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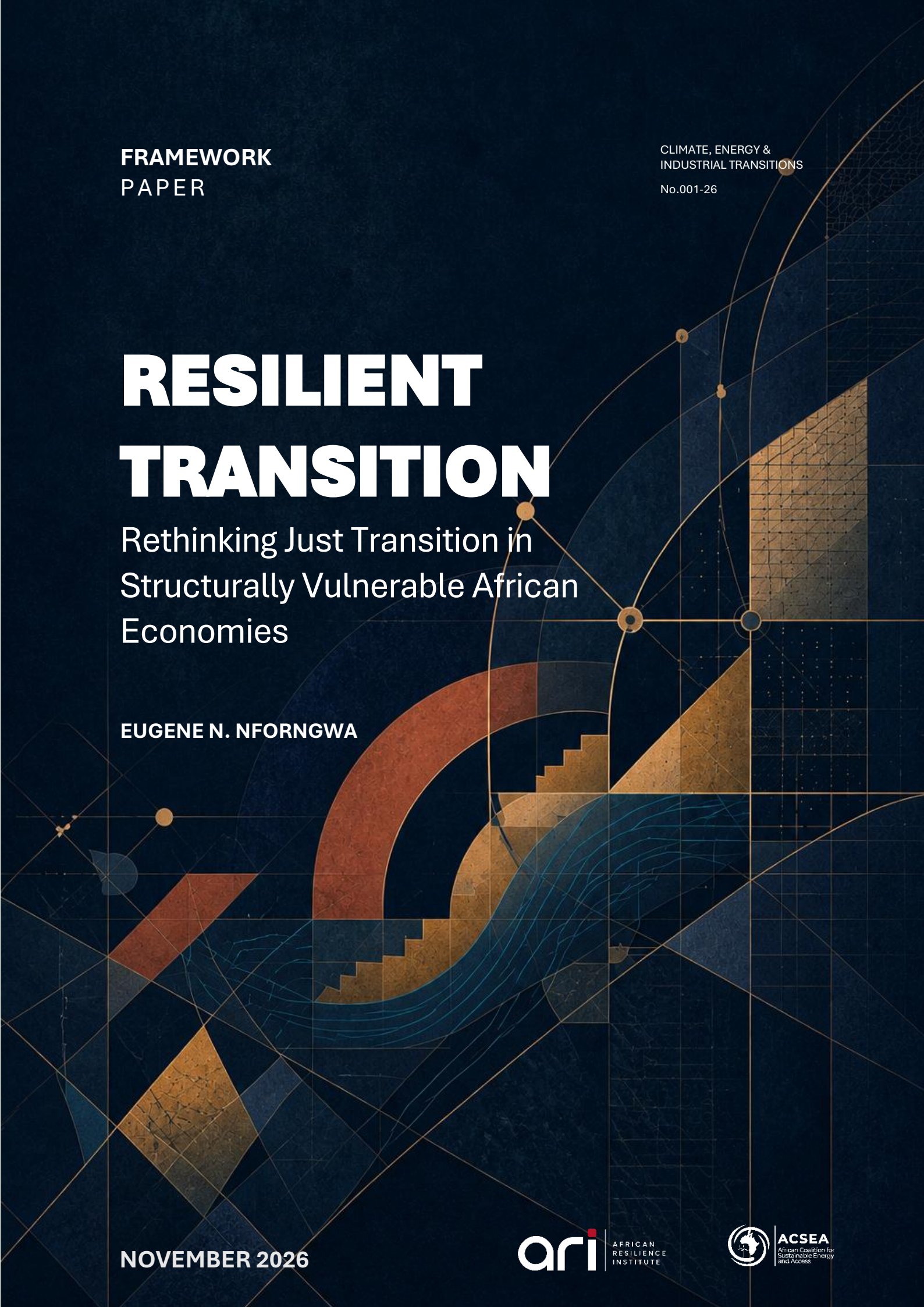
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RESILIENT TRANSITION

Rethinking Just Transition in Structurally Vulnerable African Economies

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Executive Summary

Why Africa needs a wider transition framework

Africa's energy transition is not only about replacing fossil fuels. Across much of the continent, it is also about building the energy systems needed to improve living standards, deliver public services and support productive economies. Countries must expand access while ensuring that electricity is reliable, affordable and sufficient for businesses, agriculture, manufacturing and growing cities. They must do this while managing debt, limited public revenues, institutional capacity gaps and increasing exposure to climate and economic shocks.

