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Kaleidoscope Model of Lampung's Renewable Energy Transition Policy: An Evidence-Based Reform Pathway to Regional Energy Independence

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Abstract: Mainstream frameworks—such as the policy cycle, the Multi-Level Perspective (MLP), the Advocacy Coalition Framework (ACF), and Technological Innovation Systems—help interpret energy transitions but often stop at theoretical narratives and remain insufficiently operational at the subnational level. This article adapts the Kaleidoscope Model (KM) (16 variables across agenda setting, design, adoption, implementation, and evaluation) into a quantified diagnosis-to-action framework directly linked to evidence-based policy (EBP) recommendations. The Lampung case study integrates thematic analysis, social network analysis (SNA), and regression to map leverage variables such as actor support, data readiness, cross-sector coordination, and elite attention. Variable scores reveal a dependence on external momentum—regulations and crises—paired with still-fragile internal capacity. Integrating the KM with EBP yields an operational policy package: the establishment of a regional energy-transition coordination body, an integrated energy data system, and performance-based fiscal incentives. The study's main contributions are fourfold: first, operationalizing variables into measurable indicators; second, linking diagnosis to action pathways through institutional design and a policy mix; third, prioritizing interventions with quantitative evidence via SNA and regression; and fourth, enabling iterative policy recalibration. These findings provide a contextual, adaptive, and accountable roadmap for new and renewable energy (NRE) reform for regional governments.

Keywords: Renewable energy transition; Kaleidoscope Model; Evidence-based policy; Energy independence

1 Introduction

The integration of the Kaleidoscope Model (KM) and evidence-based policy (EBP) paves the way for more adaptive, democratic, and sustainable energy policy reform in Lampung Province . The transition to new and renewable energy is an inevitable choice to address the global energy crisis, climate change, and over-reliance on fossil fuels. In Indonesia, energy transition policy is an integral part of the sustainable development agenda and strengthening national resilience. Through Presidential Regulation No. 112 of 2022, Indonesia targets a renewable energy mix of 23% by 2025 [1]. This target requires accelerated policy reforms, both at the national and regional levels. As is known, Lampung Province is a strategic region because it has diverse renewable energy potential, such as geothermal, solar, microhydro, biomass, and wind energy. Unfortunately, this potential has not been optimally utilized.

Despite the substantial potential for new and renewable energy, the energy transition in Lampung faces various structural obstacles. First, weak cross-sectoral coordination has created fragmentation in policy implementation. Second, policy stagnation and low attention from political elites have hampered the consolidation of clean energy programs. Third, minimal private investment and limited fiscal schemes exacerbate the gap between planning and implementation. Fourth, weak data capacity and energy information systems make policy formulation tend to be normative and less evidence-based. As a result, renewable energy transition policies remain partial, sectoral, and less adaptive to local dynamics.

Recent literature emphasizes that the success of the energy transition is determined not only by technical aspects, but also by institutional, political, and social factors. Grimpe and Sofka [2] argued that socio-technical transitions require consistent and synergistic policy interventions, while Timm and Deal [3] emphasized the role of local socio-political contexts in determining the direction of energy change. Meadowcroft further states that the politics of energy transition is a complex arena involving a tug-of-war between state, private, and civil society interests [4]. In the Lampung context, this dynamic is evident in the fragmentation of regional energy policy networks revealed through social network analysis (SNA), where there is no single coordinating authority leading the transition process. To address this complexity, this study adopts the KM as an analytical framework for policy reform. This model was developed by Resnick et al. to understand policy change in developing countries, emphasizing 16 key variables across five stages of the policy cycle: agenda setting, design, adoption, implementation, and evaluation/reform [5]. The strength of this model lies in its ability to emphasize contextual factors, the role of actors, the distribution of power, and the importance of windows of opportunity in driving change. In this study, the KM is combined with an EBP approach to identify weaknesses in regional energy policies and formulate evidence-based, participatory, and adaptive reform strategies [5].

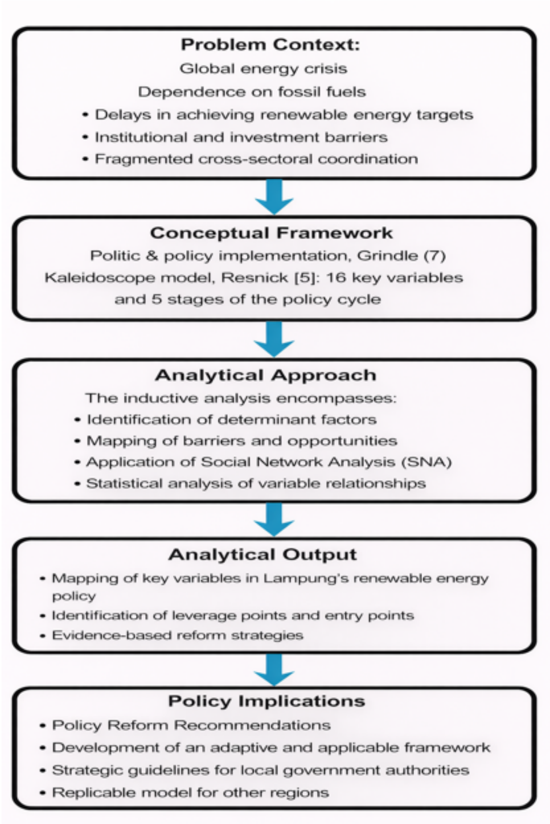

Figure 1. Problem solving approach

Initial findings indicate that renewable energy policy in Lampung remains in a low institutionalization phase, with key variables such as elite attention, advocacy support, cross-sector coordination, and mandatory evaluation lacking. The policy agenda remains dominated by fiscal logic rather than the urgency of the energy transition, while political support remains limited. This underscores the need for more systematic and collaborative policy reforms. Without institutional strengthening, increased data capacity, and attractive incentive schemes, Lampung risks falling behind in achieving its national energy transition targets [1]. Referring to the outlined policy gaps, this study formulates three key questions: (1) to what extent is the KM (16 variables) effective in identifying the determinants of renewable energy policy in Lampung; (2) which variables at the agenda, design, adoption, implementation, and evaluation stages are the levers for accelerating reform; and (3) how are these findings translated into action routes for local governments and multi-stakeholder partners. Accordingly, three objectives are summarized as follows: (a) developing a measurable Kaleidoscope-based diagnostic-action framework; (b) assessing the relationships between variables (including Data×Support interactions) using surveys, SNA, and regression; and (c) formulating an operational policy reform package (institutional design, data architecture, and fiscal incentives). Figure 1 maps the conceptual flow from contextual drivers to the Kaleidoscope diagnostic, the integration of SNA and regression (with interaction tests), and the outputs in the form of policy design quality and policy mix recommendations. The following Methods section translates the components in Figure 1 into replicable indicators, data sources, and analysis procedures.

2 Literature Review

2.1 The Complexity of the Energy Transition and the Importance of Conceptual Integration

The transition to new and renewable energy is a multidimensional process involving technical, institutional, social, and political changes. Grimpe and Sofka [2] emphasized that the energy transition is socio-technical in nature, requiring cross-actor and cross-sector engagement. In the Indonesian context, energy transition policies are often hampered by the dualism between fossil-based economic development interests and environmental sustainability agendas [3]. These obstacles are not only technical but also rooted in institutional structures, policy fragmentation, and weak coordination between actors at the national and regional levels. As a cross-country comparison, a recent review of renewable energy policies reveals variations in instrument design and policy lessons relevant to regional contexts such as Lampung [6]. The complexity of the energy transition becomes even more apparent when regional policies must balance national targets with local conditions. Meadowcroft demonstrates that the politics of the energy transition are not merely technical issues, but rather an arena for contestation over power, interests, and legitimacy [4]. In Lampung, this situation is reflected in the weak consolidation among Regional Apparatus Organizations (OPD) and the lack of coordination with the private sector and civil society.

Therefore, a conceptual approach is needed that can integrate technical and non-technical factors. One such approach is the KM, which emphasizes the importance of the interaction of policy variables in a non-linear cycle, taking into account the political context, distribution of power, and institutional capacity [5]. This approach also aligns closely with the demands of EBP, which places data and evidence at the heart of policy formulation.

2.2 Evolution and Applications of the KM

The KM was developed by Resnick et al. [5] as a framework for understanding policy reform in developing countries, particularly in the area of food security and nutrition. The model identifies 16 key variables influencing the policy change process, grouped into five phases: agenda setting, policy design, adoption, implementation, and evaluation/reform.

The KM's primary strength is its ability to explain policy change in a non-linear context. This means that policy reforms do not always follow a logical sequence but can be triggered by opportunities such as crises, external pressures, or political pressure from elites. Furthermore , the model highlights the role of actors, donor support, and institutional capacity as key determinants of reform success.

In the energy context, Timm and Deal [3] emphasized that transitions can only be effective if policies are designed adaptively, evidence-based, and supported by a strong advocacy coalition. Consequently, the KM can be seen as a relevant framework for analyzing the weaknesses of renewable energy policies in Lampung. This is evident when scores for variables such as "elite attention", "advocacy support", and "mandatory evaluation" were found to be low in the initial study.

Other studies have expanded the application of this model to the sustainability sector. For example, Tresiana and Duadji highlight the importance of the policy environment in enhancing evidence-based implementation practices in the Indonesian public sector [6]. They indicate the significant potential for integrating the KM into energy issues and emphasize that policy reform requires an adaptive policy mix that combines regulatory, fiscal, and institutional instruments. As a comparative summary, Table 1 summarizes the differences between Policy Cycle, Multi-Level Perspective, Advocacy Coalition Framework, and Technological Innovation Systems compared to the operational innovation of the KM.

2.3 EBP in Energy Transition

EBP is a crucial approach to modern policy reform. According to Head, EBP combines scientific evidence, empirical data, and policy experience to support rational decision-making [7]. In the energy transition , the availability of technical data, economic analysis, and environmental projections is a crucial prerequisite Strengthening EBP also aligns with national policy findings that link energy security and environmental protection as measurable policy outcomes. However, as Sovacool points out, energy policies in developing countries often lack robust data ecosystems, leading to decisions based primarily on short-term political or fiscal considerations [3].

