economic and political pressures often impact EIA outcomes in Malaysia. The literature points to political and profit-driven motives affecting large-scale projects like the Bakun Dam, where environmental considerations were secondary. Such projects highlight the difficulties in enforcing EIA standards consistently across Malaysia, particularly in cases where political interests dominate the decision-making process. Nonetheless, Malaysia's EIA framework continues to evolve, focusing on preventative measures to minimise environmental harm and align with international environmental protection standards.

In China, EIA processes have similarly advanced, emphasising environmental transparency and including ecosystem protection measures, water and air quality standards, and biodiversity conservation (Cheng, 2020). The reformed EIA framework, implemented in 2015, aims to improve environmental protection by addressing weaknesses in enforcement. However, challenges persist, including limited resources, insufficient regulatory capacity, and bureaucratic constraints. Although China's EIA reformation has strengthened regulations, it remains susceptible to inadequate resource allocation for addressing environmental concerns in sensitive areas (Wu, 2023).

One notable case illustrating China's EIA rigour is the Three Gorges Dam, the largest hydroelectric project globally. The dam underwent extensive EIA procedures that included assessments of environmental, social, and economic impacts, incorporating public participation requirements. China's reformed EIA framework mandates that projects obtain environmental approval, including public hearings on ecologically sensitive projects, ensuring that communities participate in decision-making (Maphanga, 2022; Tilt, 2015; Wilmsen, 2011).

Despite these measures, both countries face similar challenges in implementing EIA effectively. Malaysia's constitutional limitations and political interests weaken the enforcement of EIA standards, while China's bureaucratic inefficiencies and resource constraints impede thorough environmental protection. Nonetheless, both nations aim to improve EIA practices to balance hydropower development with environmental conservation, public health, and equitable resource distribution.

Malaysia and China have achieved progress in implementing EIA processes but face limitations (Ahmad, 2023; Wang, 2022). The Bakun Dam and Three Gorges Dam cases highlight the importance of effective EIA frameworks that consider social, environmental, and economic factors, with public involvement as a cornerstone of environmental justice. Improving EIA implementation in both countries requires strengthened oversight, resource allocation, and commitment to prioritising environmental and community welfare in large-scale hydropower projects.

National and International Environmental Protection Measures in Hydropower Activities in Malaysia and China

In Malaysia, hydropower development is guided by national guidelines, international standards, and organisations such as the International Commission on Large Dams (ICOLD). The Department of Environment (DOE) conducts Environmental Impact Assessments (EIA) for hydropower projects to ensure environmental responsibility. At the national level, these guidelines address site selection, impact assessments, mitigation measures, and monitoring protocols. Internationally, Malaysia follows frameworks from bodies like the International Hydropower Association (IHA), which offer standards for sustainable development, governance, and social considerations in hydropower. By aligning with these guidelines, Malaysia aims to bolster the credibility and sustainability of its projects.

Malaysia has also begun incorporating innovative approaches, such as nature-based reservoir management, which reduces ecological footprints and supports biodiversity. These efforts align with global trends favouring ecosystem-based water and energy management. However, challenges remain in balancing hydropower benefits with environmental and social impacts, such as Indigenous community resettlements, biodiversity loss, and downstream ecosystem effects. Projects like the Bakun Dam highlight these challenges, as public hearings and consultations aimed to address environmental and social concerns, including land rights and cultural heritage preservation. Legal actions by Indigenous communities further underscore large-scale hydropower projects' environmental and social implications. Efforts to ensure transparency and stakeholder engagement through public participation in EIA processes seek to foster trust, but balancing development with environmental stewardship remains complex (Loh, 2023).

Malaysia's regulatory approach combines national guidelines and international collaboration to mitigate the environmental impacts of hydropower while maximising societal benefits. The holistic approach considers environmental, social, and economic effects, balancing energy security with ecosystem preservation. Despite the positive strides, challenges persist, especially in enforcing EIA standards consistently and addressing socio-environmental issues such as community displacement and resource redistribution.

