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ENERGY TRANSITION IN SOUTH SUMATRA: NON-EXTRACTIVE SECTORS AND GREEN ECONOMY POLICY STRATEGIES

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ABSTRACT
South Sumatra faces a structural challenge in reducing its dependence on coal, oil and gas while maintaining regional growth and employment. This study examines which non-extractive sectors can support a locally grounded energy transition and what policy strategies the provincial government can implement under fiscal and institutional constraints. The study uses a convergent parallel mixed methods design. Quantitative data were drawn from Statistics Indonesia, Bank Indonesia, regional planning documents, renewable energy capacity data, and the SDG Index and Dashboard. Qualitative data were obtained from semi-structured interviews with Bappeda South Sumatra, IESR, and WRI Indonesia, supported by policy document analysis. The analysis applies the multi-level perspective, political economy of energy transition, and energy justice to connect landscape pressure, fossil-based regional regimes, niche innovations, and distributional risks. The findings show three core results. First, coffee, rubber, palm oil-based bioenergy, fisheries, and nature-based tourism are the most feasible non-extractive sectors because they combine local resource endowment, employment potential, value-added opportunities, and policy support. Second, renewable energy development remains at an early stage, with Rp1.2 trillion in accumulated investment from 2020 to 2024, 3.8 MW rooftop solar PV capacity, 12.5 MW biomass and biogas capacity, and 85 MW untapped micro-hydro potential. Third, the main transition barrier is not only technical capacity, but also fragmented coordination, limited fiscal incentives, weak green investment instruments, and social dependence on coal-related micro-businesses in mining regions. The study recommends a dedicated regional energy transition unit, an integrated action roadmap linked to RPJMD and RUED, green financing instruments, post-mining land repurposing, and community-based energy literacy. These findings strengthen the scientific understanding of subnational energy transition in resource-dependent provinces and provide practical policy guidance for SDG 7, SDG 8, SDG 9, and SDG 13.

Keywords: energy transition; green economy; non-extractive sectors; south sumatra; sustainable policy

TRANSISI ENERGI DI SUMATERA SELATAN: SEKTOR NON-EKSTRAKTIF DAN STRATEGI KEBIJAKAN EKONOMI HIJAU

ABSTRAK
Sumatera Selatan menghadapi tantangan struktural dalam mengurangi ketergantungan pada batubara, minyak, dan gas, sekaligus mempertahankan pertumbuhan ekonomi dan kesempatan kerja daerah. Penelitian ini mengkaji sektor non-ekstraktif yang dapat mendukung transisi energi berbasis potensi lokal serta strategi kebijakan yang layak dijalankan pemerintah provinsi dalam keterbatasan fiskal dan kelembagaan. Studi ini menggunakan desain mixed methods konvergen paralel. Data kuantitatif bersumber dari BPS, Bank Indonesia, dokumen perencanaan daerah, data kapasitas energi terbarukan, serta SDG Index and Dashboard. Data kualitatif diperoleh melalui wawancara semi-terstruktur dengan Bappeda Sumatera Selatan, IESR, dan WRI Indonesia, serta analisis dokumen kebijakan. Analisis menggunakan multi-level perspective, ekonomi politik transisi energi, dan energy justice untuk menghubungkan tekanan lanskap, rezim ekonomi berbasis fosil, inovasi ceruk, dan risiko distribusi. Temuan penelitian menunjukkan tiga hasil utama. Pertama, kopi, karet, bioenergi berbasis kelapa sawit, perikanan, dan pariwisata berbasis alam merupakan sektor non-ekstraktif paling layak karena memiliki basis sumber daya lokal, potensi pekerjaan, peluang nilai tambah, dan dukungan kebijakan. Kedua, pengembangan energi terbarukan masih berada pada tahap awal, dengan akumulasi investasi Rp1,2 triliun pada 2020 sampai 2024, kapasitas PLTS atap 3,8 MW, kapasitas biomassa dan biogas 12,5 MW, serta potensi mikrohidro 85 MW yang belum dimanfaatkan optimal. Ketiga, hambatan utama transisi bukan hanya kapasitas teknis, tetapi juga koordinasi kelembagaan yang terfragmentasi, insentif fiskal yang terbatas, instrumen investasi hijau yang belum kuat, serta ketergantungan sosial pada usaha mikro terkait batubara di wilayah tambang. Studi ini merekomendasikan pembentukan unit transisi energi daerah, peta jalan aksi yang terintegrasi dengan RPJMD dan RUED, instrumen pembiayaan hijau, pemanfaatan lahan pascatambang, serta literasi energi berbasis komunitas. Temuan ini memperkuat pemahaman ilmiah mengenai transisi energi subnasional di provinsi bergantung sumber daya dan memberi arahan kebijakan praktis untuk SDG 7, SDG 8, SDG 9, dan SDG 13.

