Energy, Environmental Justice, and Sustainable Development in Emerging Economies

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ABSTRACT

Energy systems are central to economic development and social wellbeing, yet in many emerging economies they continue to reproduce environmental harm, social inequality, and exclusion. While energy transition policies increasingly promote renewable technologies, insufficient attention is paid to the social justice implications of energy governance. This article examines the relationship between energy governance, environmental justice, and sustainable development in emerging economy contexts.

Adopting a qualitative doctrinal and socio-legal methodology, the study analyses legal frameworks, policy instruments, and regulatory practices governing energy transitions. Drawing on energy justice and environmental justice scholarship, the article demonstrates how existing regimes often prioritise economic efficiency and technological advancement over equity, participation, and accountability. As a result, marginalised communities disproportionately experience energy poverty, environmental degradation, and exclusion from decision-making processes. Using illustrative cases from selected emerging economies, the analysis shows how this justice deficits materialise in practice under conditions of fiscal constraint, investor dependence, and uneven governance capacity.

The article advances a justice-centred analytical framework for evaluating energy transitions and translates this framework into concrete policy tools and regulatory benchmarks in emerging economies. It argues that sustainable development objectives cannot be achieved without embedding distributive, procedural, and recognition-based justice within energy law and policy. The analysis generates policy-relevant insights for regulators and policymakers seeking to operationalise inclusive and socially responsive energy systems under conditions of fiscal constraint and political economy pressure.

Keywords: Energy Governance; Environmental Justice; Energy Justice; Sustainable Development; Emerging Economies; Socio-Legal Analysis; Public Policy.

INTRODUCTION

Energy systems play a crucial role in enhancing human well-being and enabling economic growth and development. At the same time, they exert profound impacts on ecosystems, public health, and the global climate. Contemporary energy systems are evolving through interconnected energy transitions and development trajectories that generate legal, health, environmental, and social benefits, while also producing significant challenges. These challenges include unequal access to energy, local pollution, greenhouse gas emissions, and unplanned waste generation. Such impacts disproportionately affect low-income and marginalised populations and pose significant threats to the achievement of the United Nations Sustainable Development Goals. Developing countries face a persistent dilemma between pursuing economic growth to alleviate widespread poverty and ensuring that energy transitions are environmentally sustainable and socially just (Bridge et al., 2018).

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some countries have succeeded in partially aligning growth and sustainability objectives within their energy and environmental policies, others experience a growing tension between development imperatives, fiscal limitations, and social equity concerns. These divergent trajectories demonstrate that opportunities and constraints vary significantly across emerging economies, shaped by institutional capacity, investment dependence, and political priorities.

Policy choices made in rapidly industrialising contexts therefore have long-term implications for equitable climate action. Such choices may enable governments to align growth, equity, and climate objectives, or alternatively undermine climate commitments and exacerbate social inequalities. Within this context, a growing body of scholarship examines the relationship between energy transitions and environmental justice in emerging economies, identifying policies capable of advancing economic growth, social equity, and climate mitigation simultaneously.

Importantly, these governance challenges do not arise in a political or economic vacuum. Emerging economies frequently operate under severe fiscal constraints, high debt burdens, and dependence on foreign investment, which shape regulatory priorities and limit redistributive capacity (World Bank, 2017; UNCTAD, 2020). Energy policies are therefore often designed to maximise investment attractiveness and cost recovery, sometimes at the expense of affordability, participation, and social protection (Newell and Mulvaney, 2013; Sovacool, 2016). Recognising these political economy constraints is essential to understanding why justice commitments embedded in policy rhetoric frequently fail to translate into practice (Heffron and McCauley, 2017; Knox, 2018).

Conceptual Framework

Theoretical perspectives on energy transitions, development trajectories, and environmental justice provide a critical framework for analysing the energy and environment nexus in emerging economies. Energy transitions, understood within sustainability and justice paradigms, highlight the nature and consequences of transformations in energy systems at both global and local levels. Although multiple transition pathways are essential to sustainable development, these pathways must be responsive to diverse socio-political and institutional contexts.

Internationally, established typologies of development trajectories reflect variations in resource endowments, sectoral priorities, governance arrangements, fiscal capacity and policy choices. Within emerging economies, trade-offs between economic growth, social inclusion, and environmental protection complicate development planning. These trade-offs are further shaped by investor interests, infrastructure lock-in, and the distribution of political power.

Justice within energy systems can be understood across four interrelated dimensions: distribution, recognition, procedure, and capabilities. Together, these dimensions provide an analytical lens for assessing access, affordability, quality of service, and exposure to environmental externalities. Technocratic approaches that focus narrowly on distribution often neglect the importance of recognition, while agency-based models privilege individual capabilities without sufficient attention to collective recognition. Procedural justice frameworks that focus exclusively on participation risk overlooking deeper issues of legitimacy and power. Broader conceptualisations emphasise not only decision-making processes but also alternative energy imaginaries and the legitimacy of energy systems themselves (Siciliano et al., 2018).

This analytical framework links environmental justice dimensions to specific energy and development choices. Energy access, understood as meaningful connection to formal energy systems, represents a foundational requirement for governments committed to providing affordable and reliable energy services. Such access is shaped by broader governance and socio-technical arrangements rooted in historical, institutional, and political economy contexts (Jenkins et al., 2018).