In the Lampung context, limited renewable energy data is a major obstacle. A study by the Energy and Mineral Resources Agency (ESDM) showed that despite the significant potential of geothermal, solar, and biomass energy, there is no integrated database on technical capacity, investment maps, and community social readiness [8]. Consequently, regional policies tend to be normative and lack evidence-based legitimacy.

The EBP makes three important contributions to the energy transition. First, it ensures that policy designs are supported by realistic projections and simulations. Second, it increases political legitimacy by strengthening policy arguments with data. Third, it improves policy evaluation with measurable performance indicators. Without the

EBP, energy transition policies risk stagnating, as evidenced by the low realization of the clean energy budget in Lampung, which is estimated to reach only 30.73% by 2025.

Table 1. Comparison of policy frameworks for RE transition and Kaleidoscope Model innovation [2–5]

Framework	**Unit of Analysis and Focus**	**Main Power**	**Limitations at the Regional Level (Indonesia)**	**Operationalization Status (Indicators / Scores)**	**What Kaleidoscope Adds**
Policy Cycle	Policy stages (agenda - formulation - adoption - implementation - evaluation)	Simple; easy to teach; provides a process flow	Descriptive; lacks guidance on intervention priorities; does not assess the readiness of key variables in a measurable manner	Low - there are rarely standard indicators per stage	Converting stages into measurable diagnoses (scored 0 - 5) and linking them to specific routes of action
Multi-Level Perspective	Niche - regime - landscape level; sociotechnical dynamics	Explaining the co-evolution of technology, markets, and institutions	Abstract for local government; difficult to translate into concrete institutional design and incentives	Moderate - qualitative proxies exist, quantification is limited	'Downsizing' the abstraction to a matrix of cross-stage variables that guide institutional/incentive design
Advocacy Coalition Framework	Advocacy coalition, belief systems, policy learning	Powerful for mapping actors/coalitions and learning processes	Lack of action priorities and implementation readiness indicators	Low - Medium - network mapped, but without readiness scoring	Combining actor mapping (SNA) with variable scoring so that coalition → intervention choice
Technological Innovation System	Functions of the innovation system (entrepreneurial activity, knowledge diffusion, market formation, etc.)	Reading the barriers to technological innovation function	Lack of specificity regarding regional institutional design and the relationship between data and fiscal incentives	Medium - some functions can be proxied; still partial	Linking functions to operational policy packages (regulation - incentives - data - coordination) based on scores
Kaleidoscope Model (in this study)	16 cross-stage variables (agenda - design - adoption - implementation - evaluation)	Measurable diagnosis; priority order; defined route of action; iterative	—	High - each variable is scored (0 - 5) and prioritized via SNA/regression	Offering a diagnostic → action framework: from variable scores to institutional design, data systems, and incentives

This finding aligns with Meadowcroft, who stated that energy transition failures are often driven by weak sectoral integration and a lack of adaptive coordination mechanisms [4]. From the perspective of the KM, this weak coordination is reflected in low scores for the variables "cross-sectoral coordination" and "implementation capacity" [5].

To strengthen institutions, a dedicated coordination unit, such as the Regional Energy Transition Coordination Agency (BKET), should be established to serve as a cross-sector integration hub [9]. This body could align the roles of local government agencies, the private sector, academia, and civil society within the energy transition framework. A similar approach has proven effective in other sectors, such as community-based tourism governance in West Tulang Bawang, which emphasizes multi-stakeholder participation and local institutions.

2.4 Policy Mix for Energy Policy Reform

The concept of a policy mix is used in the literature on sustainable development. A policy mix is necessary to address complex, cross-sectoral issues [10]. In the energy context, the policy mix can include regulations, fiscal incentives, institutional strengthening, and information instruments [11]. Lampung requires a policy mix that is not only normative but also adaptive to the local context [12]. For example, fiscal incentives such as tax exemptions and interest subsidies can attract private investment in the clean energy sector. Furthermore, regional regulations need to be integrated into the Regional Medium-Term Development Plan (RPJMD) and cross-sectoral strategic plans to maintain policy consistency. Within the KM framework, such interventions would improve the scores of the "political incentives" and "political opportunities" variables, which are currently low. To summarize the key variables from previous studies and their mapping to the 16 Kaleidoscope variables, see Table 2.

Table 2. Variable synthesis matrix: Previous research vs. 16 variables of the Kaleidoscope Model

Variable Cluster	Key Variables (Kaleidoscope 16)	How It Appears in Previous Literature	Measurement Method/Indicator (Examples)	Implications of Policy Action (Examples)
Capacity & Data	Data readiness; Monitoring–Evaluation; Evidence use	Often referred to as 'lack of data' or 'weak M&E', but rarely quantified	Existence of dashboard; update frequency; completeness of metadata; data quality score (0–5)	Build an integrated energy data system; update SOPs; standardize performance indicators
Coordination & Institutions	Cross-sector coordination; Lead agency clarity; Role clarity	Many studies highlight inter-departmental silos; solutions remain common	Cross-OPD coordination index; clarity of mandate (document); density of SNA relationships	Establishment of a Regional Energy Transition Coordination Agency; alignment of mandates and MoUs across regional government agencies
Political & Public Support	Elite attention; Stakeholder support; Public communication	Elevated as a key factor, but without relative prioritization	Elite attention score (document/agenda analysis); support survey; public campaign intensity	Evidence-based communication program; integration of renewable energy targets in the RPJMD/Renstra
Economic Instruments & Regulation	Fiscal incentives; Regulatory alignment; Market signals	Discussed separately (regulation vs incentives), rarely as a 'policy mix' package	Map of regulatory overlap; existence/size of incentives; market response indicators	Design a phased fiscal incentive package; harmonize regulations; pilot market creation
Technology & Infrastructure	Technology readiness; Grid readiness; Project pipeline	Often appears as a purely technical issue, less linked to governance	Technology/grid readiness index; number of project pipelines; licensing process time	Accelerated licensing scheme; interoperability standards; technology trial support

Sources: Several relevant references and previous studies, 2025

Furthermore, institutional learning needs to be strengthened through a mandatory evaluation system. Currently, the evaluation variable is the weakest point in Lampung's renewable energy policy, with the lowest score (1-2). Without a feedback mechanism, the policy risks stagnating. Results-based evaluation can ensure that policies are not merely normative documents but actually produce real impact.

Referring to the literature review, there are three main findings relevant to this study. First, the energy transition is a complex socio-technical process that requires cross-sector and cross-actor integration. Second, the KM is a relevant conceptual framework for analyzing the weaknesses and opportunities of renewable energy policy reform. Third, an EBP approach and an adaptive policy mix can strengthen regional capacity to achieve a more systemic, participatory, and sustainable energy transition.

By integrating findings on data readiness, multi-stakeholder support/coordination, and political attention and incentives, this study positions the KM not only as a diagnostic tool, but also as a strategic framework for EBP reform in Lampung Province. Next, in the methods section, 16 Kaleidoscope variables are mapped to measurable indicators and data sources to measurable indicators, detailing the data sources (surveys, interviews/documents, and actor network mapping), and explaining the analysis design (thematic analysis, SNA, and regression—including data interactions and support so that relationships between variables can be tested in a transparent, replicable, and policy-relevant manner.

3 Method

3.1 Problem Solving Approach

Building on the synthesis of the literature review, we reduced the 16 variables of the KM into a set of operational indicators (see Table 1 and Appendix) measured on a 1–5 Likert scale for stakeholder surveys, calibrated by thematic analysis of interviews/documents, and mapped in SNA to assess actor support and coordination. Data readiness was estimated through a completeness/integration index of sectoral data; multistakeholder support/coordination through measures of centrality and perceived collaboration; and political attention/incentives through indicators of perception, policy footprint, and budget allocation. Causal-deductive relationships were then tested using OLS regression (including Data × Support interactions), while quantitative findings were triangulated with qualitative evidence and network maps to ensure theoretical coherence, construct validity, and policy effectiveness.

This study focuses on policy changes in the transition to new and renewable energy in developing countries. The aim is to identify factors influencing the effectiveness of policy implementation, resource distribution and allocation, and energy service delivery mechanisms. Policy changes, in this study, are understood not only as normative formulations but also in the context of their implementation, which can be measured through administrative indicators, the amount of public spending, and the quality of energy service provision to the public.

To analyze its complexity, this study integrates two analytical frameworks: political approach and policy implementation and the KM [5]. This approach emphasizes the importance of politics, institutions, and bureaucratic capacity in determining the success of policy implementation, while the KM provides a more detailed analytical tool through 16 key variables spread across five stages of the policy cycle: agenda setting, design, adoption, implementation, and evaluation/reform.

The analysis is carried out inductively to:Identifying opportunities and barriers to energy policy reform at the national and regional levels; explore the determinants that shape the decision-making dynamics of policy actors; and develop more effective, adaptive, and EBP implementation strategies that take into account the local socio-political context.

With this approach, research not only aims to understand the process of policy change but also facilitate sustainable energy policy reform in diverse and complex environments, such as in Lampung Province.

Figure 1 shows several things. First, agenda setting, which is the stage of determining the issues to be discussed by policymakers, including elite attention, external crises, and advocacy support. Second, policy design, which is the stage of formulating solutions or policy designs, including solution fit, stakeholder support, and data availability. Third, adoption, which is the stage of formal policy ratification, including leadership influence, political incentives, and political opportunities. Fourth, implementation is the stage of policy implementation in the field, which is determined by cross-sector coordination , implementation capacity, and financial resources. Fifth, evaluation/reform is the stage of policy assessment and adjustment, which includes mandatory evaluation, accountability pressures, changes in key actors, and policy learning.

3.2 Research Design

The transition to renewable energy is a complex, multidimensional, and cross-sectoral phenomenon. Therefore, an exploratory case study design with mixed methods was chosen. This allows for the simultaneous integration of qualitative and quantitative data to obtain a comprehensive picture of the dynamics of energy policy in Lampung Province. Conceptually, this study combines the KM as a policy variable mapping instrument with EBP principles to ensure empirical data-driven analysis, resulting in more valid, adaptive, applicable, and contextual policy recommendations.