Just Transition provides an essential ethical foundation for this task. Its commitments to equity, participation and social protection help ensure that workers and communities do not bear an unfair share of the costs of change. However, its dominant policy applications developed largely in industrialised economies, where the central challenge was to manage the decline of established carbon-intensive industries. Policies designed mainly to protect people during that decline do not fully address the needs of countries still constructing and expanding their energy and productive systems.

This paper therefore distinguishes between a *just exit* from harmful or unsustainable systems and a *just entry* into adequate energy supply, productive opportunity and resilient development. African countries may need to pursue both. The proposed Resilient Transition framework complements rather than replaces Just Transition: it retains its justice commitments while widening the policy lens to include what countries need to build, how they can finance and govern that process, and who controls and benefits from it. This wider lens starts with a practical question: what level and quality of energy supply do households, public services and productive sectors need? Answering that question requires looking beyond household connections to whether energy systems can support development.

Measure energy progress beyond household connections

A household electricity connection is an important achievement, but it does not show whether the wider energy system can support development. A connected school or health facility still needs dependable power. A manufacturer, irrigation scheme or processing business needs supply that is sufficient for its operations and affordable enough to sustain them. Energy planning must therefore look beyond the number of connections to the quality and productive value of the services delivered.

The paper calls this objective *developmental energy adequacy*: sufficient, reliable and affordable energy for households, public services and productive activities. For policymakers, the practical implication is to assess access alongside reliability, affordability and the capacity to meet expanding demand. Generation choices must be considered together with transmission, distribution, storage, system balancing, regional connections and institutional capability. The relevant question is not simply which technology produces electricity most cheaply at project level, but which combination can deliver dependable energy across the whole system.

Four connected priorities for policy

Delivering developmental energy adequacy also depends on productive economies, sustainable public finance and capable institutions. Resilient Transition brings these priorities into one policy framework. Its four pillars are mutually reinforcing, not a fixed sequence of steps. Reliable energy supports productive investment; a more diversified economy strengthens revenues and capabilities; sound public finance sustains investment; and accountable governance helps coordinate decisions and share benefits fairly. The four policy priorities below translate these connections into areas for action.

- **Adaptive Energy Systems.** Build systems that can meet household and productive demand and maintain essential services during climatic, economic or geopolitical disruption. Assess the full system, not generation alone. Technology choices should reflect national resources, demand,

grid connections, industrial priorities, fiscal capacity and institutional capabilities. No single energy mix is prescribed for every African country.

- **Inclusive Economic Diversification.** Use energy and climate investments to develop domestic and regional productive capabilities rather than reinforce dependence on a narrow range of commodities or export markets. Priorities include manufacturing, agro-processing, mineral processing, supplier networks, skills, innovation and technological learning. Increased exports of minerals, hydrogen or other resources are not, by themselves, evidence of structural transformation if value addition remains elsewhere and local communities bear the costs.
- **Fiscal and Financial Resilience.** Incorporate debt, borrowing costs and long-term public liabilities into energy planning. Concessional and patient finance, domestic resource mobilisation, debt restructuring and regional financing mechanisms can help sustain investment. Instruments such as blended finance, debt-for-climate swaps and insurance must be assessed for their suitability, scale, additionality, costs and fiscal implications. More finance is useful only if it also preserves the ability to invest over time.
- **Adaptive Governance and Local Agency.** Strengthen institutions that can coordinate policy, learn from evidence and adjust to changing conditions. Participation must go beyond consultation: affected communities need access to information, protection of land and resource rights, influence over decisions, and grievance and redress mechanisms. Transparent procurement, benefit sharing and capabilities to negotiate and regulate investment agreements are central to legitimacy and domestic value retention.