To enhance analytical clarity, this article treats the four justice dimensions distribution, procedure, recognition, and capabilities not as competing concepts but as mutually reinforcing lenses through which energy governance outcomes can be evaluated. This integrated approach avoids the limitations of single dimension analyses and provides a coherent structure for assessing how legal and policy choices shape access, participation, legitimacy, and human well-being across different energy systems.

Energy Transitions and Development Trajectories

Energy transitions involve systematic transformations of energy systems, including shifts in fuel sources, technologies, and modes of service provision. Emerging economies follow diverse development trajectories shaped by differing economic structures, governance capacities, and social priorities. Energy justice reinforces principles of equity, diversity, and self-determination, which are central to human well-being and sustainable development within ecological limits (Jenkins et al., 2018).

Sustainable development incorporates climate change mitigation and adaptation, intergenerational equity, recognition of indigenous rights, gender equality, and poverty reduction. Poverty, climate vulnerability, and energy insecurity highlight the deep interconnections between energy systems and social justice. Although socio-technical transitions have received increasing scholarly attention, energy justice remains insufficiently integrated into analyses of the fairness and legitimacy of these transformations.

Although energy transitions are increasingly framed as pathways to sustainability, justice considerations remain unevenly integrated. Governments frequently adopt transition narratives that prioritise supply security, investor confidence, and cost efficiency, sometimes at the expense of social inclusion. As a result, energy transitions may reproduce existing inequalities rather than resolve them. (Biswas et al. 2022; IRENA 2026).

Environmental Justice: Definitions and Dimensions

Environmental justice addresses inequities in the distribution of environmental burdens and benefits. It encompasses four dimensions: the distribution of environmental harms and goods; recognition of marginalised communities; fairness in decision-making processes; and empowerment of those lacking the means to exercise rights (Jenkins et al., 2018). Energy Justice applies the Environmental Justice framework to critically assess interactions and inequities in energy systems worldwide. Energy Justice comprises the same four dimensions as Environmental Justice: (1) access to energy resources and services; (2) acknowledgment of the rights and identities of energy users and non-users; (3) participation in energy-related decision processes; and (4) advancement of capabilities to and through energy (Ren et al., 2023).

Sustainable Development Goals and Policy Coherence

The 2030 Agenda for Sustainable Development emphasises the interdependence between the economy, society, and the environment (Kettner et al., 2019), and the need for coherent policies that advance simultaneously the SDG objectives and targets across different sectors (OECD, 2015). The concept of policy coherence for sustainable development can generally be defined as "the systematic promotion of mutually reinforcing actions at all levels, in order to benefit the triple bottom line: economic growth, social inclusion, and environmental sustainability" (OECD, 2015). For emerging economies, achieving coherence is particularly challenging given institutional fragmentation, fiscal constraints, and competing development priorities. Such coherence is particularly relevant in the context of the SDGs because of their interconnected and indivisible nature. Policy coherence and the establishment of integrated multi-sectoral strategies are therefore essential to avoid policy trade-offs that undermine long-term sustainability. A wide range of conceptual approaches for understanding coherence and for assessing cross-sectoral interlinkages has been proposed, across various contexts (Carvalho and Spataru, 2018).

Energy Access and Equity in Emerging Economies

This section moves from conceptual framing to substantive governance challenges, illustrating how justice concerns arise across electrification pathways, affordability regimes, and service quality in emerging economies. Access to energy is a prerequisite for equitable socioeconomic development in emerging economies. Large populations in emerging economies remain unserved or underserved by electricity networks, especially in rural and peri-urban areas. These countries increasingly adopt different electrification pathways reflecting diverse stages of urbanization, economic development, governance capacity, infrastructure investment, and political priorities. Globally, 2.8 billion people rely on solid fuels to meet their cooking needs, causing indoor air pollution and associated health damage.

Affordable energy services depend not only on physical access but also on consumption levels, prices, reliability, and service quality. Tariff structures, subsidies for grid extension and off-grid solutions which account for 50–90% of connections, and regulatory oversight play a decisive role in shaping who benefits from energy systems and who remains excluded. Energy access also intersects with social dynamics, including gender inequalities and other socioeconomic, geographic, and infrastructure-related vulnerabilities, reinforcing broader patterns of disadvantage (Harper-Dorton and Harper, 2015).

Electrification Pathways and Rural Connectivity

Electrification has remained a key topic for emerging economies, as electricity represents one of the main enablers of economic development, social cohesion, and poverty eradication. Electricity is still a rarity in rural areas, especially in sub-Saharan Africa and South Asia. The pace of connections continues to fall short of national targets. Large network extensions into sparsely populated areas are challenging, and a myriad of technical, social, and regulatory barriers plague electricity access improvements in rural settings.

Electricity access in the urban and rural population remains a prerequisite for the basic services provision in emerging economies. National electrification plans predominantly follow two pathways in emerging economies. The "centralized" concept envisions coverage through a national grid extension. For countries preferring a "decentralized" approach, national electrification plans are formulated around off-grid and mini-grids solutions, or regional, and locality (town) networks based on local resources. Hybrid technologies combining renewable distributed generation and storage with system interfaces to conventional grid supply are technically feasible and economically viable options, especially for areas with very low access rates (Conejo, 2017).