Kata kunci: transisi energi; ekonomi hijau; sektor non-ekstraktif; sumatera selatan; kebijakan berkelanjutan

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INTRODUCTION

The transition toward a green economy and sustainable energy has become a central policy agenda for resource-dependent regions. At the national level, Indonesia has committed to achieving Net Zero Emissions by 2060 and to increasing the role of renewable energy in its energy system. At the subnational level, this agenda becomes more complex because many provincial economies still depend on extractive sectors. South Sumatra represents this challenge. The province has long served as one of Indonesia's energy-producing regions, especially through coal, oil, and gas. This position creates fiscal benefits, but it also produces vulnerability to commodity price volatility, environmental degradation, and social dependence on mining-related activities.

In 2024, the mining and quarrying sector contributed approximately 24.6% to South Sumatra's Gross Regional Domestic Product. This contribution shows that extractive activities remain important for regional revenue and employment. However, the same structure also raises transition risks. Environmental loss in resource-producing areas, low compliance among several firms, and the concentration of economic activities around coal indicate that South Sumatra cannot treat energy transition only as a technical shift from fossil fuels to renewables. It must also redesign its economic base. In this context, non-extractive sectors become important because they can reduce fiscal dependence, expand local employment, and support more inclusive development.

Table 1. Contribution of Extractive and Non-Extractive Sectors to South Sumatra's GRDP (2019–2023)

Year	Extractive Sector (%)	Non-Extractive Sector (%)	Economic Growth (%)
2019	26.1	73.9	5.02
2020	25.4	74.6	-0.32
2021	24.9	75.1	3.21
2022	24.7	75.3	4.89
2023	24.6	75.4	5.12

Source: (Badan Pusat Statistik (BPS), 2025b; Bank Indonesia, 2025; Pemerintah Provinsi Sumatera Selatan, 2025)

Table 1 shows a gradual decline in the extractive sector share from 26.1% in 2019 to 24.6% in 2023. The non-extractive sector increased from 73.9% to 75.4% in the same period. This shift remains modest, but it indicates an opportunity for diversification. The central issue is not whether extractive activities will disappear in the short term. The practical issue is which sectors can absorb transition pressure, create new value-added activities, and support social stability as fossil-based industries face stronger climate and market pressure.

Previous studies on energy transition have developed at least three relevant streams. The first stream focuses on socio-technical transition and explains how niche innovation can challenge a dominant regime under landscape pressure (Geels, 2002, 2011; Markard et al., 2012). The second stream examines the political economy of energy and shows that energy transition involves interests, institutional power, rent distribution, investment rules, and resistance from incumbent actors (Bridge et al., 2013; Meadowcroft, 2011; Newell & Mulvaney, 2013). The third stream develops the energy justice perspective, which stresses recognition, procedure, and fair distribution for communities affected by energy transition (Carley & Konisky, 2020; Jenkins et al., 2016; McCauley & Heffron, 2018). These three streams explain different dimensions of the same problem. The multi-level perspective explains system change. Political economy explains power and incentives. Energy justice explains who bears costs and who receives benefits.

The green economy literature adds an important economic dimension to these transition debates. It argues that low-carbon development should not only reduce emissions, but also improve resource efficiency, expand decent work,

