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Risk Governance and Public Acceptance in Indonesia's Nuclear Power Development: An Energy Justice Perspective

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Abstract

The development of nuclear power in Indonesia raises questions about how regulatory oversight and public acceptance are addressed within energy policy. This article examines the relationship between nuclear risk governance and public acceptance through qualitative document analysis and a narrative synthesis of scientific literature, regulatory documents, institutional reports, and secondary survey data. The analysis identifies established procedures for technical risk assessment and ongoing developments in radioactive waste regulation, alongside public concerns regarding environmental impacts, coastal livelihoods, and participation in decision-making. Differences between provincial survey findings and documented local opposition suggest that general support for nuclear energy should not be equated with acceptance of development at a particular location. Drawing on risk governance and energy justice, the discussion distinguishes regulatory compliance from the institutional consideration of affected communities. The study contributes to understanding how technical oversight, public participation, and institutional accountability intersect in Indonesia's nuclear power policy, while recognizing the limitations of documentary evidence in assessing their practical effectiveness.

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Introduction

The Nuclear Power Plant Development Plan in Indonesia took a more concrete form through the ratification of PT PLN's Power Provider Business Plan for 2025 – 2034 which was ratified through the Decree of the Minister of Energy and Mineral Resources Number 188.K/TL.03/MEM.

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L/2025 includes a nuclear capacity plan of 500MW (Ministry of Energy and Mineral Resources, 2025a) with an allocation of 250 MW each for the electricity systems of Sumatra and Kalimantan (Ministry of Energy and Mineral Resources, 2025). As nuclear enters the electricity supply plan, attention to the development process includes the position of the people who have the potential to bear the impact. The issue of public revenue is related to citizens' opportunities to understand the risks and influence decisions regarding their living space (Duvic-Paoli & Lueger, 2022). Public attitudes towards nuclear energy are formed through an assessment of benefits and risks, with trust in managers also playing a role. Singapore demonstrates the importance of the credibility of information sources to understand how the public assesses the development of nuclear energy (Ho et al., 2018). In Indonesia, trust in nuclear authorities and local governments has a positive relationship with the acceptance of nuclear power plants, while the role of the central government in encouraging acceptance is more limited (Sugiawan & Managi, 2019).

A survey of 1,500 respondents in Bangka Belitung in April 2021 recorded acceptance for the construction of a nuclear power plant of 73.73%. Recognition of the benefits reached 94.27%, while recognition of risks reached 70.93% (Kartono et al., 2023). This figure illustrates the distribution of answers in the survey and is not enough to establish acceptance requirements at the individual level. The data collection also preceded the ratification of the 2025–2034 RUPTL, so its use in this article is limited as a description of revenue before the policy was issued. The percentage of support becomes more meaningful when read together with a process that allows citizens to obtain information and express their views (International Atomic Energy Agency, 2021). Stakeholder involvement from the outset is part of the development of the nuclear program, with communication taking place throughout the facility cycle to waste management and decommissioning. The right to participate also places communities as parties whose interests need to be taken into account in decisions regarding nuclear activities (Duvic-Paoli & Lueger, 2022) this reference is used to examine the arrangements for community involvement in Indonesian policy documents. Energy justice provides a framework to examine the distribution of benefits and burdens, decision-making processes, and recognition of affected groups (Jenkins et al., 2016). This article uses this framework to read the position of communities in nuclear power plant policies. The risk governance analysis focuses on the regulation of institutional responsibilities and the provision of information related to community protection. Checks are carried out on documented provisions, without equating the existence of the rules with the success of their implementation.

The referred study provides information on public acceptance and trust, while the policy document contains arrangements for the development of nuclear power plants. This article examines the relationship between the two through the question of how risk management in Indonesian nuclear power plant policies accommodates the public revenue problems identified in previous research. The aim is to examine the relationship between the evidence of acceptance and the regulation of community involvement and institutional responsibility through literature synthesis and document analysis.