Keep justice and long-term risks at the centre

The four pillars identify connected policy priorities; the justice questions provide a way to assess choices across them. *Carbon justice* asks how responsibility and costs should reflect historical emissions and unequal capabilities. *Energy justice* asks who receives sufficient, reliable and affordable energy. *Resource justice* asks who controls and benefits from land, minerals, infrastructure and value chains, and who bears their impacts. *Development justice* asks whether investments expand productive capacity, employment, technological learning and material wellbeing.

These questions help make trade-offs visible. An investment may expand supply while increasing foreign-exchange exposure or sovereign liabilities. Lower operational emissions may coexist with community displacement, concentrated ownership or dependence on imported technology. All technologies therefore need assessment of their lifecycle impacts, material requirements, durability, repairability and end-of-life costs. This does not imply that renewable and fossil-energy impacts are equivalent; it means that low operational emissions alone do not establish the justice or sustainability of a system.

Different starting points require different pathways

These common assessment questions do not imply a common transition pathway as African countries face different energy needs and risks. A coal-dependent industrial economy must manage retirement and replacement while maintaining supply and protecting workers and communities. A low-access country with hydropower or geothermal resources must expand systems while managing climate and fiscal exposure. A fossil-fuel exporter must reduce dependence on volatile revenues and address stranded-asset risks. A small import-dependent island state must strengthen reliability and affordability while reducing exposure to imported fuels and external shocks.

Resilient Transition neither justifies unrestricted fossil-fuel expansion nor treats the speed of fuel elimination as the only measure of climate ambition. It assesses pathways by their ability to deliver durable emissions reductions, adequate energy, reduced vulnerability and stronger productive capabilities. Where time-bound natural gas or other dispatchable generation is considered, its necessity

and consistency with long-term development and climate objectives must be demonstrated. Choices should remain subject to transparent comparison and adaptive review.

What this means for governments and international partners

For African governments, this means making energy adequacy, productive transformation, fiscal sustainability and accountable governance central to energy and climate policy, rather than separate supporting agendas. Assess investment and financing against whole-system performance and long-term liabilities, protect community rights, and examine who benefits and who bears risks. Strengthen the capabilities that allow development and climate gains to withstand disruption.

For international partners, affordable finance, technology access and policy space are part of an equitable and durable climate response. Support networks, storage, balancing, regional interconnection and institutional capability alongside generation. Stronger domestic skills, productive capacity and public revenues can help countries adopt, maintain and adapt lower-carbon technologies. Resilience supports climate ambition by helping countries implement and sustain it.

POLICY TAKEAWAY

Make energy adequacy, productive transformation, sustainable public finance and accountable governance central to transition policy. Align international support with these priorities, judging investments by whole-system performance, long-term risks and who benefits.

Research agenda: testing and refining the framework

The framework is a conceptual, policy-oriented proposal, not a proven implementation model or uniform national plan. Further research and comparative application must test how its pillars interact, how competing objectives are negotiated, and which indicators distinguish electricity access from developmental energy adequacy. Just Transition must address not only the costs of shifting away from fossil fuels, but what countries build, who benefits, and how those systems become more resilient and progressively less environmentally intensive.

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List of Abbreviations

ACSEA — African Coalition for Sustainable Energy and Access

AfDB — African Development Bank

ARI — African Resilience Institute

DTU — Technical University of Denmark

IEA — International Energy Agency

ILO — International Labour Organization

IPCC — Intergovernmental Panel on Climate Change

IRENA — International Renewable Energy Agency

JETPs — Just Energy Transition Partnerships

NDC / NDCs — Nationally Determined Contribution / Nationally Determined Contributions

SDG — Sustainable Development Goal

UNEP — United Nations Environment Programme

UNFCCC — United Nations Framework Convention on Climate Change

UNSD — United Nations Statistics Division

WHO — World Health Organization

WMO — World Meteorological Organization

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Introduction

Shifting from fossil-fuel-based to lower-carbon energy systems is vital for addressing the climate crisis. This transition is increasingly understood not solely as a technological shift, but also as a political and developmental process (Newell & Mulvaney, 2013; Sovacool et al., 2022). As countries pursue decarbonisation, questions of fairness, opportunity and resilience have become central to climate diplomacy and policy (Heffron & McCauley, 2018; Mbeva et al., 2025). Just Transition provides a leading framework for addressing these concerns.