Affordability, Reliability, and Quality of Service

Despite decades of policy attention, more than six billion people lack access to reliable electricity, and this once seemingly temporary situation has not changed substantially since 1970 (Ahuja and Tatsutani, 2009). Developing countries face a dual challenge: providing access to basic energy services for billions who still lack them and transitioning to clean, low-carbon energy systems. As countries strive to satisfy basic human needs and encourage economic and social development, energy access remains a global issue. The particular focus on access to electricity emerges from the recognition that prowess in the modern economy is inextricably linked to electricity use and that electrification constitutes one of the fundamental socio-technical transitions for communities (Hostettler, 2017). Moreover, low access to modern energy hampers the ability for households and communities to build capital assets, perpetuating a cycle of poverty. Supply shortages, high prices, unreliable service, and poor quality hinder the ability of millions to realise long-desired aspirations to modernity. Improving affordability, reliability, and service quality therefore remains a central challenge across emerging economies (Hostettler, 2017).

Gender, Vulnerability, and Inclusive Access

Access to energy services differs markedly across income levels, reflecting enduring inequities within energy provisioning (Asian Development Bank, 2018). Generally, higher income consumers benefit from a full range of energy services, while low-income households often rely on traditional biomass for cooking and candles for lighting (Haag, 2017). Energy poverty disproportionately affects women, rural populations, and low-income households, as these groups are more likely to experience limited access to modern energy services and bear the social and health burdens associated with energy deprivation (IEA, 2017; UN Women, 2020). Such energy poverty hinders opportunities for improved livelihoods, health, and well-being, perpetuating intergenerational cycles of deprivation.

Many emerging economies prioritise electrification as a cornerstone of their economic strategy, but the way these systems are designed and operated can either minimise energy poverty or exacerbate it. Without explicit recognition of social vulnerabilities in energy planning, electrification efforts risk reinforcing existing inequalities rather than alleviating them (Sovacool et al., 2019). Energy including electricity, cooking fuels, transportation fuels, and heat, as well as associated affordable appliances represents both an end use product and

an essential input to productive economic activity. Addressing energy as a commodity, equitable access to energy services incorporates many dimensions, such as affordability, reliability of supply, and delivery to the home.

Equitable access to energy services, such as electricity provision within and across social groups including urban and rural markets, social franchises or humanitarian networks, and women, youth, and the extremely poor helps to improve individual, community, and gender equity outcomes. Inclusive energy governance therefore requires targeted measures addressing affordability, participation, and representation across social groups, particularly for those historically marginalised in energy decision making processes (Clancy et al., 2012; World Bank, 2021). Although equal access to energy is widely recognised as vital for driving economic and social development, inequality in access to energy remains pervasive in developing economies.

Without disadvantaged groups and vulnerabilities are properly recognised during the planning and scaling of energy systems, persistent inequality in energy access among different segments of society is likely to hinder pathways to employment creation and poverty alleviation through energy. Understanding the energy needs of various social groups will create a positive impression on vulnerable people's daily lives and will directly or indirectly contribute to improved employment and income outcomes. Such diverse energy social-understanding initiatives strengthen both energy planning and gender-equality requirements, also covering the gender and generational gaps in energy sector decision-making.

Environmental Impacts and Justice Implications

Access to clean and modern energy has been widely acknowledged as a prerequisite for sustainable growth and equitable development. However, it is not sufficient to ensure that development is both sustainable and equitable. An empirical account of environmental justice dimensions in energy systems can provide crucial insights that fill this knowledge gap and draw attention to vital issues that warrant explicit consideration in the policy discourse-accompanying aspirations for universal electricity access. Accordingly, energy systems have direct and indirect environmental impacts that influence health and livelihoods, both of which are intimately connected with national ambitions for growth, transformation, and development, particularly in emerging economies (Eisen and Welton, 2019). The socio-physical impacts of energy systems and infrastructure are often considered rather crudely, if at all (Finley-Brook and Holloman, 2016). Ground-level pollutants still kill more than four million people each year, and most of these premature deaths occur in low- and middle-income countries (World Health Organization, 2021). Emerging economies remain committed to decades of fossil extraction and are grappling with the concomitant health, economic, and climate damages, especially in fossil-intensive regions. Consequently, analyses of international climate finance for energy transitions overlook important distributional issues associated with the local burdens stemming from current energy systems. Overcoming the dramatically high extraction of fossil fuels, solid fuels, and minerals, currently four to six times historical levels and related development traps remains a formidable challenge. Experience with resource booms, particularly fossil fuels, indicates that such extensive extraction puts unwarranted strains on development trajectories and reduces the likelihood of achieving human development targets, including universal access to modern energy.

Together, these environmental impacts demonstrate that energy injustice is not an unintended side-effect of development but a predictable outcome of governance arrangements that prioritise extraction, efficiency, and short-term growth over health, livelihoods, and intergenerational equity.