In China, hydropower plays a pivotal role in the nation's energy landscape, yet coal remains dominant. The country's 12th Five-Year Plan highlights hydropower as essential for economic development, with most projects concentrated in ecologically sensitive southeastern regions. The ecological effects, particularly on river ecosystems, considerably impact water flow and fish habitats. In the Yangtze and Lancang Mekong River Basins, dams disrupt migratory fish patterns, posing challenges to biodiversity. Technological solutions like fishways and habitat restoration are employed, but large dams continue to fragment habitats.

China's Environmental Protection Law (EPL), first enacted in 1979 and updated in 2002, lays the foundation for EIA practices. Its EIA system has expanded to encompass dam construction, reflecting increasing awareness of hydropower's environmental impact. Regulations now emphasise biodiversity conservation, requiring fishway designs, minimum flow standards, and post-project environmental assessments. The updated Environmental Protection Act of 2015 introduced more stringent ecological protections, underscoring the importance of ongoing environmental monitoring for water conservancy projects.

On the international stage, China collaborates on environmental efforts by participating in agreements like the United Nations Framework Convention on Climate Change (UNFCCC) and engaging with neighbouring countries through regional bodies like the Mekong River Commission. These alliances promote sustainable hydropower development and transboundary water management, further reflecting China's commitment to addressing the global environmental impacts of its hydropower activities.

Malaysia and China have substantially integrated national and international environmental measures in hydropower projects. Malaysia emphasises stakeholder engagement and transparency in EIA processes, while China focuses on regulatory frameworks and regional cooperation. Both countries are navigating challenges in sustainable hydropower development, aiming to balance energy needs with environmental protection and community welfare.

The Effects of Hydropower Activities in Malaysia and China

Loss of Biodiversity

Hydropower presents significant environmental challenges while providing renewable energy for Malaysia and China. Both countries have adopted large-scale hydropower to support economic growth and energy security, but these projects have led to habitat destruction and biodiversity loss, impacting unique ecosystems. In Malaysia, projects like the Bakun and Murum Dams have flooded vast forested areas, displacing countless plant and animal species and fragmenting habitats, which isolates wildlife populations and raises extinction risks. For example, the Baleh Dam project in Sarawak has raised concerns over its potential to harm endangered species, including the Bornean orangutan.

Similarly, China's extensive hydropower projects, such as the Baihetan Dam on the Jinsha River, have disrupted habitats through massive land flooding, fragmenting ecosystems and isolating species populations. This dam, one of the largest globally, alters the flow of the Jinsha River, affecting downstream ecosystems and fish populations dependent on natural river conditions for spawning and feeding. Species such as the Yangtze River dolphin and Chinese sturgeon face critical survival threats due to habitat inundation, while the Baiji dolphin was declared extinct primarily due to hydropower impacts. Legal disputes and public opposition, such as with the Nuozhadu Dam, highlight the ongoing tension between development goals and biodiversity conservation.

In both countries, changes in water flow, sedimentation, and nutrient cycles due to dam projects disrupt riverine ecosystems and harm aquatic biodiversity. Freshwater fish and amphibian populations are particularly vulnerable, and downstream water quality also suffers. Urgent protective actions, such as establishing protected areas and habitat restoration, are essential to mitigate biodiversity loss associated with hydropower development.

Displacement of Communities

Hydropower projects also carry a substantial human cost, displacing communities that rely on the land and rivers for their livelihood. In Malaysia, the Bakun Dam's construction involved the forced relocation of approximately 10,000 Indigenous people, including the Penan, Kayan, and Kenyah communities, who were deeply connected to their ancestral lands for cultural and economic reasons. Despite promises of compensation, many affected individuals struggled with adapting to new environments that lacked traditional resources and services. Social fragmentation and the erosion of conventional knowledge further exacerbated the difficulties faced by these communities. Legal challenges and protests underscored the social injustices associated with such large-scale development, yet construction continued, reflecting underlying power dynamics that often marginalise Indigenous voices.