By emphasising social legitimacy alongside environmental effectiveness, the framework has reshaped approaches to decarbonisation among governments and international institutions (Newell & Mulvaney, 2013; Heffron & McCauley, 2018; Intergovernmental Panel on Climate Change [IPCC], 2022). Nevertheless, the framework's dominant policy formulation is shaped by the historical and institutional conditions in which it developed. These include established energy systems, predominantly formal labour markets and comparatively strong fiscal capacity. In these settings, transition policy has focused primarily on managing the decline of mature carbon-intensive industries.

Across much of Africa, the transition begins from a different structural position. The principal challenge is not the retirement of existing energy systems, but the construction and expansion of systems capable of widening access, supplying productive sectors and supporting structural transformation. This objective must extend beyond household electrification to provide sufficient, reliable and affordable energy for manufacturing, mineral and agricultural processing, irrigation, transport, digital infrastructure and expanding urban economies. Meeting these requirements often includes working under conditions of constrained fiscal space, high debt burdens, institutional capacity gaps and increasing exposure to climatic and geopolitical shocks. *The analytical question is therefore not whether the principles of Just Transition remain relevant, but whether they provide sufficient guidance for energy-system construction and transformation under these conditions*.

This difference can be conceptualised as a distinction between a *just exit* and a *just entry*. Conventional Just Transition frameworks have largely focused on protecting workers and communities from disproportionate costs when countries exit carbon-intensive industries. Many African countries, by contrast, must secure just entry into modern energy abundance as well as productive capacity and industrial development. These processes are not mutually exclusive: energy supply can expand alongside improvements in efficiency, reductions in environmental harm and a progressive decline in the carbon intensity of the systems being constructed.

This paper argues that Just Transition remains an essential normative framework for equity, participation and social protection. Its dominant policy applications, however, do not consistently centre the challenges of energy-system construction, productive transformation, macro-fiscal vulnerability and climate resilience across much of Africa. It introduces *Resilient Transition* as a complementary framework for constructing and transforming energy, economic and industrial systems under conditions of structural vulnerability. Rather than replacing Just Transition, the proposed framework extends its analytical scope from the distribution of decarbonisation costs to the governance of interdependent processes of energy expansion, resilience, structural transformation and progressively lower-carbon development.

The paper develops a normative and policy-oriented analytical framework rather than a uniform national transition model. Its assessment concerns the assumptions and instruments of dominant Just Transition applications, not the rejection of Just Transition scholarship as a whole. The proposed framework organises questions for contextual policy assessment; its application requires attention to national starting conditions, institutional capabilities and the interaction of development and climate objectives.

The analysis is organised into six sections. Section 1 assesses the strengths and limitations of Just Transition. Section 2 examines the structural conditions that distinguish Africa's energy-development challenge. Section 3 defines Resilient Transition and sets out its cross-cutting justice principles. Section

4 presents the framework's four mutually reinforcing pillars. Section 5 examines how differentiated national pathways can combine developmental energy expansion with global climate objectives. Section 6 concludes by examining the implications for African energy and climate policy and for transition thinking more broadly.

01 Just Transition: An Honest Assessment

Just Transition has emerged as a leading normative framework for addressing the social and distributional dimensions of the shift to a low-carbon economy. Rooted in labour movement advocacy for workers affected by industrial restructuring (Eisenberg, 2019), the concept became part of international climate governance through the International Labour Organisation's Guidelines for a Just Transition (ILO, 2015). The framework now informs negotiating texts under the United Nations Framework Convention on Climate Change (UNFCCC) (Winkler, 2020). Its influence also extends to national transition strategies and financing initiatives, including the Just Energy Transition Partnerships (JETPs) established in South Africa, Indonesia, Viet Nam and Senegal. A substantial body of scholarship has also refined and expanded the concept as a framework for equitable climate action (Mbeva et al., 2025).

Contemporary scholarship has broadened Just Transition beyond its labour origins to encompass distributive, procedural, recognition, energy and environmental justice. These developments reflect the framework's substantive contributions. By challenging predominantly technical and economic approaches to climate policy, it has established equity, participation and social protection as central concerns of transition governance. It has also extended the objectives of climate action beyond emissions reduction to include livelihood protection, procedural fairness and public legitimacy. The question examined here is therefore not whether Just Transition has evolved, but whether its dominant policy applications adequately address energy-system construction and transformation in economies with substantial energy-access, industrial and fiscal deficits.