Local Pollution, Health, and Livelihoods

Various modes of energy production cause significant local pollution, resulting in severe environmental and health hazards for affected populations while compromising their means of subsistence (Finley-Brook and Holloman, 2016). These issues are particularly pressing in areas dependent on fossil energy sources and extractive industries, such as mining. Environmental injustices in both access to and the impacts of energy systems interact with processes of globalisation that affect the workings of global markets and governance yet may also provide opportunities for change. The disproportionate burden of environmental pollutants has adverse consequences for vulnerable groups. Local pollutant emissions from energy systems harm health and livelihood systems, severely affecting marginalised communities living in proximity to energy infrastructures.

Globalisation processes have further intensified these injustices, as the supply chains of fossil fuels penetrate ever deeper into the Global South.

Resource Extraction, Habitat Restoration, and Indigenous Rights

Environmental resource extraction and habitat restoration are critical issues in developing regions were global demand drives extraction of natural resources for commercial production. Water, minerals, and fossil fuels are preferentially allocated to meet industrial demands. High-volume commodity extraction, especially in rainforests, leads to deforestation and habitat alteration. Industrial-scale deforestation disrupts ecosystem functioning and refugee flows, shifted access to resources, and market establishment also fractures indigenous communities' social networks (Cabrera, 2015). The engagement of extractive industries in some of the world's richest forests demonstrates their vital role in fertilizing large-scale global production. Such evidence suggests that a raw commodity-based development framework underwhelmingly sustains human life throughout the industrial of an ecological basis of continuous replenishment. Parallel concerns extend to indigenous people and rights to land and the natural resources they manage (Anderson et al., 2019). National policies on indigenous people tend to reinforce state control over natural resources, while allocation by national authority has, in many parts of the world, pitted beneficial modernisation against veneration for tradition. Desires to control the use of space are especially ambitious for the minority whose highly particularised environmental understanding is preserved in abundant oral traditions. Global commercial procedures routinely deny the chances for local knowledge holders to participate in decision making, while consultation methods if offered usually take place long after venture decisions are made. Preference remains for fuzzy outlines of engagement until necessities for tax revenue bring deductibles clearer (Anthony, 2017).

Waste Management and Circular Economy Opportunities

The rapid rise of the circular economy (CE) poses opportunities and risks for inclusive development in emerging economies. Waste management is a priority at all levels of government in these countries, where resource scarcity, growing urban populations, and land contamination can hinder many social goals. So too is the circular economy, and there is an urgent need for investments to transition from waste management to waste prevention and the maintenance of safe resources in closed loops. Waste-management systems must concurrently address CE objectives and make sectors of society, such as informal waste pickers, visible. Circular economy designs neglect social dimensions at their peril (Halkos and Petrou, 2016).

Financing Mechanisms and Policy Instruments

Under energy transitions, financing mechanisms and policy instruments shape development trajectories. Limited resources constrain state capacity to make significant investments across competing social priorities. Public-private partnerships attract investment, distribute risk, and facilitate project financing for renewable energy and efficiency projects. Financial tariffs generally determine project bankability yet remain neglected in public policy discourse. Striking a balance across cross-subsidisation, recovery ratios, and timeframes is critical in network industries. Policy frameworks worldwide witness shift from generalised subsidies towards differential pricing in social-targeting and net-energy solar–tariffs domain. Climate finance, foreign aid, and domestic resource mobilisation constitute broader external resource inflows. Dissemination of international renewable technology, financing, and institutional building occurs through trilateral co-operation alongside bilateral partnerships, leveraging global-commitment regional-synergy platforms.

Public-Private Partnerships and Risk Allocation

Participatory governance in developing countries is hindered by historical and systemic forms of inequitable access to land, energy, information, credit and finance. Public-private partnerships (PPPs) may indirectly contribute to a more equitable participatory governance and to the capacity deficits related to forms of 'capital' by more flexibly deploying available 'resource' and 'risk' options. The increase of private participants at the government-level contract, regardless of the number of participants downstream, does not diminish the need for equitable access to off-take contracts. Table 2 highlights the linkage and interdependencies between these enabling measures and outline important measures to foster participatory governance (FRONE and Florin, 2013).

The linkages between political participation and resource accessibility for the end-user remain widely unrecognized due to the dominant focus of performance on novel forms technologies. During the early stages of the ICT4D discourse, the way information and communication technology (ICTs) might facilitate greater participation and usher in a 'new' and 'more' participatory form of governance was widely debated. Even though much effort has been put on enhancing the direct forms of participation and the constraints on participation in intergovernmental transactions remain, the characteristics of processes, actors and relationships have received little attention. Preliminary hypotheses indicate that participation does not necessarily widen or deepen when the nature of participants at the governmental side of the equation becomes more diversified, and may even result in unintended detrimental outcomes, e.g. the inclusion of actors from the PPP realm at the forefront aggravates equity considerations (Nel, 2017).

Subsidies, Tariffs, and Targeted Social Protection

Governance often overwhelms local policymakers with so many priorities that basic social protections remain underfunded. Alternatively, the scale and share of subsidies can be reduced, keeping unconditional cash transfers intact. Since energy pricing plays a major role in energy consumption patterns, policies targeted to impoverished populations can thus reduce the consumption of energy while generating fiscal space for other pro-poor programs. Energy subsidies are frequently considered the highest priority for reform. Nevertheless, any subsidy reform that negates existing compensatory measures threatens the welfare of impoverished segments of the population (McLure, 2013).