Methods

This study uses a qualitative approach through document *analysis* and literature narrative synthesis to examine risk governance and public acceptance in nuclear power plant (NPP) development policies in Indonesia. Document analysis is used to examine the policy substance, institutional arrangements, and risk management provisions listed in written sources (Bowen, 2009). Meanwhile, literature synthesis allows various empirical findings and conceptual perspectives to be

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linked to understand policy issues involving a number of analytical dimensions (Gilson, 2014; Snyder, 2019). This approach is directed to elucidate the relationship between nuclear policy settings and the public acceptance factors that have been identified in previous studies, without examining causal relationships statistically.

The research data is sourced from official government documents, publications of international institutions, scientific articles, and the results of published public acceptance surveys. Policy documents include Government Regulation Number 40 of 2025 concerning the National Energy Policy, the Electricity Supply Business Plan (RUPTL) 2025–2034, as well as BAPETEN publications on nuclear safety supervision and the development of radioactive waste management policies. IAEA documents are used as a reference to understand safety principles and stakeholder involvement in the nuclear program. Scientific literature is purposively selected based on its relevance to risk governance, public acceptance, institutional trust, and energy justice. Empirical studies are prioritized in publications for the 2016–2026 period, while earlier methodological and conceptual literature is still used if they are basic references. The selection of sources considers the suitability of the substance, the credibility of the publisher, the clarity of the method, and the traceability of the information used (Bowen, 2009; Snyder, 2019)

The analysis was carried out through reading and grouping the content of the document based on themes related to the research question. The initial stage was directed to identify the position of nuclear power plants in national energy policy, the division of institutional authority, as well as safety regulations and risk management. Furthermore, the information from the documents was grouped using *directed qualitative content analysis*, which is a technique that uses previous concepts or findings as the basis for developing analysis categories (Hsieh & Shannon, 2005). The *risk governance* framework is used to read risk assessment settings, risk management, communication, and stakeholder engagement (*Introduction to the IRGC Risk Governance Framework*, 2017). The *energy justice framework* complements the analysis through the dimensions of procedural, distributive, and recognition of affected groups (Jenkins et al., 2016). Both frameworks are used to interpret the substance of the document, not to generate a numerical score on governance performance or maturity levels. The data of the public revenue survey was analyzed descriptively by referring to the results of published research, especially the 2016 national survey, the 2017 Bangka Belitung and West Kalimantan surveys discussed by (Wisnubroto, Ruslan, dkk., 2021) and the published Bangka Belitung survey (Kartono et al., 2023). The information considered included the percentage of acceptance, the perception of benefits and risks, and the institutional factors reported in each study. The comparison was carried out by taking into account differences in regions, sample characteristics, instruments, and data collection times. Percentage variation was not treated as a change in attitudes in the same population or as direct evidence of the influence of a variable. The survey results are used to provide an empirical context for the discussion of risk governance and public acceptance, not as a basis for regression testing or predicting levels of support.

Analytical traceability is maintained by comparing information from policy documents, institutional publications, and scientific research results and listing sources for each finding used. Statements regarding the existence of a rule are distinguished from evidence of implementation and effectiveness. When a regulation is not found in the document being analyzed, it is not directly interpreted as the absence of policy. Thus, conclusions are limited to the substance of the document and the available empirical evidence. The absence of interviews, field observations, and individual survey data limits the ability of research to assess community experiences directly and to ascertain the cause-and-effect relationship between risk governance and public acceptance.

Results and Discussions

1. Institutional Risk Governance In Nuclear Power Development

Supervision of the nuclear power plant construction plan in the Bangka Belitung Islands has entered the process of examining the requirements of the site evaluation by the Nuclear Energy Supervisory Agency, 2025a). In the evaluation results report dated March 21, 2025, the Site Evaluation Program (PET) and Site Evaluation Management System (SMET) documents submitted by the initiator were declared to have not met the technical requirements. The inspection then continued through several stages of field improvement and verification. The Safety Evaluation Report (Nuclear Energy Supervisory Agency, 2025a) recorded 173 findings in the initial PET inspection, reduced to 33 in the second evaluation and eight in the third evaluation. The SMET document also decreased the number of findings from 59 to 11 and then ten. Once the documents are assessed to meet the requirements to carry out a site evaluation, BAPETEN issues approval on July 30, 2025. In this licensing mechanism, the initiator still has to carry out a location investigation before the feasibility of the site can be assessed for the next stage of licensing.