This paper argues that these applications remain insufficient to address that structural task.

The widespread adoption of Just Transition has extended its application to contexts that differ from those in which its dominant policy formulation developed. Assessing its policy instruments for energy-system construction and transformation across much of Africa therefore requires examining their underlying assumptions, rather than questioning the value of Just Transition's ethical commitments. As Figure 1 illustrates, many applications assume established energy systems, predominantly formal labour markets and comparatively strong public institutions. These assumptions have more limited applicability where energy supply, productive capacity and resilience must be expanded while environmental impacts are managed.

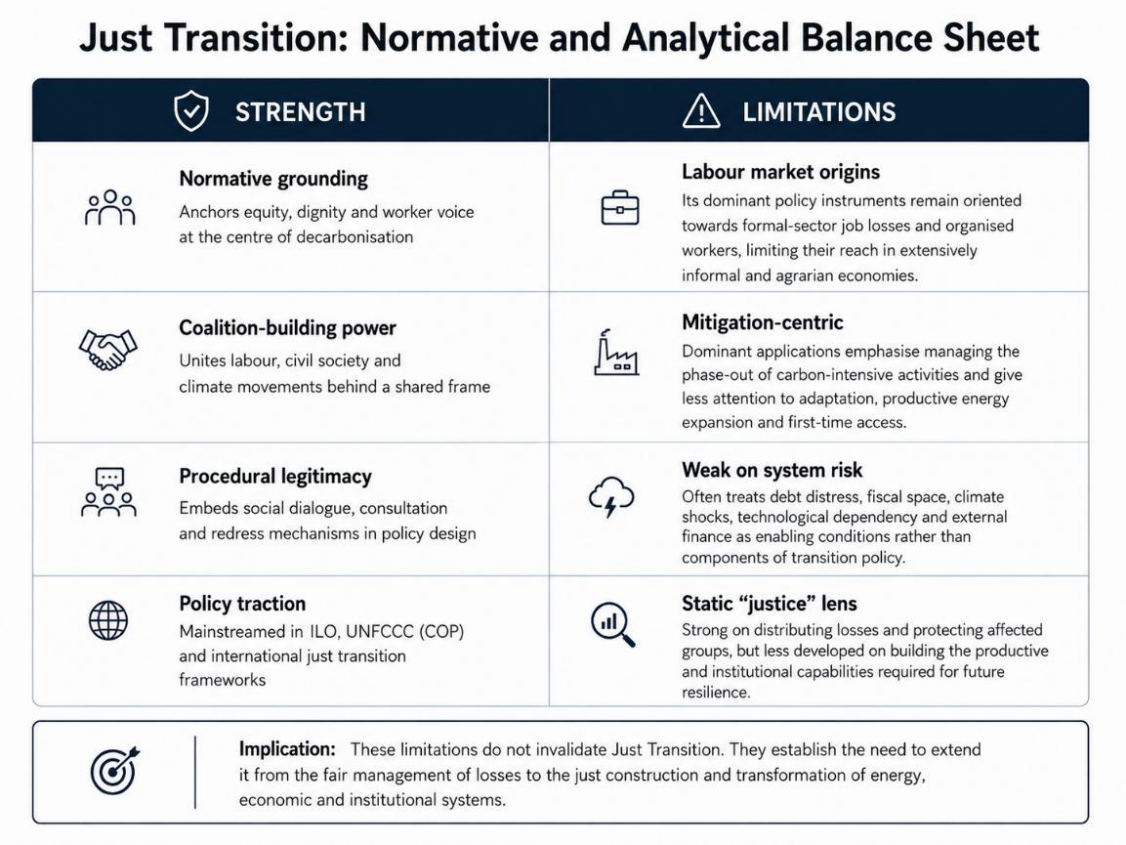


Figure 1. Just Transition: normative strengths and analytical limitations. Source: Author

1.1 Contributions of Just Transition

A fuller account of Just Transition's contributions provides the basis for assessing the scope of transition policy.