The mixed-methods design in this study is Convergent Parallel: qualitative data (interviews / observations / documents) and quantitative data (16-variable survey, SNA, and regression) are collected simultaneously, analyzed separately, and then integrated through a joint display and composite score. The integration weighting is determined by KUANT. namely quantitative data = 0.60 and QUAL = 0.40 with 0-1 normalization; variable composite score = 0.60 QUANT + 0.40 QUAL to rank intervention priorities. Validation was carried out in layers: survey reliability (Cronbach's $\alpha > 0.70$), qualitative reliability with two independent coders (Cohen's $\kappa \geq 0.75$) and codebook-based reconciliation, method and source triangulation (survey–interview–document) with discrepancy resolution rules (e.g., high QUANT but weak QUAL $\rightarrow$ "needs field verification"), weight sensitivity tests (0.50/0.50 and 0.70/0.30) that do not change the order of the top five variables, SNA robustness through edge deletion stress-test ± 10% (central node ranking is stable), and regression diagnostics (VIF < 5 and residual normality test) to ensure transparent and replicable QUANT–QUAL integration. QUAL = qualitative data (e.g., interview results, observations, and document reviews that are thematically coded).

External validity relies on analytical generalization through pattern matching to other provincial contexts. We added comparative plausibility probes (brief desk reviews) in two reference provinces (e.g., Central Java, Bali) using comparable secondary indicators: (a) the existence/mandate of a transition coordination body; (b) the readiness of the energy data system (dashboard/metadata); (c) the regulatory instrument-incentive map; and (d) the footprint of stakeholder participation in planning documents. The probe results were not used for statistical inference, but rather to test the transferability of the patterns and clarify the limits of the model's generalizability.

3.3 Research Location and Subjects

Lampung Province was deliberately chosen as the research location. There were three main considerations. First, Lampung has high technical potential, meaning it has geothermal capacity of up to 898 MW, solar power potential through floating solar power plants, and wind energy potential on the west coast. Second, there are significant institutional barriers—fragmented coordination among local government agencies, low private investment, and weak cross-sector policy integration. Third, the urgency of policy reform—the delay in achieving the 23% energy mix target by 2025 requires EBP reform. Fourth, the research informant network included officials from the Energy and Mineral Resources Agency, the Regional Development Planning Agency, the Regional People's Representative Council, the Environmental Agency, private sector representatives, academics, and civil society.

3.4 Data Collection Techniques

Data collection was conducted through: (a) In-depth interviews with 20 key informants (local government, legislative, private sector, academics, NGOs); (b) Document analysis (RPJMD, ESDM Strategic Plan, APBD reports, RDP presentations, and national energy policy documents); (c) Participatory observation in regional energy coordination forums to observe interactions between actors and decision-making dynamics; and (d) Quantitative surveys of 100 stakeholder respondents, using a Likert scale of 1–5 to measure perceptions of the 16 variables in the KM.

The survey (n=100) used stratified purposive sampling across stakeholders: local government/technical OPD, legislative (DPRD), private sector, academics, and NGOs/communities. Each respondent rated 16 KM variables on a 0-5 Likert scale with operational anchors per variable (e.g., 0 = none/not working; 3 = partially/inconsistently working; 5 = established/institutionalized), accompanied by examples of practical indicators (availability of dashboards/data, formal coordination mandate, existence of fiscal incentives, etc.). We attach a scoring guide (item wording, anchor definitions, and example indicators) to ensure uniform understanding among respondents.

3.5 Data Analysis Techniques

3.5.1 Qualitative thematic analysis

Qualitative data from in-depth interviews, policy observations, minutes of regional energy coordination meetings, and planning and regulatory documents were analyzed using a thematic analysis approach. The process included: (1) verbatim transcription; (2) open coding by two researchers independently to identify issues, barriers, opportunities, and decision-making dynamics; (3) axial coding to group codes into themes such as "cross-sector coordination," "political legitimacy," "funding constraints," and "policy leadership"; and (4) selective coding to link these themes to the dimensions in the KM (agenda setting, policy design, adoption, implementation, and evaluation/reform). Inter-coder consistency was tested through consensus discussions until a stable thematic agreement was reached. The results of this thematic analysis were then used to interpret the political, institutional, and administrative context in Lampung Province.

3.5.2 SNA

SNA was used to map the relationship structure between key actors in the new and renewable energy (EBT) transition policy in Lampung Province. Network data were obtained from: (a) a stakeholder survey (n = 100) asking which actors they coordinate, consult, or seek approval from on energy transition issues; (b) cross-verification through in-depth interviews with local government officials, local legislators, energy/private sector actors, universities, and civil society organizations; and (c) a review of coordination meeting documents, regional energy forums, and public hearing minutes (RDP).

The network is then modeled as an undirected graph of inter-actor policy collaboration, where each node represents an institution (e.g., Bappeda, ESDM Agency, Provincial DPRD, BUMD, private energy actors, universities, NGOs), and each edge represents a reported policy coordination or consultation relationship. Two primary centrality metrics are calculated using Gephi:

•Degree centrality, to measure how many direct connections an actor has;

•Betweenness centrality, to measure the extent to which an actor functions as a liaison (broker) between different groups.

The analysis outputs are: (1) a centrality table for each main actor, and (2) a network visualization showing the center of gravity of policy coordination at the regional level. The numerical results and SNA network visualization are only reported in the Results section (Chapter 4) without repeating this methodological description.

3.5.3 Statistical analysis (linear regression)

Quantitative analysis was conducted using simple linear regression (Ordinary Least Squares) using Likert scale survey data (0–5). The main independent variables were: (i) availability of reliable data and technical information; (ii) cross-actor stakeholder support for the energy transition agenda; (iii) cross-sector coordination; and (iv) attention from regional political elites. The dependent variable was the quality of regional energy transition policy design as perceived by respondents (clarity of policy objectives, consistency of instruments, and readiness for implementation).

Estimates of the β coefficient, p-value, and R^2 were used to assess the significance of each variable's contribution to the quality of policy design. Multicollinearity testing was performed by examining the Variance Inflation Factor (VIF) and was below the conservative limit of 5. Residual normality and homoscedasticity were also checked to maintain model validity. The regression results, including coefficient values, are presented in Chapter 4 (Results section), while their strategic implications are further discussed in Chapter 5 (Discussion).

3.6 Research Stages for the Transition to Renewable Energy in Lampung Province

The KM serves as a conceptual framework for comprehensively understanding the dynamics of policy change, which means that policy change is not something linear, but rather influenced by various factors that emerge at each stage of the policy cycle (Figure 2).

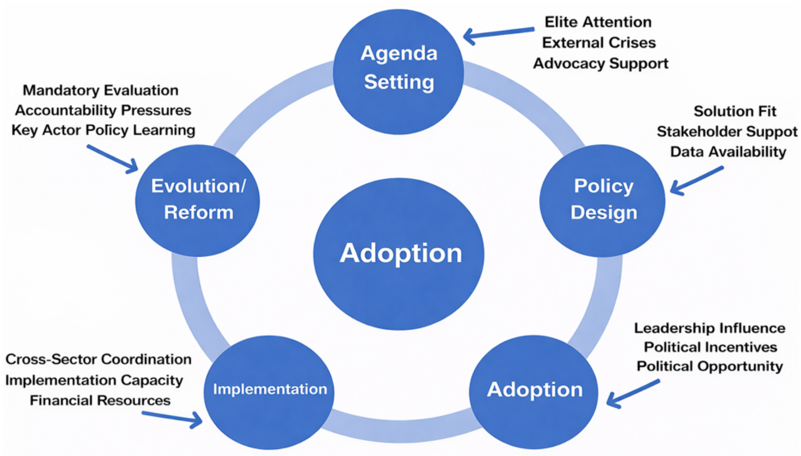

Figure 2. Kaleidoscope Model [5]

Table 3. Kaleidoscope Model: Policy cycle and content dimension

No.	Cycle	Content Dimensions (Factors that Play a Role)
1	Agenda setting: This initial stage determines the issues that will be prioritized by policymakers.	- Elite attention, namely the extent to which political and bureaucratic elites pay attention to an issue. - External crises, which are pressing events such as disasters, conflicts, or global pressures that bring problems to the surface. - Advocacy support from civil society groups, NGOs, or the media that strengthens the legitimacy of the issue.
2	Policy design: Once the issue is deemed important, the next step is to design a policy solution.	- The solution is according to the problem faced. - Stakeholder support that strengthens policy acceptance. - Availability of data that forms the basis of evidence-based policies.
3	Adoption: The formal policy approval stage involves a political process. Determining factors include:	- The influence of leadership in directing and promoting policy. - Political incentives for actors to support policies. - Political opportunities that open up space for legitimacy and consensus.
4	Implementation: The policy implementation stage in the field is crucial because it determines whether goals are achieved.	- Cross-sector coordination so that implementation is not fragmented. - Implementation capacity in the form of human resources, technology, and institutions. - Adequate financial resources to support policies.
5	Evaluation / Reform: This cycle concludes with policy evaluation and reform. This stage is crucial to ensuring policy sustainability through:	- Mandatory evaluation, which is required by regulations. - Accountability pressure from the public and regulatory bodies. - Changes in key actors can alter the direction of policy. - Policy learning that enables future improvements.

Table 4. Mapping of the new and renewable energy transition cycle and research activities using the Kaleidoscope Model

No.	Policy Cycle	Research Activities
1	Agenda setting: Identifying priority issues in Lampung	- Return to the Regional Energy General Plan (RUED) of Lampung Province and regional energy mix targets. - Interview local elites (Governor, DPRD, Energy and Mineral Resources Agency, Bappeda) to assess elite attention to renewable energy issues. - Analysis: e.g., the impact of the electricity crisis, rising fuel prices, and pressure from the central government to implement the energy transition. - Identify advocacy support from local NGOs, regional media, and green energy communities (e.g., rooftop solar communities, environmental NGOs in Lampung).
2	Policy design: Formulating local policy solutions	1. Analyze the suitability of the solution by evaluating local renewable energy potential: Biomass (bagasse in Central Lampung & Way Kanan); Solar power (rural areas, small islands like the West Coast); Microhydro (West Lampung & Tanggamus); Bioenergy from palm oil and corn 2. Conduct stakeholder mapping at the provincial level: ESDM, Environmental Service, PLN UID Lampung, private sector, universities (Unila, ITERA), local communities. 3. Field data collection: technology availability, potential electricity capacity, funding access, and community readiness.
3	Adoption: Ratification and legitimation of renewable energy policy in Lampung	- Study the role of regional leadership (Governor, Regent, DPRD) in promoting green energy programs. - Analyze political incentives: central government opportunities (environmental-based Regional Incentive Fund, ESDM programs, PLN). - Identify policy windows during political moments: new RPJMD, leadership changes, energy crises that open policy adoption opportunities.
4	Implementation: Policy implementation in Lampung	- Assess cross-sector coordination: OPDs (ESDM, Bappeda, Agriculture, DLH), PLN, private sector, village communities. - Analyze implementation capacity: PLN UID Lampung's technical ability to integrate renewable energy; Regional human resource capacity (technicians, energy extension workers); Supporting infrastructure (e.g., biomass plants, solar panels) - Review financial resources: APBD for EBT programs; Private investment & CSR; Potential for green bonds or carbon trading - Survey pilot villages (e.g., solar in Pesisir Barat, microhydro in Tanggamus) to assess implementation effectiveness.
5	Evaluation/Reform: Assessment and policy sdjustment in Lampung	- Design local evaluation framework based on: Lampung's 2025 energy mix target; GHG emissions reduction; Rural electricity access - Assess accountability pressures: reports to ESDM Ministry, DPRD oversight, civil society. - Analyze changes in key actors: regional head replacements, OPD rotations that impact policy consistency. - Policy learning: compare Lampung with more advanced provinces (e.g., Central Java, Bali) for recommendations.