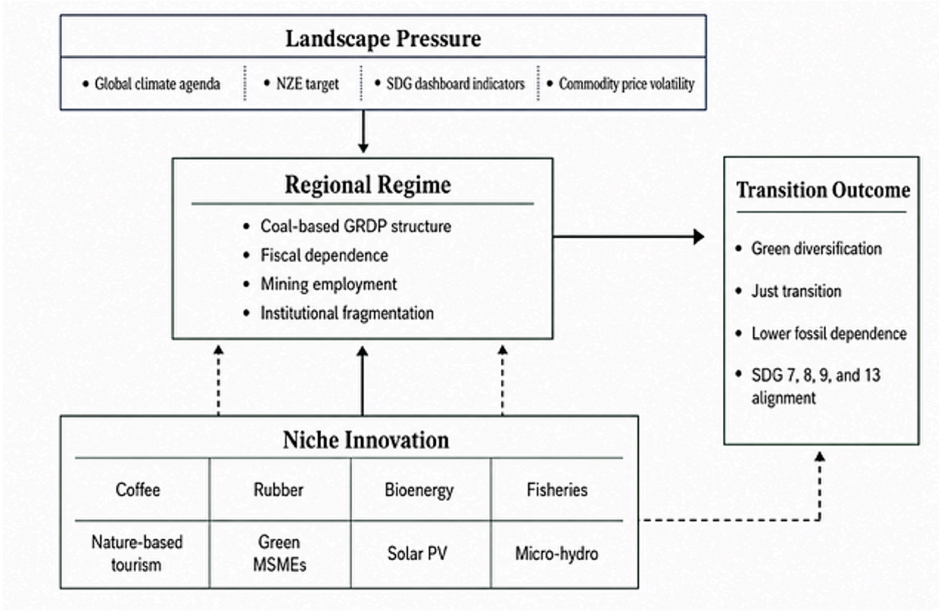

Figure 1. Analytical Framework of the Study

Source: Authors' Elaboration

and protect vulnerable groups from the social costs of structural change (United Nations Environment Programme, 2011; Sachs et al., 2025). For a province such as South Sumatra, this perspective is useful because the main problem is not only the energy mix. The province must decide which sectors can replace part of the fiscal, employment, and livelihood functions that extractive industries have performed for decades. A green economy lens therefore helps translate energy transition into sectoral choices, investment priorities, labour preparation, and regional development planning.

This article uses the multi-level perspective as the main analytical frame and supports it with political economy and energy justice perspectives. The MLP identifies three linked levels: landscape pressure, the dominant regional regime, and niche innovations. Political economy clarifies how incumbent interests, fiscal dependence, and investment incentives shape the pace of change. Energy justice clarifies whether affected communities, workers, and small businesses are recognized in the transition process. The combination of these theories allows the study to move beyond a descriptive list of sectors. It explains why certain sectors are more feasible, why institutional barriers persist, and why policy strategies must include financing, coordination, and community protection.

Research on Indonesia has mostly discussed national transition policy, renewable energy investment, and coal phase-down scenarios. Studies of regional diversification often focus on provinces that have earlier transition narratives, such as East Kalimantan and Riau. South Sumatra remains less examined as a subnational case, although it combines high fossil dependence, strong agricultural potential, bioenergy resources, post-mining land issues, and emerging green policy forums. This gap limits the theoretical understanding of how a resource-dependent province can connect non-extractive diversification with a just energy transition.

This study offers scientific novelty in three ways. First, it localizes energy transition theory by applying the multi-level perspective to a coal-dependent provincial economy. Second, it integrates quantitative sectoral indicators with qualitative policy narratives in a convergent parallel design. Third, it links regional findings with SDG 7, SDG 8, SDG 9, and SDG 13 indicators so that SDGs function as an analytical benchmark, not only as a normative label. The study asks two operational research questions: Which non-extractive sectors are most feasible to support South Sumatra's green economy transition, and why? What policy strategies can the provincial government implement under fiscal limits, institutional fragmentation, and social dependence on coal-related activities?

By linking these theories with provincial indicators, the study treats South Sumatra as an empirical case of subnational transition in a re-

source-dependent economy. The expected contribution is twofold. Scientifically, it shows how transition theory can be operationalized at the provincial scale through sectoral feasibility criteria and joint interpretation of data. Practically, it provides a policy basis for provincial agencies that must align energy transition, green economy diversification, and SDG achievement within limited budgets and uneven institutional capacity.

The framework guides the selection of indicators, interview questions, and interpretation of findings. Landscape pressure explains why transition is necessary. The regional regime explains why change is difficult. Niche innovation explains where new economic pathways can emerge. Transition outcome explains the policy target of the study.

METHOD

This study uses a convergent parallel mixed methods design. Quantitative and qualitative data were collected within the same research period, analyzed separately, and integrated during interpretation. This design was selected because the study compares sectoral and energy indicators with institutional perceptions and policy narratives. The design is consistent across the abstract, method, and analysis. It differs from explanatory sequential design because the qualitative component does not merely explain the quantitative results after data collection. Both components address the same concepts in parallel.

The quantitative component used secondary data from Statistics Indonesia South Sumatra for 2019-2023, Bank Indonesia regional economic assessments, the South Sumatra RPJMD 2025-2029, renewable energy data from ESDM South Sumatra, PLN, and IESR, and national SDG dashboard data from the Sustainable Development Report 2025. The indicators included extractive and non-extractive GRDP share, economic growth, renewable energy investment, installed solar PV capacity, biomass and biogas capacity, micro-hydro potential, green industry count, renewable energy village count, green job estimates, and sectoral feasibility indicators.