- First, *it established people-centred objectives alongside emissions trajectories in climate policy*. Its emphasis on the equitable distribution of decarbonisation costs and benefits embedded social justice within the climate agenda rather than treating it as a secondary concern.
- Second, *it supported coalition building across stakeholder groups*. The concept provided a shared language through which labour unions, civil society organisations, environmental movements and policymakers could pursue climate objectives without framing employment and environmental protection as necessarily competing interests.
- Third, *it institutionalised procedural justice as a principle of transition governance*. Social dialogue, consultation, participation and grievance mechanisms are now widely recognised as components of legitimate and durable transition processes rather than optional additions.
- Finally, *it has acquired substantial policy influence*. Just Transition has shaped international climate negotiations, informed implementation of the Paris Agreement, guided the ILO's transition agenda and provided a conceptual foundation for country-level initiatives such as the JETPs (Dietzel, 2025). Its movement from labour advocacy into international climate governance demonstrates the framework's institutional reach.

These contributions help explain the prominence of Just Transition in equitable climate policy and provide the basis for this paper's retention of its ethical commitments. The assessment of limitations

that follows does not reject those commitments. It examines whether dominant policy applications adequately account for the energy, developmental, fiscal and institutional conditions that shape transition outcomes in African economies.

1.2 Limitations in the African Context

The limitations examined here concern the assumptions embedded in dominant policy applications rather than the ethical principles of Just Transition. The concept gained influence partly through efforts to manage industrial restructuring in advanced economies. These efforts included managing the decline of mature, formal and unionised sectors such as coal mining, electricity generation and manufacturing. The framework's principal instruments have consequently focused on protecting workers and communities affected by the phase-out of carbon-intensive activities (Eisenberg, 2019; Stevis & Felli, 2015; Newell & Mulvaney, 2013; Heffron & McCauley, 2018; McCauley & Heffron, 2018). This emphasis offers limited guidance for countries where energy systems remain underdeveloped, productive demand is unmet, social protection is limited and large portions of the population lack modern energy services. Although contemporary scholarship has expanded the concept, energy-system construction, macro-fiscal vulnerability and structural transformation remain unevenly incorporated into policy practice.

The application of dominant Just Transition approaches to African contexts reveals four structural mismatches.

- *Informality gap:* Just Transition developed around organised labour, collective bargaining and formal employment relationships. Most African workers, however, are employed in the informal economy, agriculture or micro- and small enterprises, where labour protections, social dialogue and severance mechanisms are limited or absent. Instruments centred on workers in formal carbon-intensive industries therefore have limited coverage across the continent's workforce. Justice in these settings requires attention not only to compensation for displaced workers, but also to livelihood security, access to productive assets, social protection for informal workers and the distribution of opportunities created by new energy investments.
- *Access-versus-exit mismatch:* Across much of Africa, the principal energy challenge is the construction and expansion of modern energy systems rather than the retirement of existing fossil-fuel assets. According to the International Energy Agency (IEA), around 600 million Africans still lack access to electricity (IEA, 2025), while many connected households and firms face unreliable or inadequate supply. Conventional Just Transition approaches focus primarily on the equitable management of an exit from carbon-intensive systems. They offer less guidance on securing a just entry into energy abundance through universal household access, reliable public services, productive energy use and sufficient system capacity for industrialisation.
- *Macro-fiscal gap:* Sovereign debt distress, narrow domestic revenue bases, high borrowing costs, limited fiscal space and exposure to external economic shocks are central to the financing and implementation of African transition plans. Just Transition discourse remains predominantly shaped by the institutional and economic conditions of advanced economies (Winkler, 2020), and its dominant applications give insufficient attention to these constraints. They also give limited visibility to the foreign-exchange, sovereign-guarantee and stranded-asset risks associated with energy infrastructure choices.
- *System-construction gap:* Transition debates frequently compare individual generation technologies without adequately accounting for whole-system requirements. For countries rapidly expanding electricity supply, these requirements include firm capacity, transmission and distribution, storage, system balancing, regional interconnection, demand growth and resilience to climatic disruption. Approaches centred on fuel substitution may therefore underestimate the institutional, material and financial requirements of constructing reliable energy systems at industrial scale.