Kaleidoscope emphasizes that the success of policy change is not only determined by the formulation of ideas, but also by the interaction between leadership, political context, implementation capacity, and ongoing evaluation mechanisms, as detailed in Table 3.

If the KM is applied as the basis for analysis of renewable energy research in Lampung Province, the steps are reflected in the research activities as shown in Table 4.

Therefore, it can be explained that there are 16 variables in the KM as the basis for research to assess renewable energy policies in Lampung. Each variable is given a score of 0–5 based on survey and interview results, then visualized in tables and graphs.

3.7 Validity and Reliability

To maintain validity, this study used method triangulation (interviews, documents, surveys) and source triangulation (government, private sector, academia, civil society). The reliability of the survey instrument was tested using Cronbach's Alpha, with results > 0.7, indicating high consistency.

This research method is not only descriptive but also analytical. The KM serves as a conceptual framework for mapping policy variables, while EBP is a normative approach to strengthen the quality of recommendations. Consequently, this study bridges energy transition theory with regional policy practice, making the results academically relevant and applicable to decision-makers.

4 Results

4.1 Renewable Energy Potential in Lampung Province

Lampung Province has significant and diverse renewable energy potential, ranging from geothermal, solar, micro-hydro, wind, and ocean energy [13]. According to data from the ESDM, the available technical capacity far exceeds current electricity needs by 2025, although much of it remains underutilized. Geothermal energy is the most promising energy source, with a potential of 898 MW in Ulubelu, Rajabasa, Way Panas, and Lake Ranau, but installed capacity is only around 220 MW (24%), reflecting classic constraints such as permitting, regulatory certainty, and community resistance in sensitive areas. Solar energy also holds significant potential, particularly through floating solar power plants in the Batutegi and Way Sekampung reservoirs and large-scale development plans in Margatiga. However, limited fiscal incentives and high module prices hinder investment growth. Microhydro has potential in the hilly areas of Tanggamus and West Lampung, suitable for rural areas not yet covered by PLN electricity, although utilization has been slow due to minimal technical and financial support. Wind power is feasible to develop on the West Coast, Tanggamus, and Pesawaran with an average speed of $>$ 190 kWh/m^2 per year, but so far, there have been no large-scale projects [14, 15]. The potential for ocean energy on the west and south coasts is also quite promising, but the technology remains expensive and has not been a priority for regional policy [16]. Demonstrating the economic viability of solar-wind combinations at strategic facilities (e.g., EV charging stations) in the Indonesian context suggests technical-economic feasibility that could be replicated in Lampung [17]. Despite the significant potential, budget realization as of May 2025 was only 30.73% of the Rp19.52 billion ceiling, indicating a serious gap between strategic planning and program implementation, as well as revealing weak institutional capacity, coordination mechanisms, and political priorities for the energy transition [18]. This situation illustrates that the renewable energy transition in Lampung is taking place amidst resource constraints and policy challenges, with the energy mix still dominated by coal and fossil fuels, while the contribution of renewables remains relatively small [6, 19].

Table 5 shows that renewable energy-based power generation capacity will only reach 14.5% in 2023, up from 9.8% in 2020 and 16.2% in 2024. This increase reflects a positive trend, but remains far from the national target of 23% in 2025, although increases in rooftop solar and biomass power generation capacity demonstrate policy momentum. This is in line with several studies in the references that confirm that provinces dominated by coal-based industries tend to experience a slower energy transition. Further details can be seen in Figure 3.

Table 5. Energy mix in Lampung Province 2020–2024

Year	Fossils (%)	EBT (%)	Solar (%)	Biomass (%)	Microhydro (%)	Another (%)
2020	90.2	9.8	3.2	2.5	3.1	1.0
2021	88.6	11.4	3.9	3.1	3.5	0.9
2022	86.9	13.1	4.5	3.5	4.1	1.0
2023	85.5	14.5	5.1	3.9	4.5	1.0
2024	83.8	16.2	6.0	4.2	5.0	1.0

Source: PLN RUPTL and data from the Lampung Province ESDM Service

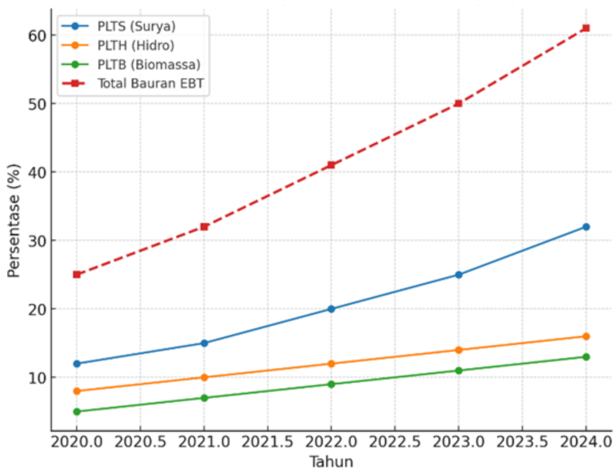

Figure 3. Renewable energy mix development trends in Lampung 2020-2024

Source: PLN RUPTL & Lampung Province ESDM Service, 2025

Although the renewable energy mix in Lampung shows improvement, its achievements remain relatively limited compared to the available potential. Figure 3 demonstrates a consistent shift toward renewable energy, but accelerating this transition still faces structural obstacles, particularly in terms of investment, infrastructure, and supporting regulations. This situation emphasizes that increasing the share of renewable energy requires not only policy commitment but also an implementation strategy that can bridge the gap between national targets and regional realization.

Furthermore, it is important to examine the renewable energy potential spread across various regions in Lampung. This potential includes not only geothermal energy, which has significant capacity, but also solar, microhydro, wind, and ocean currents, which have not been fully utilized. Table 6 provides a comprehensive overview of energy locations and capacities in Lampung Province, while also highlighting strategic opportunities to accelerate the achievement of national energy mix targets by optimizing local resources.

However, budget realization as of May 2025 had only reached 30.73% of the total budget of Rp19.52 billion (RDP OK Exparan, 2025). This indicates a gap between energy policy planning and implementation.

Table 6. Type, location, and capacity of energy in Lampung Province

Types of Energy	Potential Locations	Capacity (MW)
Geothermal	Ulubelu, Rajabasa, Way Panas, Lake Ranau	898 MW (220 MW installed)
Solar	Batutegi Floating Solar Power Plant, Way Sekampung, Margatiga	–
Microhydro	West Lampung Hills	–
Wind	West Coast, Tanggamus, Pesawaran	> 190 kWh/m^2
Ocean Currents	West, East, and South Coast	Tall (not yet utilized)

Source: Processed from data from the Lampung Province ESDM Service, 2025

4.2 Uncovering the Complexity and Key Factors of the Renewable Energy Transition in Lampung Using the KM

The energy transition in Lampung Province is not simply a technical issue, such as the construction of solar power plants, micro-hydro power plants, or the utilization of geothermal potential. It is a policy journey fraught with conflicts of interest, fraught with information asymmetries, and often stalled in bureaucratic red tape. Within this framework, the KM serves not only as an analytical tool but also as a “layered mirror” reflecting policy dynamics across 16 key variables.

By dividing the policy cycle into five stages—agenda setting, design, adoption, implementation, and evaluation / reform - KM allows researchers and policymakers to trace the causal chain of success and failure. Like a kaleidoscope that always displays different patterns depending on the perspective, this model emphasizes the dynamic, non-linear, and context-rich nature of public policy.

In this study, the Constitutional Court is used to measure the effectiveness of the renewable energy transition policy in Lampung. Effectiveness is defined as the model’s ability to uncover dominant factors, reveal hidden weaknesses, and guide evidence-based reforms.

To bridge the previous section with the description of quantitative data, it is important to emphasize that the application of the KM is not limited to a conceptual framework but also manifested in systematic measurements. Emphasizing effectiveness as the ability to uncover dominant factors, identify weaknesses, and provide evidence-based reform guidance, the next step is to ensure that each relevant variable can be measured objectively. This is why quantitative instruments are a key pillar, as they provide a basis for decision-making that is verifiable and scientifically accountable.

In this context, the use of surveys, in-depth interviews, and document reviews not only enriched the information but also enabled data triangulation, thus strengthening the analysis. The quantitative scores assigned to each Constitutional Court variable provide a clearer picture of the strengths and weaknesses of the renewable energy transition policy in Lampung. Therefore, the next stage will focus on presenting quantitative data from the 16 measured variables, which will form the basis for a deeper understanding of the dynamics of policy effectiveness.

The results of a survey of 100 respondents (local government, legislature, private sector, academics, civil society), combined with in-depth interviews and document review, provided a score of 0-5 for each Constitutional Court variable.

The assessments in Table 7 are derived from a survey of n=100 stakeholders (local government/OPD, DPRD, private sector, academics, NGOs/communities) using a 0-5 scale with operational anchors per variable. For example, “data availability”: 0 = no database; 3 = partially available and not regularly updated; 5 = integrated data system with indicators, metadata, and regular updates. “cross-sector coordination”: 0 = no mechanism; 3 = ad-hoc forum/incidental meetings; 5 = formal mandate, coordination SOP, and documented cross-OPD collaboration. Figure 4 displays a radar of these scores to briefly demonstrate the strengths-weaknesses pattern.