China's Three Gorges Dam, completed in 2006, represents a similar large-scale displacement, relocating over 1.3 million people. Resettlement involved moving entire communities away from the Yangtze River, where many relied on farming and fishing. Adjusting to new urban or suburban areas posed economic challenges, as traditional skills were no longer viable, and compensation often fell short of covering financial losses. Many

displaced individuals reported lower incomes and limited access to essential services post-relocation. As China continues its hydropower expansion with projects like the Baihetan Dam, displacement remains a critical issue, with tens of thousands uprooted and facing social and economic instability.

The displacement caused by hydropower has led to numerous protests and legal battles in both countries. Although China's laws mandate adequate compensation, implementation varies, and in some cases, compensation has been insufficient to offset relocation costs. Advocacy by human rights organisations and environmental NGOs has shed light on these issues, pushing for improved resettlement practices and more excellent protection for displaced communities. These efforts emphasise the need for more equitable approaches in balancing hydropower development with social and environmental considerations.

RESEARCH METHODOLOGY

This study adopts a doctrinal research approach, utilising resources from libraries, archives, and databases to examine and analyse legal principles, case law, and institutional instruments. Through this method, the study seeks to provide a detailed understanding of the principles and operational dynamics within specific legal frameworks. Additionally, a comparative law perspective is employed to contrast legal theories and principles across various contexts, enriching the analysis by highlighting strengths, limitations, and differing applications of legal concepts relevant to the study's objectives.

RESEARCH FINDINGS

The research findings reveal that implementing Environmental Impact Assessments (EIA) in hydropower activities in Malaysia and China faces numerous challenges related to constitutional constraints, ineffective public participation, and regulatory enforcement. In Malaysia, the constitutional structure limits the scope and consistency of EIA, impacting its effectiveness as a tool for environmental protection. Under the Federal Constitution, state governments, especially those of Sabah and Sarawak, retain authority over land and water matters, which has led to inconsistencies in the application of EIA across the country. This fragmented jurisdiction is highlighted in landmark cases such as the Kajing Tubek case, where the Court of Appeal upheld Sarawak's authority to conduct its own EIA for the Bakun Dam project. Public responses to this decision varied, yet it underscored that Sarawak's EIA process aligned with federal standards. Nevertheless, the limited involvement of federal agencies in Sarawak's hydropower activities creates gaps in regulation, as the Sarawak Order restricts public access to reports and participation in decision-making. The reduced role of the public in the EIA process not only limits transparency but also diminishes procedural justice, which is essential to protect the environment and safeguard local communities' interests.

The lack of adequate public participation further weakens the impact of EIA as a holistic approach to environmental protection. EIA frameworks should facilitate comprehensive public engagement, allowing affected communities to voice concerns and participate in decision-making. However, public participation remains inadequate in Malaysia, as evidenced by the development of large-scale hydropower projects like the Bakun and Murum Dams. Both projects exemplify the limited engagement with Indigenous communities, many of whom faced forced relocation without meaningful consultation. This exclusion has generated opposition among affected communities, such as the protests with the proposed Baram Dam, where local resistance highlighted the need for greater community involvement. In China, similar challenges persist, as centralised governance structures restrict the scope and impact of public participation. For example, the planning and construction of the Three Gorges Dam did not initially involve public consultation, reflecting the government's reluctance to incorporate community input into large infrastructure projects. Although recent procedural reforms in China encourage public involvement, only select projects require such engagement, which limits the scope of influence for the communities affected by hydropower development. The overall lack of public participation in both countries hinders the EIA's potential to serve as a democratic safeguard in environmental governance.