These mismatches suggest that Just Transition provides an essential but incomplete foundation for African energy transformation. Application without contextual adaptation risks relying on assumptions of predominantly formal labour markets, mature energy systems awaiting retirement, universal access and sufficient fiscal capacity to absorb transition costs. The policy task is therefore to extend the framework from the equitable management of an energy exit to the just construction and transformation of systems that support material wellbeing, productive development and progressively lower environmental intensity. The following section examines the structural conditions underlying these mismatches, linking energy-access and productive constraints with fiscal vulnerability and climate exposure while recognising variation across national contexts.

02 Africa's Structural Position

2.1 Energy Access, Climate Exposure and Historical Emissions

Assessing the applicability of Just Transition requires attention to Africa's structural conditions. The continent's energy pathways are shaped by interacting demographic, economic and climatic factors that influence the pace and direction of policy choices (Figure 2). The IEA's Africa Energy Outlook 2022 describes Africa as home to nearly one-fifth of the world's population while accounting for less than 3% of the world's energy-related carbon dioxide emissions to date (IEA, 2022). The World Meteorological Organization (WMO), in its State of the Climate in Africa 2024, documents persistent droughts, exceptional flooding and contrasting rainfall conditions across the continent, with severe consequences for agriculture, food and water security, and livelihoods (WMO, 2025). These pressures coincide with a substantial electricity-access deficit: the IEA's 2025 report states that around 600 million people in Africa still lack access to electricity, with its detailed assessment identifying around 600 million people without access in sub-Saharan Africa as of 2024 (IEA, 2025).

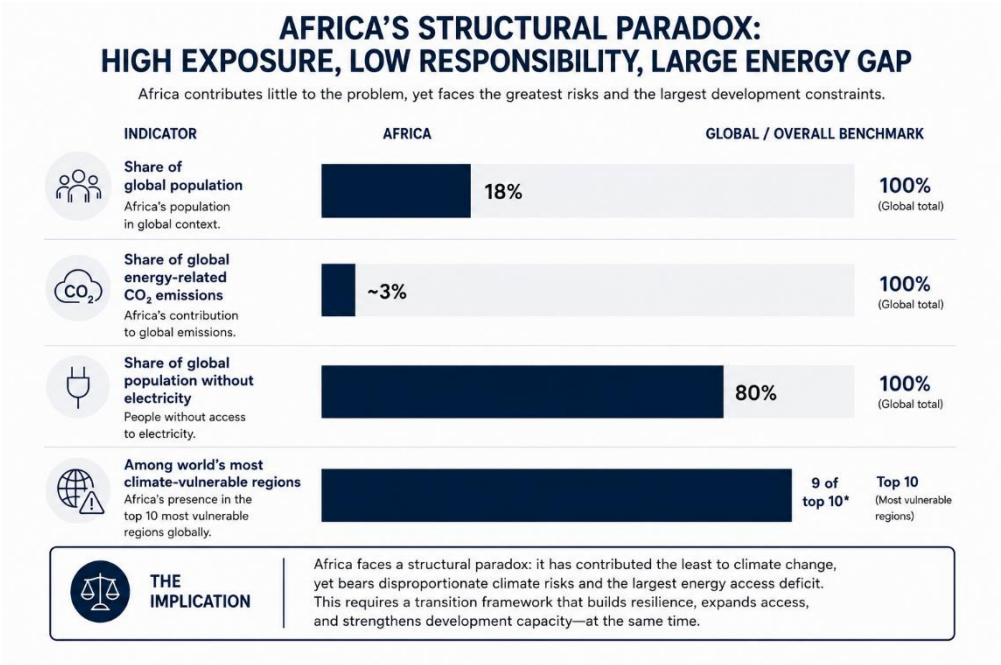


Figure 2. Africa's structural paradox: low responsibility, high vulnerability and a persistent energy-access deficit.