Table 7. Evaluation scores of 16 variables of the Kaleidoscope Model in Lampung Province

Stage	Variables	Score (0–5)	Interpretation
Agenda Setting	Elite Attention	2	Low; EBT issues are not yet a major problem
	External Crisis / Pressure	4	High; Presidential Regulation 112/2022 and energy crisis are driving the agenda
	Advocacy Support	3	Moderate; NGOs and local media are starting to become active
Design	Solution Suitability	3	Moderate; solutions exist but are partial
	Stakeholder Support	2	Low; weak cross-actor forum
	Data Availability	2	Low; EBT data is still fragmented
Adoption	Leadership Influence	3	Moderate; governor and regional representative council provide symbolic support
	Political Incentives	2	Low; minimal fiscal incentives
	Political Opportunities	2	Low; political momentum is rarely exploited
Implementation	Cross-Sector Coordination	2	Low; OPD works independently
	Implementation Capacity	3	Moderate; technical human resources exist but are limited
	Financial Resources	2	Low; budget realization ¡35%
Evaluation / Reform	Evaluation / Reform	1	Very low; formal evaluation
	Accountability Pressure	2	Low; weak pressure from local councils and communities
	Changes in Key Actors	2	Low; rotation of officials hinders consistency
	Policy Learning	3	Moderate; minor improvements based on experience

Source: Processed from survey results (n = 100), 2024-2025

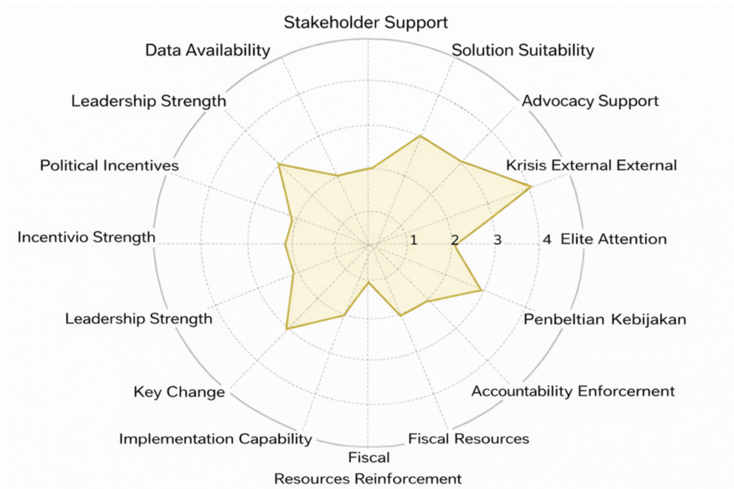

Figure 4. Radar graph of scores of 16 constitutional courts variables in Lampung

Source: Survey (n = 100) across stakeholders; processed by the author

The survey and interview results demonstrate how the dynamics of the energy transition in Lampung can be mapped more systematically using the KM approach. By assessing 16 variables across five policy stages, this analysis provides a more detailed picture of Lampung's position in managing renewable energy policies. The resulting 0–5 score is not only descriptive but also serves as an evaluative tool to identify gaps hindering the acceleration of the energy transition.

Initial findings indicate that Lampung's main strength lies in external factors, particularly national regulatory pressures and the global energy crisis, which have forced the energy transition agenda to become a policy priority. However, this reliance on external factors has not been offset by internal consolidation. Weaknesses are evident in key variables such as stakeholder support, data availability, political incentives, and cross-sector coordination. This indicates that energy policy in Lampung remains reactive and immature, lacking collaborative policy design.

Furthermore, evaluation of implementation and reform variables revealed fundamental problems in policy consistency and accountability. Low public and regional legislative pressure on energy policy oversight, coupled with the rotation of key actors within the bureaucracy, has slowed the policy learning process. Under these conditions, Lampung faces a serious challenge: how to transform external momentum into sustained internal commitment. The KM framework in Table 7 and the visualization in Figure 4 provide a clear picture of this imbalance.

Figure 4, when viewed from the 16 variables of the KM, provides a comprehensive overview of the strengths and weaknesses of new and renewable energy (NRE) transition policies in Lampung Province [5]. The asymmetric polygon shape indicates imbalance: some variables stand out strongly, while most others remain concave, indicating structural weaknesses in the policy cycle [5, 9].

At the agenda-setting stage, external crises and national regulatory pressures appear to be the factors most likely to push renewable energy issues to the forefront [1, 20, 21]. Their high scores indicate an open "policy window" due to global energy pressures and central government policies [1, 5]. However, internal factors are much weaker. Attention from regional political elites remains low, limited to rhetoric, while advocacy support from NGOs and local media has not yet developed into a solid coalition [12, 22]. In other words, the statement by Resnick et al. [5] held true in Lampung. While external crises can indeed open windows of opportunity (policy windows), without elite attention and advocacy support, policy change tends to stagnate, and the inclusion of green energy issues on the policy agenda is driven more by external pressure than by awareness emanating from within Lampung's political leadership [5]. Furthermore, It emphasizes the importance of the local socio-political context [3]. While the green narrative has strengthened (a score of 3 for advocacy support), it has not been sufficient to mobilize institutional structures. This suggests that the energy transition is not merely a technical but also a political one. The conditions in Lampung, which show weak cross-sector coordination and low political incentives, are a tug-of-war between interests that have not yet produced a consensus [14].

Entering the design phase, several technical solutions are available, such as solar, biomass, or micro-hydro power plants, which are considered suitable for the region's needs. However, data supporting the planning remains fragmented, and cross-stakeholder support is relatively weak [15]. This situation confirms that policy design in Lampung is not fully evidence-based. As Sovacool emphasized, energy transitions in developing countries often become trapped in normative design due to the lack of a robust data ecosystem [16].

The policy adoption stage also shows limitations. Leadership influence does exist, but only at a symbolic level. There are no real political incentives for elites to mainstream renewable energy, and exploitable political opportunities often disappear without follow-up [17]. This explains why green energy policies in Lampung often remain limited to discourse and are difficult to translate into concrete regulations or regional bylaws [18].

Obstacles became increasingly apparent during the implementation phase. Figure 4 demonstrates weak cross-sectoral coordination, with each regional government agency (OPD) working independently without any integrative mechanisms [19]. Technical capacity is available, but remains limited in terms of human resources and infrastructure. Financial resources are also a major constraint, as evidenced by the low budget realization, which does not even reach a third of the total allocation. This situation confirms that the energy transition in Lampung is more often hampered by weak institutional structures than technological limitations [21].

The peak of weakness is evident in the evaluation and reform phase. Mandatory evaluation scores are very low, indicating that evaluation is merely a formality and does not generate meaningful learning. Accountability pressure from the Regional Representative Council (DPRD) and the public is also weak, while turnover of key actors due to official rotation has led to inconsistent policy direction [9]. Some policy learning has occurred, but it is sporadic and lacks structured feedback mechanisms capable of correcting policy direction.

Overall, Figure 4 confirms that the energy transition in Lampung is taking place in a phase of low institutional capacity [9]. While green energy issues have become part of the policy discourse due to the external crisis and national regulatory pressures, regional institutions remain fragile [22]. Without strong elite attention, a comprehensive database, solid cross-sector coordination, clear fiscal incentives, and mandatory evaluation, renewable energy policies will remain merely strategic documents without any real driving force.

Low scores on the variables of data availability, stakeholder support, financial resources, and mandatory evaluation are not just numbers; they are truly felt by policymakers on the ground [23]. This is clearly evident from the qualitative narratives of in-depth interviews, as in the following excerpt:

ESDM Official: *"We've received encouragement from the central government, but the technical data isn't yet complete. Investors always ask about the actual capacity of rooftop solar or biomass power plants, and we don't have comprehensive data."*

Regional Development Planning Agency: *"We often act as liaisons between OPDs, but we are not the implementers. Coordination usually only occurs in large meetings, not as a routine mechanism."*

ESDM Official: *"We are very interested in entering the clean energy sector, but there are almost no fiscal incentives in this region. The project ROI is too long."*

Thus, the key takeaway from Figure 4 captures how the KM successfully reveals the strengths and weaknesses of the energy transition in Lampung. This visual illustration explains that its strength lies in external momentum, while its weakness lies in internal capacity. A key lesson learned is that the KM effectively reveals the dynamics of the renewable energy transition in Lampung. The model demonstrates that despite national momentum, Lampung's internal capacity remains fragile. Energy policy reform in Lampung can only succeed if interventions are directed at the most fragile variables, not only adding technical projects but also strengthening the institutional, political, and social foundations that support the sustainability of the energy transition.

Furthermore, by examining the mapping of the 16 variables studied, a clear pattern can be summarized in Table 8.

Table 8. Summary of empirical conditions, strengths, and weaknesses of Lampung's new and renewable energy policy

Stage	Empirical Conditions	Strength	Weakness
Agenda Setting	Relatively strong due to the push of the crisis and national regulations	Crisis momentum and national regulations	Low attention from political elites
Policy Design	Still partial; data and stakeholder support are fragile	Technical solutions already exist (solar power plants, biomass)	Minimal data, weak stakeholder support
Adoption	Hampered by a lack of political incentives and opportunities	Symbolic leadership figures exist	Low political incentives and opportunities
Implementation	Hampered by cross-sector coordination and budget constraints	There is technical capacity at PLN/ESDM	Weak cross-sectoral and financial coordination
Evaluation	Its weakest point; evaluation is not mandatory and accountability pressure is low	There is sporadic learning	Mandatory evaluation and low accountability

Source: Processed from the results of in-depth interviews and policy documents, 2025

Thus, the explanation above not only shows a growth trend but also reflects the reality of the energy transition in Lampung. This optimism is growing slowly amidst the dominance of fossil fuels and weak regional policy support. This indicates that, without more serious government intervention, Lampung Province risks falling behind in achieving national energy transition targets, despite its significant technical potential.

4.3 Key Factors in the Transition to Renewable Energy in Lampung

This study goes beyond a general diagnosis and delves deeper into the key factors that act as levers for accelerating renewable energy policy reform in Lampung [5]. The KM approach identifies the most crucial variables, while regression analysis, SNA, and power mapping reveal how actors and resources interact to shape policy dynamics [5, 9].