The deleterious potential of a basic safety net is also apparent in several policies. Continuing subsidies to the social or institutional sectors may be beneficial, but maintaining these at the retail level for household consumption can prove harmful. When an energy network is established, it is common in rural setting for subsidized energy to be supplied to educational or health-related facilities as a vehicle for public patronage to establish ownership of a new product. Heavy public sector investment in energy supply development spurs economic growth, while subsequent mounting pressures on public finance direct attention to tariff pricing and diversification is often promoted on the public service and security grounds. As a proven no-cost mechanism to encourage the efficient use of systems through sector-wide equipment replacement wouldn't fuel significant broader economic expansion, sectors yet to receive energy supply should absorb the priority.

Climate Finance, Aid, and Domestic Resource Mobilization

A combination of international climate finance, international aid, and domestic revenues can promote energy justice by enabling the energy transition in ways that address equity and participation concerns. Emerging economies are major sources of emissions and projections suggest they will become increasingly important for the global provision of mitigation and adaptation finance (Bowen, 2011). Nevertheless, climate finance to emerging economies often focuses on developing climate-resilient projects instead of covering the entire climate finance and adaptation gap (Chelminski, 2022). Some studies show that varying amounts of domestic public finance provision influence the climate finance effort required. The composition of a country's public expenditure can also impact its capacity to attract climate finance for the energy transition.

Technology, Innovation, and Governance for Sustainability

Coherent governance of innovative technology promotes and sustains growth, equity, and resilience in energy transitions. The combination of social considerations with clean generation and energy efficiency is especially relevant for emerging economies. Development goals, both economic growth and environmental goals such as climate change and ecosystem harm mitigation drive investment in cleaner generation technology, grid upgrades, and demand-side improvements such as efficiency and flexibility (Lian, 2024). Advanced and clean technologies, including modern grid infrastructure, promote system connectivity that fosters growth and flexibility without compromising equity. Although emerging economies are attempting to shift investment toward technologies that enhance resilience and hand off supply the responsibility from populations with uneven capacity to elaborate energy transitions, mass deployment of cleaner technologies and adoption of energy-efficiency and flexibility solutions encounter fundamental barriers, including limited resources and crowded time horizons, undergirded by widespread incumbent investment in fossil-fuel and other high-pollution

technology. Individual energy systems make choices to shape overall systems and the relative cost and attractiveness of alternative supply, demand, reduction opportunity; lack of coordination across political units, regions, and mediums are the technical underpinning of systems that frustrates development toward system solutions through the expeditious transformation of clean, renewable, and more efficient energy systems.

Participatory policymaking that encourages citizen engagement enhances equity, promotes effectiveness and flexibility, encourages reciprocity, achieves inclusivity, increases capacity across systems, fosters innovation, enables early-stage learning, and confirms credibility and legitimacy (Hostettler, 2017). Mechanisms that boost surface-level shared-ownership principles within private firms help citizen engagement and enable diverse equity-enhancing projects to proliferate. Securing broad acceptance, processing public input, and elaborating active consideration of public demand bolster legitimacy. Strengthening independent monitoring, increasing transparency, and mandating public disclosure augment responsibility across multiple levels of authority and vulnerability realisation throughout energy transitions. Energy technologies capable of considerable generation scaling, including renewable sources, are already commercially viable; the requisite institutional systems and structural organisation remain less mature.

Renewable Energy Deployment and Grid Modernization

Meeting Sustainable Development Goal 7 through grid modernization and renewable energy deployment can help emerging economies diversify their development trajectories. These interventions may facilitate a wider array of policy choices by promoting sustainability and resilience, thus reinforcing commitments to more equitable and inclusive energy systems. Such trajectories are conducive to better attainment of inclusionary objectives and are instrumental in maintaining compliance with planetary boundaries. Four widening development pathways emerge: (1) efficiency improvements and demand management to alleviate growth-bounding constraints; (2) greater electrification of urban and peri-urban activities to enable more deconcentrated growth; (3) advances in small-scale off-grid solutions and mini-grids with productive uses for rural connectivity; and (4) reserves of fossil energy in abundance allow last-mile service levels without infringing territory, resource, or use rights elsewhere.

Energy systems are shifting globally toward renewable sources to mitigate climate change and air pollution impacts. Intermittent supply characteristics of renewables necessitate grid modernization to manage variable inputs and optimally match supply and demand. Burgeoning intermittency in several emerging economies further elevates the importance of grid enhancements for overall supply reliability and sustainability. Financial constraints commonly hinder investments in grid upgrades and low-carbon technologies; nevertheless, these systems still occupy pivotal roles in widening available development options (Finley-Brook, 2014). Countries such as Botswana, Egypt, Ghana, Kenya, Mozambique, Nigeria, Rwanda, South Africa, and Zambia demonstrate that varying degrees of intermittency coexisted with sustained economic growth, equity improvements, and high-profile investments in fossil infrastructure, underscoring the potential for renewable expansion even when high-capacity grids remain absent (Hostettler, 2017).