The qualitative component used semi-structured interviews with three strategic institutions: Bappeda South Sumatra, IESR, and WRI Indonesia. These institutions were selected purposively because they represent regional planning authority, technical energy transition expertise, and just transition policy advocacy. The number of informants is limited, so the study does not claim to represent all actors in South Sumatra. To reduce this limitation, the interview data were triangulated with policy documents, regional statistics, and program data. Future research should include coal industry actors, village governments, MSMEs, farmers, and affected workers to broaden the actor map.

Concepts were operationalized through four analytical dimensions: landscape pressure, regional regime, niche innovation, and justice-oriented policy strategy. These dimensions were derived from the multi-level perspective and expanded through political economy and energy justice concepts. The same dimensions guided both quantitative indicators and qualitative questions, making the convergent design genuinely parallel. Quantitative analysis used descriptive trend analysis and ordinal feasibility scoring. Qualitative analysis used thematic coding in four steps: open coding of interview notes and documents, grouping codes into MLP dimensions, comparing themes across institutions, and integrating themes with quantitative indicators in a joint display. When quantitative and qualitative findings differed, the interpretation prioritized convergence but explicitly noted divergence as a policy risk.

A sector was classified as priority when it met at least three of four criteria: local resource endowment, employment or MSME potential, compatibility with green economy principles, and policy or investment feasibility. Scores were interpreted as high, medium, or low based on convergence between statistical trends, planning documents, and interview evidence. This rule avoids a purely descriptive listing of sectors and clarifies the basis for selecting coffee, rubber, palm oil-based bioenergy, fisheries, and nature-based tourism as priority sectors.

The ordinal feasibility score did not function as a rigid statistical ranking. It served as a transparent screening tool to compare sectors with different types of evidence. A sector received stronger priority when quantitative indicators, planning documents, and interview findings pointed in the same direction. For example, coffee was classified as highly feasible because it had a clear territorial base, downstream potential, MSME linkages, and compatibility with agroforestry. Palm oil-based bioenergy was considered feasible only when the analysis focused on waste utilization and sustainability

safeguards, not plantation expansion. This distinction was important to prevent the green economy label from justifying environmentally risky growth.

Data integration was conducted through a joint display. Quantitative indicators were first used to identify trend direction and sectoral potential. Qualitative themes were then used to explain why some potentials remained unrealized and what institutional conditions were needed to scale them. When both data types converged, the finding was treated as a strong basis for policy recommendation. When they diverged, the divergence was interpreted as a governance problem, such as the gap between renewable energy potential and limited public investment. This procedure strengthens the mixed methods logic and reduces the risk of presenting interviews and statistics as separate evidence streams.

Table 2. Operationalization of Concepts, Indicators, and Data Sources

Conceptual dimension	Operational indicators, question aspects, and sources
Landscape pressure	Quantitative indicators: extractive GRDP share, economic growth, SDG 7 and SDG 13 indicators. Qualitative focus: how climate targets, fossil market risks, and SDG gaps affect provincial planning. Sources: BPS, Bank Indonesia, SDR 2025, RPJMD, and interviews.
Regional regime	Quantitative indicators: coal contribution, fiscal allocation, and institutional planning instruments. Qualitative focus: institutions and interests that sustain fossil dependence and coordination barriers. Sources: Bappeda, ESDM, RPJMD, RUED, IESR, and WRI.
Niche innovation	Quantitative indicators: renewable energy investment, installed capacity, green industries, and renewable energy villages. Qualitative focus: local sectors and innovations that can grow into green economy alternatives. Sources: IESR, WRI, Bappeda, and sectoral plans.
Justice-oriented strategy	Quantitative indicators: green jobs, MSMEs at risk, and sectoral absorption potential. Qualitative focus: income risks, training, financing, and participation mechanisms. Sources: BPS, WRI, interviews, and policy documents.

Source: Authors' Elaboration

RESULTS AND DISCUSSION

The findings are presented in four integrated parts. The first part reports the main quantitative and qualitative results, including the empirical data from the previous draft that remain relevant. The second part maps priority non-extractive sectors through a joint display. The third part interprets the findings using the multi-level perspective (MLP), political economy, and energy justice. The fourth part links the findings with SDG 7, SDG 8, SDG 9, and SDG 13 to strengthen policy relevance.

Key Findings from Quantitative and Qualitative Data

First, South Sumatra shows early diversification, but the shift remains slow. The extractive sector share declined from 26.1% in 2019 to 24.6% in 2023, while the non-extractive share increased from 73.9% to 75.4%. This shift indicates a diversification opportunity, but it has not yet changed the main regional regime because coal, oil, and gas remain important for fiscal revenue, employment, and local business linkages (Badan Pusat Statistik (BPS), 2025b; Bank Indonesia, 2025; Pemerintah Provinsi Sumatera Selatan, 2025).