Field research indicates four variables are most crucial in the policy cycle. First, data availability. The lack of technical data, potential capacity, and economic projections makes policy design partial [23]. The application of machine learning–based renewable energy generation predictions with Shapley values has been shown to improve the accuracy and explainability of output drivers, thereby strengthening data readiness for policy design [24]. When data is limited, political decisions tend to be based on short-term fiscal considerations, rather than the urgency of the energy transition. Second, stakeholder support. This support is weak due to a lack of cross-sectoral coordination, even though multi-stakeholder involvement is crucial in the energy sector, which is fraught with interests. Third, low cross-sectoral coordination poses a serious obstacle to the implementation stage. Fragmentation among government institutions leads to program duplication and low budget efficiency [9, 12]. Fourth, low elite attention leads to a lack of strong political legitimacy for green energy issues in the regions [4, 5].

These four factors are actually interrelated. Strong data will strengthen political arguments. Stakeholder support will create social legitimacy. Cross-sector coordination ensures consistent implementation. Elite attention provides the necessary political impetus [5]. From this, it can be concluded that the levers for policy reform in Lampung are not only technical but also institutional and political [5, 12].

In a more in-depth analysis, it is important to understand that the relationships between variables are not separate but rather influence each other simultaneously. Data availability, for example, not only improves technical accuracy but also serves as political ammunition to convince elites and strengthen the position of advocates [7, 20]. Conversely, stakeholder support not only expands social legitimacy but also drives the demand for transparent and integrated data. This reciprocal interaction means that strengthening one variable will impact the improvement of the others.

Based on this, this study goes beyond descriptive analysis and goes further by quantitatively examining the relationships between key variables. A simple linear regression approach was chosen to assess the extent to which data availability and stakeholder support influence the quality of energy policy design in Lampung [5]. Thus, the analysis not only uncovers structural weaknesses but also provides statistical evidence on which factors are most crucial in shaping more effective policy design [7, 8].

Table 9. Simple linear regression results

Independent Variables	β (Coefficient)	p-Value	R^2	Interpretation
Data Availability	0.35	0.012	0.21	Important, the more complete the data, the better the quality of policy design.
Stakeholder Support	0.42	0.008	0.27	It is crucial, multi-stakeholder support improves the quality of policy design.

Source: Regression output from author's survey data, 2025

In Table 9, the test results show that stakeholder support (β = 0.42, $p < 0.01$) has a stronger influence than data availability (β = 0.35, $p < 0.05$). However, both are equally significant, thus concluding that the quality of policy design is highly dependent on the combination of empirical evidence and social legitimacy. The relatively low R^2 value (0.21–0.27) also indicates the presence of other influencing factors, such as political leadership and fiscal incentives. This finding aligns with Head [23], who emphasized that evidence-based policies are only effective when combined with the support of socio-political coalitions. Scientific evidence without public acceptance will lack driving force, while stakeholder support without a data base will only result in populist policies.

The regression test results do provide a clear quantitative picture of the important role of data and stakeholder support in shaping the quality of policy design. However, these statistics are insufficient to explain how interactions between actors play out in daily practice. Energy policy is influenced not only by the availability of evidence and social legitimacy, but also by the configuration of power, strategic positions, and relationships between the institutions involved. In other words, regression reveals what influences, but it does not fully explain who plays the dominant role behind policy dynamics.

Therefore, this study complements the quantitative analysis with a SNA approach. The aim is to map the extent to which key actors—such as local governments, regional representative councils, technical agencies, the private sector, academics, and civil society—are connected and influence the direction of the energy transition. This approach allows for a more holistic reading: not only assessing variables separately, but also examining how power relations and cross-actor coordination shape the energy policy architecture in Lampung.

Table 10 provides the analytical basis for Figure 5 by detailing the centrality and strategic roles of policy actors within the Lampung renewable energy network. The data reveal Bappeda's paradoxical prominence as a coordination hub despite lacking formal authority, a position clearly visualized in Figure 5. Conversely, the Energy and Mineral Resources Agency, though formally mandated, appears weak in cross-sectoral linkages, while universities, NGOs, and the private sector remain peripheral. Together, Table 10 and Figure 5 illustrate the fragmented governance structure and highlight the risk of policy stagnation arising from limited coordination among actors.

The SNA shows that Bappeda is actually the most important node in connecting actors, even though it does not formally have full authority. Meanwhile, the ESDM Agency, which has technical authority, is weak in building cross-sectoral relationships. This indicates an institutional paradox, where formal authority does not always correspond to influence within the policy network, as emphasized in Figure 5 The network visualization shows Bappeda in a central position as a liaison across actors, while NGOs, academics, and the private sector tend to be on the periphery of the network. This condition implies that the governance network pattern is not well coordinated, thus creating a risk of policy stagnation.

Table 10. Centrality of actors in the Lampung EBT policy network

Policy Actors	Degree Centrality	Betweenness Centrality	Strategic Role
Regional Development Planning Agency	Tall	Tall	A liaison between actors, a coordination node even though it does not have full authority
Energy and Mineral Resources Agency	Tall	Low	Technical implementers, but with minimal cross-sector access
Regional People's Representative Council	Currently	Currently	Political legitimacy, but passive in policy coordination
Private Sector	Low	Low	Funding/technology sources, participation is still limited
University	Low	Currently	Provider of academic studies, liaison with the community
Community / NGO	Currently	Low	Advocacy support has not yet formed a strong coalition

The network's findings indicate that the "cross-sector coordination" variable is a significant weakness. The absence of a formal coordination node makes the policy process ad hoc and inconsistent. Thus, the Constitutional

Court was able to identify obstacles, with imbalanced coordination between actors being a key factor hindering the renewable energy transition in Lampung Province.

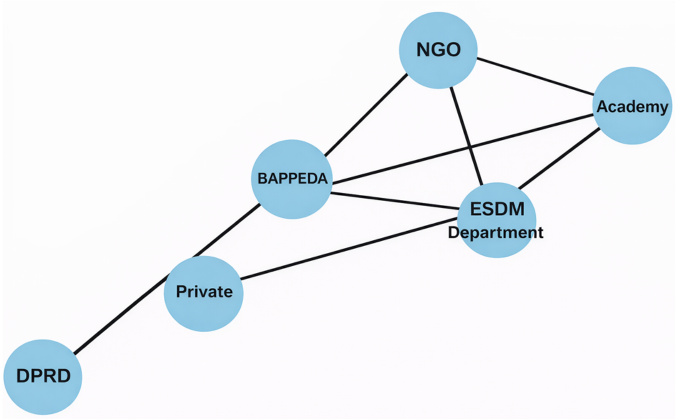

Figure 5. Renewable energy policy network in Lampung (social network analysis map) [20]

Note: This figure was prepared by the authors

Regarding key or most influential factors, Figure 5 emphasizes the importance of stakeholder support. When Bappeda appears as a node, it indicates that support between actors is established through only a single connecting channel. This is risky because over-reliance on a single institution will become a barrier if that institution loses its legitimacy or capacity. In other words, stakeholder support in Lampung remains fragile and has not yet been institutionalized. Furthermore, the strategic implication is that Lampung Province needs a formal coordinating body to reduce network fragmentation. This is where the KM can help identify reform opportunities. One such opportunity is strengthening the role of Bappeda or establishing a Regional Energy Transition Coordinating Agency (BKET) that is officially recognized as a cross-sectoral connecting node.

The network findings above indicate that stakeholder support in Lampung remains fragile due to its centralization in a single key node, the Regional Development Planning Agency (Bappeda). Excessive reliance on a single actor indicates a weak institutional framework for multistakeholder support. In the context of the energy transition, this situation is dangerous because policy stability depends heavily on the continued legitimacy and capacity of these institutions. If a single node weakens, the entire coordination process risks being disrupted. Therefore, there is an urgent need for a more formal and inclusive coordination mechanism, either through strengthening Bappeda or establishing a new institution specifically functioning as a cross-sector coordinator.

However, to better understand how the stakeholder support variable works in relation to other factors, a quantitative approach is needed to test its statistical significance. Network analysis has demonstrated who plays a strategic role, but it has not yet addressed the extent to which stakeholder support and data availability directly contribute to the quality of policy design. Based on this, this study continues the analysis using simple linear regression to empirically assess the relative influence of these two variables and provide a stronger foundation for policy recommendations.

The results in Table 11 indicate that stakeholder support has a stronger influence on policy design quality than data availability (standardized coefficient significant, $p < 0.05$; Adj. R^2 0.30-0.35). Substantively, a one-standard-deviation increase in actor support correlates with a larger jump in design quality than an equivalent increase in data. This finding suggests that socio-political legitimacy is not a complement to evidence, but rather a prerequisite for the design to be truly operational.

Table 11. Simple linear regression results

Independent Variables	β (Coefficient)	p-Value	R^2	Interpretation
Data Availability	0.35	0.012	0.21	Important; the more complete the data, the better the quality of policy design.
Stakeholder Support	0.42	0.008	0.27	It is crucial; multi-stakeholder support improves the quality of policy design.

Source: Regression output from survey data, 2025

To test for dependency, we added a Data × Support interaction term. The interaction term coefficient is positive and significant ($p < 0.05$), indicating that the benefits of data increase sharply when actor support is high. Therefore, technical data without multistakeholder coalitions yields only marginal gains; conversely, when networks are strong, data clarify indicators, baselines, and action routes, leading to a nonlinear increase in design quality. A visualization of the marginal effects is presented in Figure 6.