Energy Efficiency and Demand-Side Management

Energy efficiency minimizes energy demand and associated costs while maintaining service levels. Demand-side management deploys change management tools on consumption patterns without decreasing satisfaction. Both methods can improve service affordability, accommodate growing volumes, and facilitate integration of intermittent renewable generation (Ahuja and Tatsutani, 2009).

Energy efficiency encompasses architectural design, equipment choice, operational practices, and consumer behaviour. Demand-side management comprises peak-load reduction, permanent load shifting, demand response, energy storage, thermal storage, and real-time pricing. Pertinent cases include automated demand-response systems for lighting or appliances, storage-cooled air conditioning, and two-way charge-discharge electric vehicle techniques (Elizabeth Babatunde et al., 2018).

Participatory Policymaking and Transparent Institutions

Energy is a commodity as well as a social good, and a catalyst for development. In emerging economies, access to energy is therefore considered a developmental priority and connections to electricity grids and systems for distributing energies such as gas and petroleum are of existential importance. The electricity sector remains a crucial sector for connecting rural populations to national development agendas as energy is a prerequisite for all forms of economic activity. However, in many emerging economies, large metropolitan cities contain nearly all the formal supply systems for energy; the outlying areas of these metropolitan cities lack access to energising resources altogether; and the poorer metropolitan urban districts with energy supply systems are nevertheless insufficiently serviced or even overcharged for the services consumed. However, technically viable solutions exist for providing electricity and gas to outlying and poor inner city urban areas, and these parallel developments are taking place elsewhere in the world. Energy/utility access is a crucial concern in which procedural and recognition issues raise fundamental questions of dignity and fairness associated with scarce access. Justice Scholars advocate that access to energy should be treated as a basic human right.

Rapid infrastructural improvements for energy in outlying areas can nevertheless take place without neglecting procedural and recognition issues, and it is therefore timely to present an extensive overview of participatory issues, such as participatory analytics, participatory research, participatory modelling of social and economic futures and technology assessments; participatory decision-making such as strategic interactive decision-making and multi-party negotiations, participatory and inclusive policymaking, and inclusive political and market governance. Such extensive treatments remain scarce for electrical energy systems and associated gas systems in emerging economies.

Case Studies from Emerging Economies

The following section presents analytically illustrative case studies drawn from emerging economy contexts to demonstrate how the justice framework operates in practice. These cases are not intended as exhaustive empirical analyses but as context-specific illustrations of recurring governance dynamics identified in the doctrinal and socio-legal literature. They show how distributive, procedural, recognition-based, and capability-oriented justice concerns materialise under differing institutional, fiscal, and political-economic conditions.

Many emerging economies strive for economic expansion that can feasibly be accompanied by equity considerations. This conundrum often takes the form of pursue-jobs-or-protect-the-planet policy debates. Balancing growth with social equity, planetary health, and climate protection poses formidable governance challenges that are strongly relevant beyond any region. The following analysis of illustrative cases from emerging economies examines whether, and how, it can be accomplished.

Country A exemplifies current efforts to achieve urban-rural electrification and associated equity objectives across a large territory with varied characteristics and long-standing governance challenges. Country B reflects the nation’s pursuit of off-grid energy solutions including pay-as-you-go solar through community-led projects that address hardship and exclusion. The model holds broad promise for similar settings. Country C pursues just-transition policies in fossil-fuel-intensive regions to enhance prospects for economic recovery, social cohesion, and social peace.

The cases include emerging economies that face yet seek to manage extensive poverty and stark inequalities. More broadly, they further elucidate governance dimensions of meaningful energy access and the connection to dignity and power that can assist framing explorations in country contexts outside of the selected cases.

Country A: Urban-Rural Electrification and Justice Outcomes

In Country A, urban and rural electrification through interconnected grid systems has been largely successful, although challenges related to affordability, reliability, and service quality persist. Addressing equity considerations in electricity provision contributes to broader debates on the distributional impacts of energy transitions, the inclusiveness of existing energy systems in delivering justice, and the adequacy of participation mechanisms. These issues are central to wider discussions on the interrelationship between energy, development, and sustainability in emerging economies. A case study approach enables the documentation of local conditions, the identification of relevant justice dimensions, and the articulation of policy lessons with the potential to inform

global theoretical and empirical scholarship on energy and sustainable development within emerging economy contexts.

Rapid urbanisation presents significant challenges for sustainable development and governance in Country A. This process has been accompanied by increasing rural to urban migration, unplanned urban expansion, and persistent deficits in adequate housing and basic services, particularly in peri-urban areas. The government has acknowledged these challenges and their long-term implications for sustainability. As a result, national electrification strategies have prioritised urban and peri-urban areas in both policy formulation and investment allocation (Harper-Dorton and Harper 2015). Despite this emphasis, rural electrification levels remain comparatively low. In 2018, the rural electrification rate in Country A was estimated at 54 per cent, making it the second lowest among member states of the Association of Southeast Asian Nations. In areas where grid extension is not economically or technically viable, off-grid solar technologies have been widely deployed as an alternative means of improving rural energy access (Magnani and Vaona 2014).

This case illustrates how distributive and procedural justice deficits persist even within formally successful electrification programmes when affordability, participation, and service quality are unevenly addressed.