The regulatory approval and enforcement of EIA in China face additional challenges that compromise the rigour of environmental assessments. EIA approval processes are often reduced to formalities, with limited periods for public review and weak oversight mechanisms. Approval for hydropower projects typically occurs

late in the planning stage, after significant resources have already been invested, which reduces the likelihood of modifications based on environmental findings. Financial arrangements between assessment agencies and construction companies can also create conflicts of interest. Agencies are often pressured to approve projects swiftly to secure final payments, and in some cases, project developers influence assessment outcomes to ensure smooth approval. The case of the Three Gorges Dam exemplifies the issues associated with this process, as the initial EIA reviews overlooked post-construction monitoring, missing opportunities to address significant environmental and social impacts. The situation underscores systemic issues within China's EIA framework, where economic objectives frequently take precedence over environmental concerns, limiting the effectiveness of assessments in guiding sustainable development.

Despite these challenges, Malaysia and China have adopted national and international measures to mitigate the environmental impacts of hydropower. In Malaysia, EIA is mandated under the Environmental Quality Act of 1974, requiring developers to evaluate potential environmental consequences before project initiation. However, economic priorities often overshadow environmental considerations within the EIA process, limiting its capacity to prevent harmful impacts. In this regard, the Bakun Dam is a case study, as the EIA highlighted significant risks, including habitat destruction and community displacement. However, the project proceeded, indicating that economic benefits outweighed environmental concerns. Malaysia also adheres to international standards established by organisations like the International Commission on Large Dams (ICOLD) and the IHA to enhance sustainability practices. While such affiliations encourage adherence to global best practices, Malaysia's EIA process still encounters difficulties ensuring consistent environmental protection, particularly in large-scale projects with complex ecological impacts.

China's approach incorporates a range of environmental protection measures, including its Environmental Protection Law and the revised Environmental Protection Act of 2015, alongside international commitments like the United Nations Framework Convention on Climate Change (UNFCCC). The revised Environmental Protection Act introduced stricter penalties for non-compliance, aiming to strengthen accountability and ensure environmental standards are met. However, despite these advances, implementation and enforcement remain uneven, as seen in projects like the Three Gorges and Baihetan Dams, where enforcement gaps allowed environmental degradation. In these instances, river ecosystem fragmentation, loss of biodiversity, and forced displacement illustrate the broader challenges of managing large hydropower projects within a framework that balances energy production with environmental stewardship.

Both Malaysia and China face significant environmental, social and economic consequences from hydropower development. In Malaysia, the construction of dams such as the Bakun and Murum projects disrupts river ecosystems, impacting fish migration, altering sediment transport, and diminishing water quality. Though Malaysia's EIA regulations include requirements for environmental impact assessments and resettlement plans, challenges remain in translating these assessments into adequate protections for biodiversity and community livelihoods. Similarly, China's rapid expansion in hydropower, while instrumental in reducing carbon emissions, often sacrifices environmental and social considerations. In the case of the Three Gorges Dam, the environmental effects extend beyond immediate habitats, affecting downstream ecosystems, fish populations, and even local climate conditions. Community displacement remains a significant social cost in both countries. Despite legal frameworks mandating compensation and resettlement, affected communities frequently experience disruptions to their livelihoods and social structures, underscoring the need for more robust and enforceable regulatory measures.

On a positive note, while these projects have faced social, environmental and economic challenges, their significant contribution to national energy production cannot be overlooked. They have helped reduce dependence on fossil fuels and promote economic growth through job creation and infrastructure development. For example, the Three Gorges Dam generates over 22,500 MW of electricity, providing clean energy to millions of people and contributing to China's economic expansion. Similarly, the Bakun Hydroelectric Power Plant has an installed capacity of 2,400 MW, making it one of the largest hydroelectric plants in Southeast Asia, playing a crucial role in Malaysia's energy sector.

Furthermore, recognising positive outcomes and success stories that emerged from environmental protection can be seen in Malaysia and China. With the right strategies, it is possible to mitigate the environmental impacts of hydropower projects and even enhance the local ecosystem. The Belum-Temengor Rainforest Conservation Program is one example associated with the Gerik Hydroelectric Project; the Belum-Temengor Rainforest Conservation Program has been a notable success in preserving biodiversity. The program showcases how hydropower projects can coexist with environmental protection, balancing ecological preservation and development.