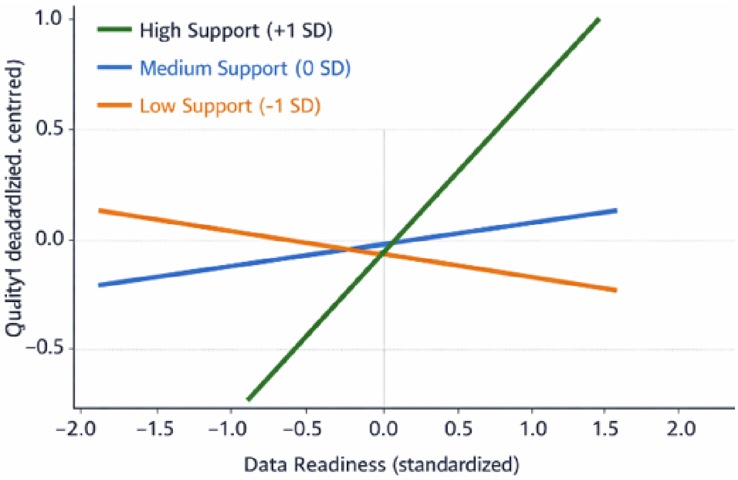

Figure 6. Marginal effects of data at different levels of stakeholder support

Source: Survey data regression output, 2025

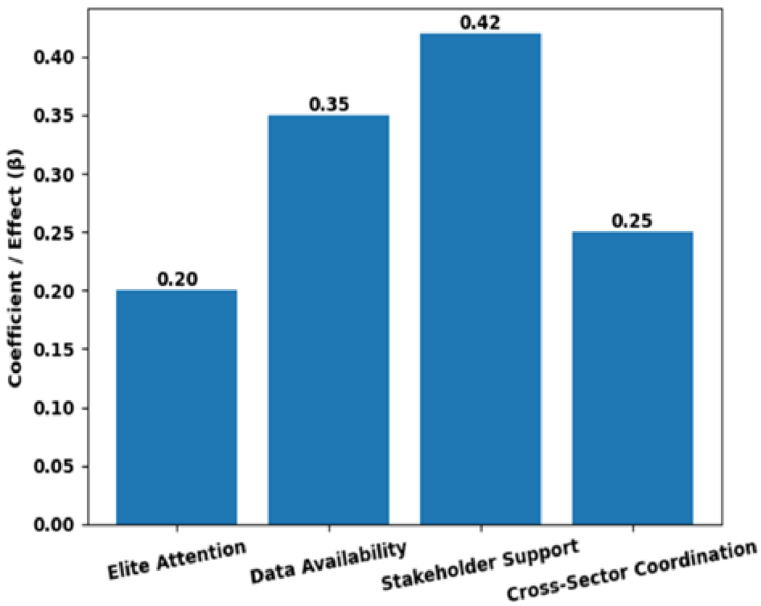

Figure 7. Influence of key variables on policy design

Synthesis with SNA positions Bappeda as a coordination broker. This mechanism aligns with the regression results: networks expand cross-OPD collaboration and implementation commitment, which in turn enhances data effectiveness. In-depth interviews confirmed this pattern—without a coordination and advocacy mandate, data tends to be normative and rarely contributes to decisions.

To strengthen the simple linear regression results presented in Table 11, a visual representation is needed to more clearly demonstrate the comparative influence of these variables. This visualization is important because it can communicate quantitative findings more intuitively, allowing for readily discernible patterns of stakeholder support and data availability. Furthermore, the graph also confirms that these two variables are key policy levers in energy policy design, while other factors, such as elite attention and cross-sector coordination, remain weak. Therefore, this study presents Figure 7 to more comprehensively illustrate the influence of key variables on the quality of policy design.

Figure 7 shows the relative influence of four key variables on the quality of renewable energy policy design in Lampung Province. Stakeholder support clearly has the highest influence (β = 0.42), followed by data availability (β = 0.35), while cross-sector coordination (β = 0.25) and elite attention (β = 0.20) show weaker effects. This substantively answers the question of which factors are most influential in the policy cycle. Field data confirms that the quality of policy design is inseparable from the socio-political legitimacy granted by stakeholders. Without strong stakeholder support, policy design will remain merely a normative document. However, this support is only meaningful if it is supported by an adequate data base so that policies are truly evidence-based, not simply political agreements.

These results also reveal a policy paradox in Lampung. Elite attention, which should be the driving force behind politics, remains weak, despite the literature emphasizing that elite legitimacy is a key prerequisite for a successful energy transition [4]. Similarly, poor cross-sectoral coordination indicates that implementation at the technical level has not kept pace with the need for integrated policy design [9, 12]. From the perspective of the Kaleidoscope Model, it is clear that the levers for policy reform in Lampung lie in data and stakeholder support, rather than fiscal logic or elite preferences [5, 21]. Meanwhile, within the policy mix framework , these findings highlight the need for a combination of instruments: data-driven regulations, stakeholder-backed incentives, and coordination mechanisms to bridge the interests of various actors [10, 12, 15, 17]. The strategic implication is that the direction of renewable energy transition policy reform in Lampung is not simply about attracting the attention of political elites; it also requires building a robust data ecosystem and strengthening stakeholder coalitions [7, 8, 11, 15, 21]. This means that policies can gain both social legitimacy and empirical validity. Only in this way can energy policy design transform from a mere document into a practical and adaptive instrument [5, 12].

4.4 Applying the Kaleidoscope Model: Uncovering Reform Opportunities, Strategic Partners, and Entry Points

The application of the KM in this study serves not only as an academic analysis tool but also as a strategic compass for the Lampung regional government in navigating the complexities of the energy transition. The KM allows for a systematic mapping of policy weaknesses while identifying realistic reform opportunities, strategic partners to engage, and effective entry points to strengthen implementation.

Regarding reform opportunities, the Constitutional Court's analysis indicates that the main weaknesses of Lampung's renewable energy transition lie in cross-sectoral coordination, elite attention, and minimal policy evaluation. However, behind these weaknesses lies room for change. The external crisis variable, which scored high (4), indicates an open policy window. Pressure from national targets (Presidential Regulation No. 112 of 2022) and regional needs for energy independence provide legitimacy to push for a new, more integrated agenda.

Furthermore, the Constitutional Court emphasized the importance of strategic partnerships through strengthening advocacy and stakeholder support. The SNA results (Figure 3) indicate that the positions of actors in Lampung remain fragmented, with the Bappeda as the primary liaison. This situation suggests that reform opportunities can only be realized if the region can build a solid multi-stakeholder coalition, involving the government, the Regional People's Representative Council (DPRD), the private sector, academia, and civil society within a collaborative framework.

In addition, the Constitutional Court helped identify effective entry points to strengthen the implementation of renewable energy transition policies. Of the 16 variables analyzed, three entry points were identified as having the greatest potential: political momentum (e.g., the formulation of a new RPJMD or a change in regional head), an energy crisis (an increase in the price of electricity, LPG, or fuel), and ongoing pilot projects (such as the Batutegi Floating Solar Power Plant and the Ulubelu Geothermal Power Plant). These three entry points can serve as concrete starting points for accelerating policy implementation.

In conclusion, to facilitate the formulation of policy recommendations, the findings on reform opportunities, strategic partners, and entry points can be summarized in Table 12.

To summarize the above findings, the following is a summary of strategic aspects that can be used as policy recommendations.

This table highlights that reform opportunities, strategic partners, and entry points are not mutually exclusive but rather complementary. Institutional reform, database strengthening, and fiscal incentives will only be effective if supported by the right strategic partners, and political momentum or crises can serve as entry points for advancing policy agendas.

To reinforce the message in the table, it's important to note that the relationship between reform opportunities, strategic partners, and entry points is not only conceptual but also operational. This means that local governments need to know not only what needs reform or who to collaborate with, but also how to prioritize and allocate attention to each aspect. With this framework, visualization is crucial because it can more concretely demonstrate the distribution of strategic weight and focus, while also clarifying which elements should be treated as key drivers and which should serve as supporting elements.

A document-based comparative plausibility probe indicates that the institutional patterns identified in Lampung share certain structural similarities with the reference provinces (e.g., the need for formal coordination nodes, the importance of data integration, and regulatory-incentive packages), while also differing in political context that influence the prioritization of interventions. These findings strengthen the transferability of the KM's mechanisms (diagnostics→actions), but emphasize that implementation designs must be calibrated to each region's configuration of actors, data, and incentives.

Table 12. Summary of reform opportunities, strategic partners, and entry points

Category	Description
Opportunity for Reform	Institutional integration through the Regional Energy Transition Coordination Agency
Opportunity for Reform	Increasing the capacity of energy data and information systems
Opportunity for Reform	Designing fiscal incentives for clean energy investments
Strategic Partner	Bappeda as a policy broker and coordination center
Strategic Partner	ESDM Office as a technical driver of energy policy
Strategic Partner	Private sector as a provider of funding and technology
Strategic Partner	Private sector as a provider of funding and technology
Entry Point	Political momentum (new RPJMD, change of regional heads)
Entry Point	Energy crisis (electricity, LPG, fuel) as a policy catalyst
Entry Point	Pilot projects (Batutegi Floating Solar Power Plant, Ulubelu Geothermal)

Source: Processed from the Indonesian RPJPN

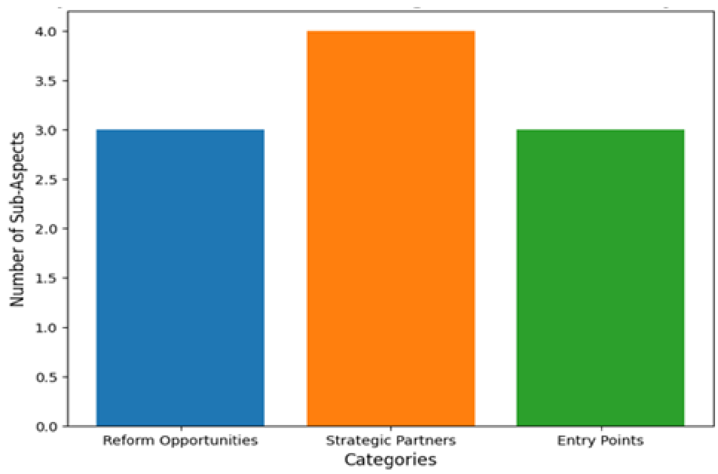

Figure 8. Representation of reform, strategic partners, and entry points

Source: Compiled from Table 11

Figure 8 shows that strategic partners have the most weight (4 sub-aspects), followed by reform opportunities (3 sub-aspects), and entry points (3 sub-aspects). This means that the success of energy policy reform in Lampung is largely determined by the ability to build and manage multi-stakeholder networks, while institutional reform and leveraging political momentum are supporting elements that strengthen implementation.

5 Conclusion and Recommendations

5.1 Conclusion

This study is a single-case study (Lampung), so the findings cannot be statistically generalized. The intended generalization is analytical, namely testing the mechanisms of the KM (16-variable diagnostic → action route) in similar contexts. Comparative plausibility probes based on desk reviews (e.g., Central Java, Bali) provide indications of pattern transferability, but the level/order of intervention priorities may differ. Further research will employ a multi-case design across provinces with a uniform indicator protocol to test theoretical replicability and strengthen external validity.