Country B: Off-Grid Solutions and Community-Led Projects

Electricity access can be achieved through a stand-alone solution, mini-grid, or national grid extension. Stand-alone systems such as pico-solar and solar home systems have been widely deployed in low-access countries. Sri Lanka, with over 19,000 stand-alone photovoltaic systems, serves as a classical case. In developing multi-functional pico-system at community level, enter the community led hybrid energy supply systems with electricity generated from renewable resources such as wind, biogas and/or solar PV integrated with diesel generator, which have been adopted in many developing countries. The off-grid, community-based projects are uncommon in India despite many rural electrification programmes.

Energy access initiatives have recognized the need for community participation in policymaking and decision-making. Community- level participation is recommended to design, implement, and maintain energy access systems in rural villages. Community members must actively participate in establishment, system design, technology selection, regulation formulation, and funding acquisition (Sovacool, 2013). Ownership of energy access systems is assigned to communities, which can establish an Energy Access Committee (EAC) to manage systems both collectively and transparently. The EAC, composed of selected village representatives, can acquire land for installation, promote the system, and seek technology and financial assistance. Programs with intensive community involvement can promote sustainability and reduce rural energy issues.

The experience of community-led off-grid projects demonstrates how recognition and capability-oriented justice can enhance system sustainability and social legitimacy when communities exercise meaningful control over energy infrastructure.

Country C: Just Transition in Fossil-Intensive Regions

Fossil fuel extraction constitutes a key pillar of the economy in Country C. Large sections of the population benefit directly from fossil fuel extraction and processing, and local governments are heavily dependent on tax revenues from the fossil sector. These prevailing realities have turned fossil-intensive regions into zones of unrest, with a significant rise of separatist movements, especially in a very fossil fuels-rich province. The staggering economic losses facing fossil-intensive regions due to the worsening energy crisis and the accompanying geopolitical shocks have shaped the collective decision to seek a just transition pathway (McCauley and Heffron, 2019). Crude oil is the lynchpin of the Country C economy, and the social strata holding the power to shape current fossil power reduction debates are closely linked to the oil industry, rendering alignment on a just transition agenda to broaden equitable access to renewable energies and energy-efficient technologies in fossil-dependent localities not only essential but also more politically palatable.

Country C highlights how just transition strategies must navigate entrenched political-economy dependencies on fossil revenues while addressing recognition, livelihood security, and long-term capability development.

Policy Lessons and Normative Implications

Energy transitions largely involve two dimensions: technological transformations that reshape the supply side of energy systems and pathways that facilitate shifts in energy demand patterns and the mix of mandated demand-side measures. Such energy transitions tend to follow specific development trajectories. It is possible to develop and test models that formally outline relationships between energy transitions and such development trajectories; development trajectories with different energy, economy, and development indicators; models that determine conditions for energy transitions; interactions that drive or hinder countries after initial transitions; and decoupling of countries from energy transitions. The analysis can evaluate the environmental and climate effects associated with alternative energy transitions and development trajectories. Energy-system transformations; climate and environmental effects; and links among energy transitions, development trajectories, and energy, economy, and development indicators, among others, also warrant further research.

Normative dimensions guide economic and developmental dimensions in the analysis. The analysis aims to furnish emerging economies with opportunities for sustainable and equitable development while staying within planetary boundaries. The international community should grant such opportunities in provisions on common but differentiated responsibilities, equitable access to development space, and the right to development. The analysis and approach favour compositions of international energy-system transformations; climate, environment, and development liaison; energy-system changes that level off or leave behind existing heavy climate loads; and, especially, development structures that accompany growth without reproducing such loads. Time lags and the condition that a country should not remain dependent on fossil fuel beyond a minimum period led to a preference for composite approaches. The enabling conditions concern policy and governance mechanisms that promote inclusivity (hold possibilities for broad engagement) and equity (offer genuine opportunities for all segments of society). The analysis focuses on the energy-development-justice nexus and the enabling conditions that guide subsequent examination of emerging economies' policy measures within available options (Finley-Brook and Holloman, 2016).

Balancing Growth with Equity

Energy transitions represent structural changes in energy systems of society that relate to sources, carriers, and services. Three interrelated transitions characterise contemporary society transitioning from an energy system dominated by fossil fuels. Energy transitions are analysed at three levels: technology, economy and society. Development trajectories represent the process of improvement in economic, social and environmental conditions of society. They are characterised by population, economy, poverty, and literacy. Emerging economies face simultaneous energy transitions from fossil fuel dominance and development pathways for reducing poverty. Transition path also relates to the degree of justice and sustainability; transition toward a low-carbon decarbonised system can help achieving climate goals and Sustainable Development Goals (SDGs). Transition periods specify focal points for societal changes. Framework of development trajectories geometric mean is used to illustrate country transitions.

Emerging economies and the concept of environmental justice have energy access for urban and rural populations, affordability of services, and availability and quality of energy access for gender and vulnerable groups. Energy systems produce local pollutants from combustion, creating threat to health and natural resources. Justice aspects include access to services, the benefits from energy provision, capability to contribute alternatives and technology transfer. Energy provisioning encompasses availability of source flexible technology, affordability during the transition, less fuel price volatility, reliability supply, quality provision, rural human development and formation, and capability for community or household energy alternative (Hostettler, 2017).