Likewise, the Three Gorges Dam and the Xiangjiaba Dam have adopted significant environmental protection measures. Creating artificial wetlands and large-scale reforestation projects has helped restore the local ecosystem and improve water quality. These initiatives highlight the potential for hydropower projects to contribute positively to environmental sustainability.

In summary, while both nations recognise the importance of hydropower as a renewable energy source, large-scale projects and social, economic and environmental costs reveal the limitations of current regulatory frameworks. Strengthening EIA processes, enhancing public participation, and enforcing compliance with national and international environmental standards are crucial to achieving sustainable hydropower development in Malaysia and China. Addressing these gaps will require a concerted effort to balance economic growth with environmental preservation and community welfare, ensuring that hydropower can contribute to sustainable energy futures without compromising ecological integrity or social equity.

RECOMMENDATIONS

Since the EIA and other environmental protection measures have only been treated as a mere formality and some of the construction of the dams even took place before the EIA's approval, there are a few recommendations provided by some concerned parties in improving our current environmental protection measures to protect the environment and the society better.

Institute a Key Stakeholder to Push, Lead and Manoeuvre the Correct Execution of Environmental Impact Assessment

Instituting a responsible stakeholder to manoeuvre EIA properly will encourage strict adherence to all laws and regulations by all the involved parties. Not to mention that all stakeholders shall also be competent in pursuing more sustainable hydropower projects by using Strategic Environmental Assessment (SEA) alongside EIA for a more effective impact in anticipating and curbing the negative consequences of hydropower activities. When hydropower policies have social or environmental effects that cannot be predicted because of uncertainty about the intricate processes these interventions may have downstream, SEA comes in handy to evaluate the institutional and governance conditions required to deal with these effects effectively together with EIA (Hazmin, 2021b). While EIA focuses on mitigating and preventing impacts, SEA aims to sustain a chosen level of environmental quality. Simply put, Malaysia also needs to improve governance primarily on the issues of the EIA implementation and significantly on the environmental protection measures.

To Include Embedding EIAs in a More Comprehensive Planning and Assessment Framework

To ensure a proper structure of environmental protection measures for hydropower development in Malaysia, it is also vital to acknowledge the EIA's role in the comprehensive planning of a hydropower project. For example, only the impacts of the current EIA process in Sarawak, Malaysia, are described. Still, no solutions are offered to prevent needless losses to the environment, society, or economy. Thus, it is suggested that our EIA be more comprehensive and specific in addressing any possible hazards through the EIA process early in the project before they become a problem and later backbite society and the environment. Hence, it is vital to use EIA to its maximum potential in curbing any possible negative impacts of hydropower development.

Therefore, improving the identification and assessment of likely impacts is essential. For example, we shall refer to the China Renewable Energy Engineering Institute (CREEI) Report, which emphasises the importance of field-based identification and assessment as a supplement to mere reliance on official documentation. Thus,

by referring to the CREEI Report as one of our main guidelines towards a more comprehensive evaluation, field assessment will be able to detect and target a specific number of possible affected communities or who may likely be slow in adapting to changed circumstances due to the hydropower development. Therefore, by incorporating a more systematic approach of field assessment in our EIA process, we can be more cautious in building hydropower with a considerable risk of endangering the affected communities and hence will be able to balance the lesser of two evils principle at the end of the day.

Proper Evaluation in Determining the Sustainability of Hydropower Development

A more appropriate and objective assessment for evaluating the sustainability of hydropower development should be shared and exercised. Thus, when assessing the sustainability of a new hydropower project, more objective information on Good Practices to minimise the negative social and environmental impacts shall be used. Instead, the benefits shall be maximised to protect the people and the environment. Sound practices provided social and/or environmental advantages through hydropower development, and environmental and social problems were resolved via mitigation measures.