The inspection refers to (Regulation of the Nuclear Energy Supervisory Agency Number 4 of 2018 concerning Safety Provisions for Nuclear Installation Site Evaluation, 2018) and (Regulation of the Nuclear Energy Supervisory Agency Number 6 of 2023 concerning Facility Management System and Nuclear Power Utilization Activities, 2023). The PET assessment covers six aspects of external hazards, including earthquakes, volcanoes, geotechnical, meteorological and hydrological, human-caused events, and dispersion of radioactive substances. The last aspect also includes a plan to evaluate radiation doses to the community and nuclear preparedness (Nuclear Energy Supervisory Agency, 2025b). The inspection of PET and SMET mainly determines whether the investigation and management program has met the requirements, so it cannot be equated with the final results of the site safety assessment. (International Atomic Energy Agency, 2021) explained that site selection and evaluation activities are also related to environmental protection, socio-economic conditions, and stakeholder involvement. These technical requirements are related to the issue of space use and coastal community activities that need to be considered during project development.



Figure 1. Institutional Risk Governance Framework for Nuclear Power Development in Indonesia

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Beyond site evaluation, radioactive waste management requires arrangements that span the operating period to the final handling of nuclear facilities (Wisnubroto, Zamroni, et al., 2021) identifying challenges in determining final storage locations, financing waste management, and transportation of radioactive materials between islands. These findings mainly come from the experience of waste management of research reactors and the use of radioisotopes, so they have not yet described the conditions of commercial nuclear power plant waste management. Indonesia itself has regulated radioactive waste management through (Government Regulation of the Republic of Indonesia Number 61 of 2013 concerning Radioactive Waste Management, 2013). On September 10, 2026, BAPETEN and relevant ministries will finalize the draft government regulation on its successor, with discussions that include improving waste management provisions (Nuclear Energy Supervisory Agency, 2026). The development of this regulation is related to the need for regulations that can be applied to increasingly diverse nuclear activities. For the development of nuclear power plants, attention also includes clarity of responsibilities for waste fuel management, long-term financing, and supervision after facilities cease to operate.

While technical supervision takes place through document checks and permits, communication with the community is carried out through activities involving supervisory agencies and local governments. On May 31, 2024, BAPETEN attended a socialization with the people of Batu Beriga Village and fishermen in Lubuk Besar District, Central Bangka. The community expressed their desire to be involved in the licensing process and asked for attention to the sustainability of fishery activities (Nuclear Energy Supervisory Agency, 2025b). The issue was discussed again in an audience with the Central Bangka Regency DPRD in October 2025, especially regarding fishermen's livelihoods, marine ecological conditions, and potential development impacts. BAPETEN said that these aspirations will be considered in the next stage of licensing (BAPETEN, 2025). The available documentation records communication activities and institutional responses, although it does not provide details on how each community input is processed in technical decisions. (International Atomic Energy Agency, 2021) places stakeholder involvement in site selection and evaluation activities, including when local interests need to be considered alongside safety requirements.

The relationship between technical checks and community engagement can be read through *the* Introduction to the IRGC Risk Governance Framework (2017) which links risk assessments to evaluation, management, communication, and stakeholder participation. In the case of Indonesia, PET and SMET examination procedures have administrative records that can be traced through evaluation reports, document revisions, and regulatory decisions. Communication with the public has also taken place, while information on the influence of public aspirations on licensing decisions is still limited in the sources analyzed. The difference in the availability of evidence is not sufficient to declare institutional failures or lack of participation. A more relevant issue is how technical considerations and public interests are linked in the decision-making process, especially when risk assessments by regulators take place at the same time as the formation of public perceptions of the benefits and potential impacts of nuclear power plants.