Second, renewable energy investment and capacity show a niche innovation pattern. Total renewable energy investment reached Rp1.2 trillion during 2020-2024. Rooftop solar PV capacity reached 3.8 MW as of September 2024, biomass and biogas capacity reached 12.5 MW, and micro-hydro potential was estimated at 85 MW. The province also targeted an additional 5 MW of solar PV capacity in 2025 for public ser-

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Table 3. Investment, Capacity, and Green Economy Indicators in South Sumatra

Indicator	Value, analytical meaning, and source
Total renewable energy investment	Rp1.2 trillion accumulated during 2020-2024. Analytical meaning: early commitment, but still modest compared with transition needs. Source: ESDM South Sumatra and IESR (2024).
Installed rooftop solar PV capacity	3.8 MW as of September 2024. Analytical meaning: early decentralized energy adoption. Source: IESR and PLN South Sumatra (2024).
Installed biomass and biogas capacity	12.5 MW, concentrated in Musi Banyuasin and Lahat. Analytical meaning: links plantation and agricultural residues with clean energy potential. Source: ESDM South Sumatra (2024).
Micro-hydro potential	85 MW technical potential, mostly untapped. Analytical meaning: requires project preparation, private partnership, and local technical capacity. Source: IESR (2024).
Targeted solar PV capacity addition	5 MW in 2025, focused on public service sectors. Analytical meaning: can strengthen SDG 7 implementation in health and education facilities. Source: RPJMD South Sumatra (2025).
Green industries	42 registered industries across palm oil, coffee, waste processing, and manufacturing. Analytical meaning: early formation of a green industrial ecosystem. Source: Bappeda South Sumatra (2025).
Renewable energy villages	19 active villages using solar PV, biogas, and micro-hydro technologies. Analytical meaning: community-scale niche innovation. Source: Bappeda South Sumatra and WRI Indonesia (2025).
Estimated green jobs	Approximately 3,200 workers. Analytical meaning: still emerging and needs stronger training and labour transition programs. Source: WRI Indonesia (2025).
Green project proposals	27 active proposals seeking funding. Analytical meaning: requires bankability support and a provincial project pipeline. Source: Bappeda South Sumatra (2025).

Source: (Bappeda Sumatera Selatan, 2025; Dinas Energi dan Sumber Daya Mineral Provinsi Sumatera Selatan, 2025; IESR, 2024, 2025; Pemerintah Provinsi Sumatera Selatan, 2025; WRI Indonesia, 2025)

vice sectors such as health and education. These figures show that clean energy projects have started, but they remain far below the technical potential and the scale needed for structural transformation (IESR, 2024, 2025; PLN, 2025).

Third, fiscal and institutional readiness remains limited. Interview data indicate that the 2025 provincial budget allocation for clean energy programs was only Rp500 million, with most of the allocation directed to outreach and feasibility studies rather than infrastructure. This confirms that the transition barrier is not only technological. It also relates to budget design, project bankability, coordination capacity, and the political influence of incumbent extractive actors (Bappeda Sumatera Selatan, 2025; Goldthau et al., 2020; Newell & Mulvaney, 2013).

Fourth, a green economy ecosystem has begun to form, although it remains fragmented. The previous draft recorded 42 green industries, 19 active renewable energy villages, approximately 3,200 green jobs in clean energy and green industries, and 27 green project proposals under review through the South Sumatra Regional Energy Forum. These data strengthen the revised argument that the province is not starting from zero. It already has scattered initiatives that need institutional integration, financing, and measurable sustainability indicators (Bappeda Sumatera Selatan, 2025; WRI Indonesia, 2025).

Table 4. Joint Display of Priority Sectors, Indicators, Constraints, and Policy Implications

Priority sector	Indicator basis, constraint, and policy implication
Coffee	Indicator basis: Lahat and Pagar Alam resource base, downstream processing, agroforestry, and MSME potential. Constraint: limited processing technology, branding, export readiness, and farmer finance. Policy implication: develop coffee downstream clusters, green certification, cooperative finance, and agroforestry-based branding.
Rubber	Indicator basis: large smallholder base, derivative product potential, and residue potential. Constraint: price instability, weak processing capacity, and limited diversification. Policy implication: promote rubber-based processing, circular economy products, and cooperative market access.
Palm oil-based bioenergy	Indicator basis: large plantation base, waste feedstock, and biomass or biogas fit. Constraint: sustainability risks, logistics cost, and conversion technology gaps. Policy implication: prioritize waste-based bioenergy, safeguards, and public-private biomass facilities.
Fisheries	Indicator basis: alternative income source in coastal and riverine areas with MSME linkages. Constraint: cold-chain limits, market access, and weak integration with green investment. Policy implication: improve cold-chain infrastructure, fisheries MSME finance, and local processing centers.
Nature-based tourism	Indicator basis: Lake Ranau, Bukit Serelo, Pagar Alam forests, and post-mining tourism potential. Constraint: infrastructure limits, skill gaps, and carrying-capacity risks. Policy implication: develop ecotourism standards, guide training, digital promotion, and post-mining conservation sites.
Renewable energy services	Indicator basis: rooftop solar PV, biomass and biogas, micro-hydro potential, and renewable energy villages. Constraint: limited fiscal support, project bankability, and technical workforce. Policy implication: create solar and biomass training, green procurement, and a regional project pipeline.