The energy transition in Lampung Province has significant potential to strengthen regional energy independence while supporting the national energy mix target of 23% by 2025. However, the MK analysis results indicate that the renewable energy transition policy in Lampung is still in its early stages, with weak and unsystematic institutions. Low scores on several key variables, such as elite focus, data and evidence availability, cross-sector coordination, and mandatory evaluation, highlight the weakness of institutional foundations, political leadership, and policy learning mechanisms.

Overall, the KM has proven effective in uncovering the key factors determining the success or failure of renewable energy policy changes in Lampung. The Constitutional Court's analysis shows that external crises and national regulatory incentives are the primary drivers of the energy transition agenda, while key obstacles arise from a lack of attention from political elites, weak cross-sectoral coordination, a lack of a database, and the absence of a mandatory evaluation system. Therefore, the Constitutional Court serves not only as a diagnostic tool but also as an analytical framework capable of identifying dominant factors (leverage points) that can accelerate energy policy reform.

The most influential factors that can be used as key variables in the policy cycle include: (1) external crises as a window of policy opportunity, (2) the availability of data and evidence to strengthen EBP formulation, (3) cross-sector coordination as a key requirement for consistent implementation, and (4) public evaluation and accountability mechanisms as the foundation for continuous policy learning. These variables are critical points that determine whether policy reforms can be more systemic and sustainable.

Furthermore, the implementation of the Constitutional Court helps local governments and stakeholders identify reform opportunities, find strategic partners, and determine effective entry points. The momentum of Presidential Regulation No. 112 of 2022 can be leveraged as an entry point for the energy transition agenda, while collaboration between the Bappeda, the ESDM, the Environmental Agency, the private sector, universities, and the green energy community forms the basis for strategic partnerships. Through the MK, intervention strategies can be more targeted, including the establishment of a coordinating body, the provision of fiscal incentives, the integration of renewable energy into regional planning documents, the strengthening of databases, and the development of concrete pilot projects.

5.2 Operational Recommendations and Directions

To translate findings into action, coordination is centralized through the BK-TED (Governor's Decree) that aligns the RPJMD, Renstra, and RKPD and acts as a clearinghouse across regional government agencies, PLN, universities, the private sector, and communities. From this mandate, the necessary instruments are born: SOPs for rapid licensing of rooftop solar power plants, mandatory energy inventories for OPDs/BUMDs, and selective incentives (levy relief and green interest subsidies) to ensure project feasibility. EBP infrastructure is provided by the Integrated Energy Data System (SDE-Lampung)—potential maps, installed capacity, project pipelines , and emission metrics—complete with input and audit SOPs, thus serving as the basis for mandatory semester-by-semester evaluations and policy adjustments. All designs are tested through pilot projects (Suoh Energy Geotourism, Batutegi floating solar power plants, local commodity-based bioenergy) as coordination laboratories, ESCO/PPP-based financing, and learning before scaling up. Performance is monitored quarterly using concise yet sharp indicators: renewable energy share, new capacity (MW/kWh), emission reduction (tCO_2e), permitting time (days), and leveraged private investment. The workflow moves sequentially—coordination mandate, instruments and incentives, data strengthening and evaluation, pilot testing, and then scaling—making it easily translated into work unit standard operating procedures.

Data Availability

The data used to support the research findings are available from the corresponding author upon request

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Conflicts of Interest

The authors declare no conflict of interest.

References

[1] Government of Indonesia, "Presidential regulation no. 112 of 2022," 2022. https://cdn.climatepolicyradar.org/navigator/IDN/2022/presidential-regulation-no-112-of-2022-on-accelerated-development-of-renewable-energy-for-electricity-supply_1a0227d67fb85790856b30cc74102d2e.pdf

[2] C. Grimpe and W. Sofka, "Complementarities in the search for innovation—Managing markets and relationships," *Res. Policy*, vol. 45, no. 10, pp. 2036–2053, 2016. https://doi.org/10.1016/j.respol.2016.07.007

[3] S. N. Timm and B. M. Deal, "Effective or ephemeral? The role of energy information dashboards in changing occupant energy behaviors," *Energy Res. Soc. Sci.*, vol. 19, pp. 11–20, 2016. https://doi.org/10.1016/j.erss.2016.04.020

[4] J. Meadowcroft, "Engaging with the politics of sustainability transitions," *Environ. Innov. Soc. Transit.*, vol. 1, no. 1, pp. 70–75, 2011. https://doi.org/10.1016/j.eist.2011.02.003

[5] D. Resnick, S. Haggblade, S. Babu, S. L. Hendriks, and D. Mather, "The Kaleidoscope Model of policy change: Applications to food security policy in Zambia," *World Dev.*, vol. 109, pp. 101–120, 2018. https://doi.org/10.1016/j.worlddev.2018.04.004

[6] J. Radtke, "Understanding the complexity of governing energy transitions: Introducing an integrated approach of policy and transition perspectives," *Environ. Policy Gov.*, vol. 35, no. 4, pp. 595–614, 2025. https://doi.org/10.1002/eet.2158

[7] K. S. Rogge and K. Reichardt, "Policy mixes for sustainability transitions: An extended concept and framework for analysis," *Res. Policy*, vol. 45, no. 8, pp. 1620–1635, 2016. https://doi.org/10.1016/j.respol.2016.04.004

[8] J. Meckling, "Governing renewables: Policy feedback in a global energy transition," *Environ. Plann. C: Polit. Space*, vol. 37, no. 2, pp. 317–338, 2018. https://doi.org/10.1177/2399654418777765

[9] M. B. Lindberg, J. Markard, and A. D. Andersen, "Policies, actors and sustainability transition pathways: A study of the EU's energy policy mix," *Res. Policy*, vol. 48, no. 10, p. 103668, 2019. https://doi.org/10.1016/j.respol.2018.09.003

[10] M. M. Vanegas Cantarero, "Of renewable energy, energy democracy, and sustainable development: A roadmap to accelerate the energy transition in developing countries," *Energy Res. Soc. Sci.*, vol. 70, p. 101716, 2020. https://doi.org/10.1016/j.erss.2020.101716

[11] A. Omri and S. Ben Jabeur, "Climate policies and legislation for renewable energy transition: The roles of financial sector and political institutions," *Technol. Forecast. Soc. Change*, vol. 203, p. 123347, 2024. https://doi.org/10.1016/j.techfore.2024.123347

[12] W. Liu, Y. Shen, and A. Razzaq, "How renewable energy investment, environmental regulations, and financial development derive renewable energy transition: Evidence from G7 countries," *Renew. Energy*, vol. 206, pp. 1188–1197, 2023. https://doi.org/10.1016/j.renene.2023.02.017

[13] H. Wehbi, "Powering the future: An integrated framework for clean renewable energy transition," *Sustainability*, vol. 16, no. 13, p. 5594, 2024. https://doi.org/10.3390/su16135594

[14] M. Michailidis, E. Zafeiriou, A. Kantartzis, S. Galatsidas, and G. Arabatzis, "Governance, energy policy, and sustainable development: Renewable energy infrastructure transition in developing MENA countries," *Energies*, vol. 18, no. 11, p. 2759, 2025. https://doi.org/10.3390/en18112759

[15] A. Sinha, S. Bekiros, N. Hussain, D. K. Nguyen, and S. A. Khan, "How social imbalance and governance quality shape policy directives for energy transition in the OECD countries?" *Energy Econ.*, vol. 120, p. 106642, 2023. https://doi.org/10.1016/j.eneco.2023.106642

[16] Z. Wang, K. Yen-Ku, Z. Li, N. B. An, and Z. Abdul-Samad, "The transition of renewable energy and ecological sustainability through environmental policy stringency: Estimations from advance panel estimators," *Renew. Energy*, vol. 188, pp. 70–80, 2022. https://doi.org/10.1016/j.renene.2022.01.075

[17] T. Zheng, C. Song, and L. Cao, "The role of policy narrative intensity in accelerating renewable energy innovation: Evidence from China's energy transition," *Energies*, vol. 18, no. 11, p. 2780, 2025. https://doi.org/10.3390/en18112780

[18] M. Diaconescu, L. E. Marinas, A. M. Marinoiu, M. F. Popescu, and M. Diaconescu, "Towards renewable energy transition: Insights from bibliometric analysis on scholar discourse to policy actions," *Energies*, vol. 17, no. 18, p. 4719, 2024. https://doi.org/10.3390/en17184719

[19] C. Breyer, S. Khalili, D. Bogdanov, M. Ram, A. S. Oyewo, A. Aghahosseini, A. Gulagi, A. A. Solomon, D. Keiner, G. Lopez, and et al., "On the history and future of 100% renewable energy systems research," *IEEE Access*, vol. 10, pp. 78 176–78 218, 2022. https://doi.org/10.1109/access.2022.3193402

[20] D. I. Söylemez and A. Söylemez, "Governance frameworks for renewable energy development: Energy transition and public governance," *Rev. Gest. Soc. Ambient.*, vol. 18, no. 11, p. e09423, 2024. https://doi.org/10.24857/rgsa.v18n11-110

[21] N. Duadji and N. Tresiana, "Analysis of child marriage and related policies in Indonesia: Sustainable development issue," *Probl. Ekoroz.*, vol. 17, no. 1, pp. 101–113, 2022. https://doi.org/10.35784/pe.2022.1.10

[22] N. Duadji, N. Tresiana, A. M. L. S. Putri, and M. Riniarti, "Can the implementation of conservation village increase the environmental support in forest management in Bukit Barisan Selatan National Park, Lampung, Indonesia," *Int. J. Sustain. Dev. Plan.*, vol. 17, no. 3, pp. 751–763, 2022. https://doi.org/10.18280/ijsdp.170306

[23] N. Tresiana and N. Duadji, "Developing forest coffee cultural tourism and historical heritage megalithic sites in social innovation governance: How does it work in a sustainable way," *J. Environ. Manag. Tour.*, vol. 13, no. 4, pp. 1036–1046, 2022. https://doi.org/10.14505/jemt.v13.4(60).10

[24] N. Tresiana and T. Kartika, "Developing a model for sustainable traditional tourism village," *Int. J. Sustain. Dev. Plan.*, vol. 19, no. 6, pp. 2135–2145, 2024. https://doi.org/10.18280/ijsdp.190613