2. Public Acceptance and Risk Perception in Nuclear Power Development

Differences in public attitudes towards nuclear development can be examined through earlier surveys conducted in Bangka Belitung and West Kalimantan. (Wisnubroto, Zamroni, dkk., 2021) compared face-to-face surveys involving 800 respondents in Bangka Belitung in 2017 and 600 in West Kalimantan in 2019, reporting support levels of 51.75% and 87.17%, respectively. The authors

associated these differences with regional electricity conditions, particularly supply constraints and dependence on electricity imports from Malaysia in West Kalimantan. Both surveys also identified preferences for renewable energy when presented as an alternative to nuclear power. The findings suggest that nuclear support was considered alongside other electricity options, although differences in survey periods and regional conditions prevent a direct causal interpretation. Electricity supply conditions offer one possible explanation for the variation, rather than a sufficient account of public attitudes across the two provinces.

The geographical dimension of acceptance deserves closer examination. (Kartono dkk., 2023) reported that respondents who supported nuclear development expressed a preference for facilities to be located approximately 30 kilometres from residential areas. Although the authors found no indication of *not in my backyard* (NIMBY) attitudes, the geographical scope of their survey does not establish whether communities near a particular proposed site would accept construction. A study by (Hlavacek dkk., 2023) in the Czech Republic examined acceptance of small nuclear reactors at different distances from residential areas and identified considerable variation in respondents' willingness to accept nearby facilities. While the technological and national contexts differ from Indonesia, the study provides a useful comparison of how location enters public assessments of nuclear development. The distinction becomes relevant when general attitudes towards nuclear technology are considered alongside the interests of communities living near a proposed facility.

In Bangka Belitung, these questions emerged in the public discussion surrounding the proposed nuclear power plant on Kelasa Island. On 31 October 2025, residents of Batu Beriga held a village deliberation forum, *Rembuk Kampung*, attended by fishers, farmers, customary figures, and young residents. Participants expressed opposition to the proposed development and raised concerns about insufficient information, coastal livelihoods, and the ecological significance of the island (Suara Bangka, 2025). The meeting provides evidence of organized local opposition, although its participants cannot be treated as a representative sample of the village population. The concerns raised extended beyond reactor safety to the relationship between the proposed facility and existing uses of surrounding coastal waters. Fishing activities and access to marine resources formed part of the discussion because the island and its waters have economic significance for nearby communities.

The concerns surrounding Gelasa Island also developed within an existing dispute over coastal resource use. In October 2024, Batu Beriga residents protested proposed offshore tin mining activities, citing possible environmental damage and consequences for fishing livelihoods (Provinsi Kepulauan Bangka Belitung, 2024). Although mining and nuclear development involve different activities and risks, both have become subjects of public disagreement over the future use of coastal areas. In September 2026, residents and civil society representatives again presented demands to the provincial legislature, including opposition to nuclear development and proposals to protect fishing areas through revisions to coastal zoning arrangements (News, Redaksi TVRI, 2026). These events do not establish that opposition to mining caused opposition to nuclear energy. They provide a documented context in which access to marine resources and decisions over coastal space have become important concerns for local communities. Questions about the availability and adequacy of project information further complicate the interpretation of local acceptance. In December 2025, the Batu Beriga village head stated that residents had not received sufficient official information about the proposed facility and requested clearer explanations of its development stages and possible consequences for fishing activities (Kurniawan, 2025). This account needs to be considered alongside BAPETEN's documentation of an earlier public information meeting in May 2024. The two records establish that communication activities had occurred while concerns about the information available

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to residents persisted. During a November 2025 meeting with the provincial legislature, the project proponent also acknowledged the need for more extensive and transparent public communication (Antara News, 2025).The available sources do not provide enough detail to determine which information residents received, whether their specific questions were addressed, or how their responses were subsequently incorporated into project decisions.

Wolsink, (2018) distinguishes public acceptance from the broader processes through which communities, institutions, and other actors negotiate changes to energy systems. This distinction is useful for interpreting the Indonesian evidence without treating survey responses and local opposition as equivalent measurements. Provincial surveys describe attitudes within their respective samples, whereas the Batu Beriga documents record concerns raised by identifiable community groups in relation to a particular proposed location. Neither source establishes the level of consent among all residents potentially affected by the project. The available evidence instead identifies several issues requiring attention in site-specific decision-making: access to reliable information, protection of fishing livelihoods, concerns about environmental impacts, and opportunities to respond to proposed land and marine uses. Whether these concerns influence subsequent project decisions remains a question of institutional practice that cannot be resolved through aggregate acceptance figures alone.