Source: Authors analysis based on BPS, Bappeda South Sumatra, IESR, WRI Indonesia, Bank Indonesia, and regional planning documents

Fifth, social dependence on coal-related activities creates a just transition challenge. In mining regions such as Muara Enim and Lahat, approximately 1,200 small businesses rely on coal-linked activities, including boarding houses, food stalls, transportation services, and local trade. A transition strategy that ignores these actors may create income loss and social resistance. Therefore, worker reskilling, green MSME financing, and post-mining land repurposing must become core policy components (Badan Pusat Statistik (BPS), 2025a; Carley & Konisky, 2020; Jenkins et al., 2016; McCauley & Heffron, 2018).

Priority Non-Extractive Sectors and Local Green Economy Pathways

The priority sector analysis integrates the sectoral data, stakeholder interviews, and green economy criteria explained in the method section. The most feasible non-extractive sectors are coffee, rubber, palm oil-based bioenergy, fisheries, nature-based tourism, and renewable energy services. These sectors were selected because they meet at least three criteria: local resource endowment, employment or MSME absorption, compatibility with green economy principles, and policy or investment feasibility.

Coffee has the strongest local green economy profile, especially in Lahat and Pagar Alam. It has value-added potential through downstream processing, local branding, export markets, agroforestry, and smallholder empowerment. Rubber and palm oil also remain important, but their green contribution depends on

circular economy strategies, waste-based bioenergy, sustainability safeguards, and better processing capacity. Fisheries can diversify income in coastal and riverine areas, while nature-based tourism can connect Lake Ranau, Bukit Serelo, Pagar Alam forests, and post-mining sites with conservation-oriented economic activity.

The previous draft's discussion on post-mining land remains relevant and has been integrated here as a policy pathway. Post-mining areas in Muara Enim, Lahat, and Musi Rawas can be repurposed into renewable energy hubs, energy farming zones, conservation spaces, ecotourism sites, and green training centers. Possible schemes include biomass co-firing using agricultural and forestry residues, energy farming with kaliandra, gamal, and elephant grass, and mine-site ecotourism through geological parks or energy arboretums. This pathway links environmental restoration with new income sources for affected communities.

Green MSMEs are central to this transition because many coal-linked micro-businesses need practical alternatives. Potential activities include organic fertilizer production from agricultural waste, household-scale coffee and rubber processing, rooftop solar PV installation and maintenance services, biomass cooperatives, and community-based ecotourism. These activities support the energy justice principle because they recognize affected groups, create participation channels, and distribute transition benefits more fairly (Carley & Konisky, 2020; Jenkins et al., 2016; Sovacool et al., 2019).

Institutional Readiness, Actor Perceptions, and Social Dynamics

The qualitative findings from Bappeda South Sumatra, IESR, and WRI Indonesia show that institutional readiness remains partial. Bappeda has supported the transition through RPJPD, RPJMD, RPRKD, and the Regional Consultation Forum. Since 2023, the forum has involved more than 30 institutions, including government agencies, media, universities, NGOs, industry associations, and community groups. The forum functions as a deliberative space for sustainability indicators, transition scenarios, and priority sector identification (Bappeda Sumatera Selatan, 2025).

Despite this progress, the Regional Energy Plan still refers to the 2020 version and has not fully aligned with the NZE 2060 target. Interview findings point to three repeated constraints: limited sectoral data, frequent staff rotation across agencies, and the absence of a dedicated provincial energy transition unit. These constraints explain why policy commitments have not yet become a coordinated project pipeline.

IESR emphasizes South Sumatra's potential in bioenergy, rooftop solar PV, and micro-hydro, but also notes weak fiscal incentives, the absence of regional feed-in tariffs, and resistance from coal-linked actors. WRI Indonesia highlights spatial justice and social inclusion because South Sumatra is one of Indonesia's major coal-producing provinces. Both institutions point to the same policy need: the province must combine technical planning with financing instruments, participation mechanisms, and protection for affected coal-linked communities.