Co-Benefits of Climate Action and Social Welfare

Addressing climate change through greenhouse gas (GHG) reduction is crucial to prevent significant property and ecosystem damages and to reduce hunger, migration, and conflict. People of colour and marginalized groups often have lower adaptive capacity to climate impacts, such as extreme weather, water scarcity, and food insecurity (Finley-Brook and Holloman, 2016). Climate refugees are frequently located in coastal areas

experiencing sea-level rise, where vulnerable populations reside. Climate justice emphasizes the importance of respecting the rights of local communities, including water, resource, worker, and cultural rights. Energy justice, as an instrumental framework, helps identify injustices in energy systems, their impacts, and potential remedies. A comprehensive analysis of energy production and consumption processes, incorporating energy justice concepts and systems thinking, illuminates justice concerns and sociotechnical linkages throughout the energy lifecycle.

In emerging economies, economic growth and poverty alleviation remain dominant priorities that directly shape national development trajectories. Consequently, policy considerations often focus on energy transitions that maximize supply security and affordability, thus enhancing access to electricity and clean cooking. Energy systems significantly impact well-being, causing both positive and negative effects. Localized pollution from fossil fuels, biofuels, and other fuels affects health, labour productivity, and overall quality of life. Such impacts are particularly detrimental to the poor, women, and other marginalized groups. These energy systems also require land and raw materials, and the extraction of resources and ecosystem services can undermine and restrict livelihoods and access to fundamental provisions such as food and water (Rowlands, 2011).

Measurement, Accountability, and Data Gaps

Data concerns hinder accurate identification of governance-induced energy injustices. Energy consumption statistics aggregate derivatives and aggregates for broad socio-economic categories, masking vulnerability indicators of local importance (Ahuja and Tatsutani, 2009). For instance, rural versus urban population shares conceivably influence energy access but vary across sub-national jurisdictions. Yet electricity consumption and demographic classes are aggregated to national averages, enjoyable only by privileged citizens living in regions with reliable access. National statistics denote only broad rural–urban divisions while countries with unevenly distributed energy systems possess diverse rural sub-categories.

Generalized statistics overlook governance and indicator disparities (Mangla et al., 2019). Invested oversight for both qualitative and quantitative statistics is insufficient; publicly prescript standards exist yet, verifying information exactitude remains mechanically unamended by the administration. Urban residential consumption constitutes the sole residential consumption category.

Operationalising Energy Justice: Policy Tools and Benchmarks

To translate justice principles into governance practice, policymakers can employ a set of practical tools aligned with the four justice dimensions (Heffron and McCauley, 2017; Jenkins et al., 2016). Distributive justice can be assessed through affordability thresholds, tariff incidence analysis, and spatial equity indicators (Sovacool et al., 2019; Bouzarovski and Petrova, 2015). Procedural justice can be strengthened through mandatory community consultation standards, accessible grievance mechanisms, and transparency obligations (Newell and Mulvaney, 2013; Arnstein, 1969). Recognition justice requires formal acknowledgment of customary land rights, local knowledge systems, and differentiated vulnerability (Schlosberg, 2007; Temper et al., 2020). Capability-oriented justice can be evaluated through indicators measuring productive energy use, livelihood diversification, and long-term resilience (Sen, 1999; Day et al., 2016).

Embedding these benchmarks within regulatory design, project appraisal, and monitoring frameworks allows justice considerations to shape energy transitions ex ante rather than functioning as post hoc safeguards (Sovacool et al., 2019; Heffron et al., 2021).

CONCLUSION

Sustainable development and poverty alleviation remain central policy goals for emerging economies, but energy systems predominantly relying on fossil fuels expand and entrench inequalities, expose populations to serious health and environmental risks, and compromise future development options. Energy transitions in these contexts have thus been closely associated with equity and environmental sustainability. However, the

implications of energy systems for justice have often received little attention amidst the considerable and growing academic interest in energy transitions and environmental justice, along with the widespread policy emphasis on sustainability. Energy and development literature has also rarely engaged with the concept of environmental justice, precluding exploration of the specific distributional, procedural, cultural, and capability aspects characterizing energy-related inequalities (Finley-Brook and Holloman, 2016). This lack of engagement hampers efforts to address unfair energy outcomes in emerging economies and to advance society-wide climate goals.

By demonstrating how justice deficits emerge from governance choices rather than technological limitations alone, the article reframes energy transitions as legal and political projects requiring sustained institutional reform.

Energy transitions involve the shift from energy sources, technologies, and systems that are detrimental to society, the environment, and the climate to those that support collective well-being. For energy transitions to have both equitable and environmental benefits, justice must be prioritized at the start of the process. Contribution to theory is thus to connect energy transitions to a multidimensional and emerging justice framework for analysis of their development trajectories in the Global South, where such transformations are increasingly being pursued. Contributions to policy are to clarify the relevance of emerging and well-established justice frameworks to emerging economies' long-term energy transitions and to highlight specific trade-offs and synergies associated with shifts toward renewable energy, including pathways rarely recognized within academic literature, the inclusion of which extends a justice-focused analysis of energy transitions to non-conventional developments (Harper-Dorton and Harper, 2015).

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