3. Risk Governance, Energy Justice and Public Acceptance

Nuclear safety assessment and public acceptance involve different considerations within the same policy process. Technical evaluation provides a basis for identifying hazards and examining proposed safety measures, while the acceptability of risks also involves how their consequences are understood and valued. The risk governance framework accommodates scientific evidence and stakeholder concerns within the processes of risk appraisal and evaluation (*Introduction to the IRGC Risk Governance Framework*, 2017). Differences in risk judgments may arise from scientific uncertainty, competing interests, or disagreement over acceptable consequences, even when the parties involved have access to similar information (Renn dkk., 2018). Regulatory assessments primarily address compliance with established safety requirements, whereas community concerns may extend to livelihoods, environmental conditions, and future uses of surrounding areas. The place afforded to these concerns is partly shaped by the opportunities available for public involvement in decisions concerning nuclear development (Duvic-Paoli & Lueger, 2022). Public participation acquires significance through its relationship with formal decision-making. Legal frameworks governing nuclear activities provide different opportunities for access to information and public involvement, with considerable variation in how these principles are applied across regulatory settings (Duvic-Paoli & Lueger, 2022).

The existence of participatory procedures does not necessarily determine the extent of public influence, particularly when important aspects of a decision have already been established. Institutional constraints, predefined procedural boundaries, and changes in administrative commitments have complicated attempts to develop consent-based approaches to nuclear waste siting in the United States (Richter dkk., 2022). Similar questions arise when consultation activities are documented without a corresponding explanation of how submissions are evaluated within subsequent decisions. Public authorities must also consider several competing values, including safety, economic development, and fairness, whose relative importance may differ among those involved (Van Uffelen, 2022). Beyond the opportunity to express concerns, participation is influenced by

which perspectives institutions recognize as relevant to the decision. Recognition justice addresses how affected actors and their interests are understood within energy governance.

The inclusion of communities in participatory activities is not necessarily equivalent to recognition, particularly when their experiences and circumstances receive limited consideration in the assessment of competing interests (Duvic-Paoli & Lueger, 2022). Knowledge of fishing grounds, seasonal activities, and dependence on coastal resources may contribute to understanding the socioeconomic consequences of proposed infrastructure, although such knowledge serves a different purpose from technical evidence concerning reactor safety. The relationship between institutional expertise and locally situated experience also raises questions of epistemic justice, including how certain forms of knowledge acquire authority within decision-making processes (Valkenburg, 2025). Differences in evidentiary weight remain relevant, since public concerns and scientific assessments need not be treated as interchangeable. Recognition instead concerns whether the perspectives of affected groups receive consideration appropriate to the issues being assessed, including circumstances in which disagreements cannot be resolved through technical findings alone. For communities whose livelihoods depend on surrounding environments, the consequences of development also involve how access to resources and economic opportunities may be distributed.

The distribution of benefits and burdens introduces geographical and temporal dimensions into nuclear energy governance. Electricity generation may serve a broader energy system, while changes in land use, environmental monitoring, and possible restrictions on surrounding activities concern particular locations. Uneven exposure to the costs and opportunities associated with energy development has been widely discussed in the literature on energy transitions (Carley & Konisky, 2020). Judgments about distributive justice require attention to the affected groups, geographical scale, and period over which consequences are considered (Van Uffelen dkk., 2024). Nuclear waste management extends these considerations beyond the operating life of a facility because responsibilities for storage, monitoring, and long-term protection may continue across generations. Disagreements concerning expertise, public involvement, and institutional responsibility have also been identified in research on nuclear waste governance in the United Kingdom (Towers & Cotton, 2025). Determining how such responsibilities should be shared involves judgments about whose interests deserve priority, particularly when present energy needs are considered alongside obligations extending into the future.