Community-level findings also support this interpretation. Coffee farmers, biomass cooperatives, renewable energy villages, and green MSME actors show that local initiatives already exist. However, they need energy literacy, access to technology, financing, market access, and stronger coordination. This finding connects the old discussion on community participation with the revised theoretical framework. It shows that niche innovation will remain small unless the regional regime creates rules, budgets, and institutions that allow it to scale.

MLP Interpretation: Landscape, Regime, and Niche Dynamics

The MLP clarifies why South Sumatra's transition remains gradual. At the landscape level, the province faces pressure from Indonesia's NZE 2060 target, global decarbonization, SDG performance gaps, fossil commodity volatility, and investor attention to low-carbon development. These pressures create a policy rationale for diversification, but landscape pressure alone does not automatically change the regional economy (Geels, 2002; Geels, 2011; Markard et al., 2012).

At the regime level, South Sumatra's coal-based economic structure, fiscal expectations, established infrastructure, employment linkages, and coal-related MSME ecosystem sustain fossil dependence. This regime shapes budget priorities and limits risk-taking in renewable energy investment. The small clean energy budget and the dominance of feasibility activi-

Table 5. Alignment between South Sumatra Findings and SDG Dashboard Indicators

SDG	Benchmark, evidence, and policy response
SDG 7	Dashboard benchmark: access to electricity, clean cooking, renewable energy share, and CO2 from electricity output. South Sumatra evidence: solar PV, biomass, biogas, renewable energy villages, and micro-hydro remain at an early capacity stage. Policy response: set annual installed-capacity targets, prioritize public buildings and villages, and expand community-scale energy projects.
SDG 8	Dashboard benchmark: financial inclusion, unemployment, and labour rights. South Sumatra evidence: coal-linked MSMEs face income risk, while green jobs remain emerging. Policy response: use green MSME finance, worker reskilling, cooperative models, and downstream commodity clusters.
SDG 9	Dashboard benchmark: internet users, mobile broadband, infrastructure quality, research, and innovation. South Sumatra evidence: digital promotion, logistics, and project preparation are needed for tourism, coffee, fisheries, and renewable energy. Policy response: strengthen digital marketing, innovation hubs, technical training, and project bankability support.
SDG 13	Dashboard benchmark: CO2 emissions from fossil fuel combustion and cement production. South Sumatra evidence: coal dependence remains a regional regime and post-mining land requires productive restoration. Policy response: repurpose post-mining land and embed emission-reduction indicators in RPJMD and RUED.

Source: Authors analysis based on the Sustainable Development Report 2025 and South Sumatra empirical findings.

ties over infrastructure confirm the political economy argument that incumbent interests can slow structural transformation (Baker et al., 2014; Goldthau et al., 2020; Newell & Mulvaney, 2013).

At the niche level, the province has several emerging innovations: rooftop solar PV, biomass and biogas projects, micro-hydro proposals, renewable energy villages, green industries, coffee agroforestry, green MSMEs, and nature-based tourism. These initiatives are small but strategic. They can challenge the fossil regime if policy support improves, financing becomes accessible, and local communities gain technical capacity. South Sumatra is therefore in a niche accumulation phase, not yet in a full regime shift phase.

Energy justice strengthens this interpretation. The transition may impose costs on mining-dependent communities if policy focuses only on renewable capacity. Recognition justice requires identifying workers, MSMEs, and households linked to coal activities. Procedural justice requires their participation in planning. Distributional justice requires training, financing, infrastructure, and new markets. These principles justify the emphasis on green MSMEs, post-mining land use, and community-based renewable energy.

SDG Alignment and Policy Relevance

The SDG Index and Dashboard strengthens the policy relevance of the findings. The Sustainable Development Report 2025 places Indonesia at rank 77 of 167 countries, with an SDG Index score of 70.22. This benchmark does not replace regional data, but it helps interpret why South Sumatra's transition should connect energy, jobs, innovation, and climate policy (Sachs et al., 2025).

For SDG 7, South Sumatra's policy relevance lies in increasing renewable energy capacity and decentralized energy access through rooftop solar PV, biomass, biogas, and micro-hydro. For SDG 8, green job creation must focus on MSME upgrading, worker reskilling, and downstream processing in coffee, rubber, fisheries, and tourism. For SDG 9, digital promotion, logistics, innovation hubs, and project bankability are needed to make non-extractive sectors competitive. For SDG 13, the province

must reduce fossil dependence through post-mining land restoration, renewable energy expansion, and emission-reduction indicators in RPJMD and RUED.