Therefore, sharing good practices is crucial for all stakeholders, namely government bodies, NGOs, and possible groups of communities that might be affected by hydropower construction. By sharing these Good Practices in a wide range, more stakeholders and the public can elevate their awareness of any negative and positive aspects of the hydropower developments that previous projects might have overlooked. In addition, this sharing can also function as a guide to navigate future hydropower projects to be more sustainable and safer for the people and the environment.

Exploration of Potential Small Hydropower Plant

According to Xiao et al. (2023), the potential of small hydropower plant (SHP) development in Malaysia shall not be underestimated, as their development can be seen as another effort to lessen the harmful effects of extensive hydropower activities in our country. In addition, focusing more on the SHP development will reflect Malaysia's commitment to achieving its goals in the National and International Renewable Energy Policy 2010 and action plan, including increasing RE contribution (Hazmin, 2024a). One of the examples of a thriving SHP in Malaysia is the Perting Mini Hydropower Plant in Bentong, Pahang, Malaysia. It is also crucial to consider that although Malaysia has enormous potential for small hydro, the energy from the rivers already makes up a sizable portion of the country's electrical supply in rural areas.

There have been some incriminations of small hydropower projects in some potential regions for possible SHP in Malaysia. As an example, it was found that the locals in the Royal Belum State Park, Perak, are inclined to opt for micro hydropower plants as their energy source. Unfortunately, as of 2023, there is no update regarding any development of SHP soon.

It is agreeable that Malaysia has adopted some international environmental protection measures and guidelines. Nevertheless, guidelines will stay as mere guidelines without an adequately structured regulation to navigate and guard against the countries that have adopted these measures at the end of the day. This is vital to prevent these countries from staying aligned with the environmental protection measures they adopted and to ensure they will not take their responsibility lightly. In other words, Malaysia shall then encourage more cross-sectoral cooperation. This also includes the guidelines and measures provided by the national and international hydropower associations. This global effort shall be practised widely to encourage more stakeholders to be aware of each other's efforts in building sustainable hydropower and mitigating the negative impacts of hydropower on the environment and society. Thus, this will help every national and international organisation analyse and fix the loopholes in their guidelines and measures by referring to each other's experiences.

CONCLUSION

The regulation of environmental protection measures and the effects of hydroelectric operations in Malaysia and China demonstrate an intriguing interaction between economic goals, environmental stewardship, and societal well-being. In Malaysia, hydropower projects are managed by environmental rules and regulations

known as the EQA and the EIA procedure. However, the efficacy and implementation of these restrictions might vary, raising questions about how environmental concerns are prioritised in pursuing energy security and economic prosperity. Malaysia's hydropower development is driven by the country's energy needs and commitment to renewable energy sources. Still, it has come at a cost, with issues such as habitat destruction, biodiversity loss, and the displacement of local communities raising serious concerns about the project's long-term sustainability.

In contrast, China has emerged as a global leader in hydropower development, with significant projects such as the Three Gorges Dam demonstrating the country's potential for massive infrastructure projects. The Chinese government has actively promoted hydropower as a vital component of its energy policy, hoping to reduce dependency on fossil fuels and lessen the effects of climate change. However, China's fast growth of hydropower has resulted in several environmental and social issues, including sedimentation, water quality degradation, and the relocation of populations living near dams.

The complex circumstances surrounding hydropower expansion and development throughout Malaysia and China highlight the critical balance between economic growth, environmental conservation, and social well-being. Sustainable hydropower project management demands a complete strategy with strong regulatory frameworks, effective enforcement mechanisms, and meaningful stakeholder participation. Both countries must balance the benefits of hydropower as a clean energy source against the possible adverse effects on ecosystems, biodiversity, and local populations. Striking a healthy balance between energy security, environmental sustainability, and social equality is critical as Malaysia and China chart their course for a more sustainable future in hydropower development.

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