These judgments may differ even where the technical characteristics of an energy project are relatively well understood. Disagreements over infrastructure development can involve competing conceptions of justice rather than merely differences in access to scientific information (Van Der Wel dkk., 2024). Communities and public authorities may attach different importance to economic opportunities, environmental protection, territorial interests, or the distribution of possible consequences. Such differences become more difficult to reconcile when several public values must be considered within the same decision (Van Der Wel dkk., 2024). Additional technical information can clarify the nature of particular hazards, although it may leave disagreements over acceptable land use or competing development priorities unresolved. Risk communication therefore operates within a broader institutional relationship in which information, responsibility, and the credibility of those involved may influence how decisions are received. Public confidence in the institutions responsible for nuclear development deserves attention alongside the substantive concerns expressed about the projects themselves. Institutional trust has a more complex relationship with public acceptance than a simple reduction in perceived risk. Evidence from Indonesia, Malaysia, and Singapore indicates that

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trust in nuclear-related institutions is associated with perceived benefits, while greater trust in scientists may also accompany stronger recognition of nuclear risks (Ho dkk., 2025).

Confidence in institutional competence can coexist with concern about possible hazards, just as recognition of technological benefits does not necessarily establish agreement with a proposed location. Public attitudes also develop in relation to the institutions responsible for producing information and managing the consequences of policy decisions. The distinction between trust and acceptance is especially relevant when evaluating survey findings, since measures of institutional credibility, perceived benefits, and support for nuclear development do not necessarily capture the same attitudes. Without individual-level survey data, the strength or direction of these relationships cannot be independently assessed in the present study. Aggregate acceptance figures and documentary evidence of institutional arrangements consequently provide different kinds of information about the social and regulatory dimensions of nuclear policy. Risk governance and energy justice can be brought together through the institutional treatment of risks and affected interests. The former concerns how technical assessments, stakeholder concerns, and policy judgments are incorporated into risk-related decisions(*Introduction to the IRGC Risk Governance Framework*, 2017), while the latter provides a basis for examining recognition, participation, and the distribution of consequences.

Their relationship does not require public acceptance to be treated as a direct measure of regulatory effectiveness. Judgments about justice involve different normative principles and may vary according to whose interests, knowledge, and temporal circumstances are considered (Van Uffelen dkk., 2024). The documents and secondary studies examined here contain information on institutional responsibilities, consultation activities, and public concerns, although they offer a more limited account of how those concerns influence specific licensing decisions. Tracing that relationship requires attention to the reasons recorded by decision-makers, particularly where community submissions intersect with technical assessments and competing public interests (Richter dkk., 2022; Van Der Wel dkk., 2024)

Conclusion

This study concludes that Indonesia's nuclear power development framework provides a formal basis for risk assessment, regulatory oversight, and site evaluation, but the relationship between institutional risk governance and public acceptance requires further examination. Viewed through the perspectives of risk governance and energy justice, the findings highlight the need to distinguish regulatory compliance from meaningful public participation and the equitable treatment of affected communities. Public support for nuclear energy does not necessarily constitute consent to a specific project, particularly when local livelihoods, environmental conditions, and resource allocation are at stake. Although existing regulations provide mechanisms for consultation and public engagement, the available documentary and secondary survey evidence is insufficient to establish whether these mechanisms meaningfully influence licensing decisions. The study therefore contributes an analytical framework for examining regulatory accountability and public acceptance as related but distinct dimensions of nuclear power governance, emphasizing that institutional legitimacy depends not only on technical compliance but also on transparent decision-making and meaningful consideration of community interests.

Future research should employ comparative case studies, stakeholder interviews, and empirical surveys to assess how public participation mechanisms operate in practice and whether community

concerns influence site evaluation, licensing, and environmental decision-making. For practitioners, regulatory authorities should strengthen transparency, communicate technical risks in accessible language, and establish clear procedures for incorporating community concerns into project assessments and regulatory decisions. At the policy level, the government should ensure that nuclear energy regulations provide clear requirements for public consultation, disclosure of environmental and safety information, and accountability for responding to community input. These measures should be integrated with existing safety oversight, radioactive waste management, and environmental protection frameworks. By connecting technical risk governance with procedural fairness and community participation, Indonesia can develop a more accountable and socially responsive institutional framework for nuclear power development without assuming that regulatory compliance alone guarantees public acceptance.

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