The SDG comparison shows that South Sumatra's transition strategy should not be limited to energy infrastructure. SDG 7 requires more renewable capacity and better access, but SDG 8 and SDG 9 require labour absorption, MSME upgrading, innovation capacity, and infrastructure readiness. SDG 13 requires emission reduction and productive restoration of degraded land. This means that the province should evaluate green projects through multiple indicators at once. A solar project, for instance, should be assessed not only by installed capacity, but also by local employment, maintenance skills, village participation, and contribution to public services. This integrated SDG reading responds to the reviewer concern by using the dashboard as a benchmark for policy improvement rather than as a decorative reference.

Policy Strategies

First, South Sumatra should establish a Regional Energy Transition Unit under Bappeda or the Energy and Mineral Resources Office. This unit should coordinate data, project preparation, inter-agency planning, stakeholder participation, and SDG-linked monitoring. This is the most urgent step because fragmented coordination appears across all qualitative findings.

Second, the province should develop a concrete action roadmap integrated with RPJMD and RUED. The roadmap should include annual renewable energy capacity targets, priority non-extractive sectors, green job targets, post-mining land priorities, and SDG-linked indicators. This roadmap would translate broad sustainability language into measurable programs.

Third, the government should introduce green financing instruments. These can include regional green bonds, blended finance, tax incentives for green MSMEs, public-private partnerships, and project preparation facilities for biomass, solar PV, and micro-hydro. Financing reform is needed because the current budget is insufficient to move from feasibility studies to infrastructure.

Fourth, post-mining lands should be repurposed for energy farming, biomass facilities, conservation zones, ecotourism, and green training centers. This strategy connects environmental restoration with employment creation and can reduce resistance from coal-dependent communities.

Fifth, public participation and energy literacy should be expanded through schools, village forums, cooperatives, and MSME training. Energy transition will gain stronger legitimacy when affected communities can see concrete income opportunities and take part in project design.

Implementation should follow a clear sequence. In the short term, the provincial government should update RUED, create a transition data dashboard, and map coal-dependent workers, MSMEs, and post-mining lands. In the medium term, it should build a bankable project pipeline for rooftop solar PV, biomass, biogas, micro-hydro, coffee downstream clusters, fisheries processing, and ecotourism. In the longer term, fiscal instruments should reward districts that reduce extractive dependence and expand measurable green jobs. This sequence is important because South Sumatra cannot shift directly from fossil dependence to a mature green economy. It needs a managed pathway that protects affected communities while allowing niche sectors to grow.

The most urgent policy priority is the creation of a dedicated coordination unit and an integrated action roadmap. These two steps are prerequisites for the other strategies. Without a unit, no institution has a clear mandate to combine sectoral data, investment preparation, social protection, and SDG monitoring. Without a roadmap, green economy programs may remain fragmented across agencies. The roadmap should include annual targets, responsible agencies, funding sources, monitoring indicators, and mechanisms for public consultation. It should also separate low-risk actions, such as public-building solar PV and energy literacy, from more complex actions, such as post-mining land conversion and green bonds.

CONCLUSION

This study answers the research objective by showing that coffee, rubber, palm oil-based bioenergy, fisheries, and nature-based tourism are the most feasible non-extractive sectors for supporting South Sumatra's green economy transition, while renewable energy services provide an enabling sector for clean-energy expansion. These sectors are feasible because they combine local resource endowment, employment and MSME potential, value-added oppor-

tunities, and partial policy support. The study also finds that the main transition barrier is not only technical capacity, but the persistence of a coal-based regional regime, fragmented coordination, limited fiscal incentives, weak green financing instruments, and livelihood dependence among coal-linked communities. Through the MLP, landscape pressure comes from NZE 2060, SDG gaps, fossil market risk, and climate commitments; the regime is sustained by extractive revenue, infrastructure, and incumbent interests; and the niche level consists of renewable energy villages, bioenergy, coffee agroforestry, green MSMEs, and ecotourism. The most urgent provincial policy steps are to establish a dedicated regional energy transition unit and integrate a measurable action roadmap into RPJMD and RUED, supported by green financing, post-mining land repurposing, worker reskilling, and community energy literacy. The scientific contribution of the article lies in integrating MLP, political economy, and energy justice to analyze subnational transition in a resource-dependent province. The main limitation is the restricted number of institutional informants, which limits the breadth of actor representation. Future studies should involve coal firms, village governments, MSMEs, farmer groups, workers, and affected households, and should combine regional input-output analysis with household-level livelihood data to estimate the distributional effects of transition more precisely.

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