2.2 Political Economy of Structural Vulnerability

These vulnerabilities cannot be explained solely by geography, resource scarcity or limited domestic capacity. They reflect interactions between historical and contemporary political-economic processes, including colonial patterns of extraction and infrastructure development, dependence on primary commodity exports, uneven industrialisation, limited domestic value addition, unequal access to technology and long-term finance, and an international financial architecture that exposes many African countries to high borrowing costs and external shocks. Domestic policy choices, institutional weaknesses, political settlements and unequal distributions of power and resources also shape how these pressures are experienced and managed. The relative significance of these factors varies across countries, but their interaction helps explain the persistence of energy, fiscal and institutional vulnerabilities despite substantial variation across the continent.

2.3 Material Requirements and Control of Energy Value Chains

These structural conditions also influence the material foundations and distributional outcomes of the emerging energy economy. Solar panels, wind turbines, batteries, transmission networks and electric vehicles require substantial quantities of minerals, industrial materials, land and infrastructure. Although many of these inputs are extracted in Africa, processing, manufacturing, technological ownership and the largest shares of value addition frequently remain elsewhere. An African transition framework must therefore assess not only the carbon intensity of generation, but also the distribution of control over the resources, technologies and value chains through which energy systems are constructed.

2.4 Developmental Energy Adequacy and Policy Implications

This paper uses *developmental energy adequacy* to distinguish the energy requirements of structural transformation from a minimal conception of electricity access (Table 1). The term refers to the availability of sufficient, reliable and affordable energy for households and public services, as well as for manufacturing, mineral processing, irrigation, transport, digital infrastructure and other productive activities. A household connection is an important access outcome, but is not, by itself, evidence that an energy system can support structural transformation.

Table 1. Electricity access and developmental energy adequacy: differences in focus, scope and developmental significance.

Dimension	Electricity access	Developmental energy adequacy
Core focus	Household electricity connections.	Sufficient, reliable and affordable energy.
Scope	Household electrification.	Households, public services and productive activities, including manufacturing, mineral processing, irrigation, transport and digital infrastructure.
Developmental significance	An important access outcome; a connection alone does not demonstrate capacity to support structural transformation.	Energy systems capable of supporting productive capacity and structural transformation.

The policy implication is that household connections should be assessed alongside the sufficiency, reliability and affordability of energy for public services and productive activities. Planning and evaluation must therefore consider whether energy systems support productive capacity and structural transformation, rather than treating expanded access alone as evidence of developmental energy

adequacy. These objectives must be pursued alongside progressive improvements in resilience, efficiency and environmental sustainability.

The central policy question consequently extends beyond *how to decarbonise existing energy systems* to *which systems African countries need to construct to achieve developmental energy adequacy and structural transformation, and how these systems can become progressively more resilient, efficient and environmentally sustainable*. This formulation does not subordinate climate objectives to unrestricted energy expansion. It situates emissions reduction within the broader political economy of development, technological capability, resource sovereignty and global climate justice. These considerations support an extension of transition policy's analytical and operational scope while retaining the ethical foundations of Just Transition.

03 Introducing Resilient Transition

3.1 Rationale for a Complementary Transition Framework

The preceding analysis identifies energy-development challenges in Africa that are not fully addressed by conventional Just Transition approaches. Justice, equity and participation remain essential, but do not, on their own, provide sufficient operational guidance for pursuing energy-system construction, industrial development, resilience and progressively lower-carbon growth together. This paper proposes Resilient Transition as a complementary framework for addressing these interdependent objectives.

3.2 Conceptualising Resilience and Defining Resilient Transition

Resilience is understood here as more than recovery from shocks. It refers to the capacity of societies, economies and institutions to anticipate, absorb, adapt to and transform in response to climatic, economic and geopolitical disruptions, while maintaining essential functions and creating developmental opportunities. Applied to energy-system construction and transformation, this conception extends beyond infrastructure protection to the capabilities required to sustain industrial progress and climate ambition under fiscal pressure, market volatility, technological change and increasingly frequent climate extremes. Resilient transformation thus combines the capacity to withstand disruption with the use of energy and climate investments to strengthen economies, institutions and communities.

Resilience has two related roles within the framework. As a capability, it enables societies, economies and institutions to sustain essential functions and development under disruption. As a policy objective, it directs transition investments towards reducing vulnerability and strengthening those capabilities. Its pursuit therefore supports, rather than substitutes for, mitigation and structural transformation.

On this basis, the paper defines Resilient Transition as follows:

> *Resilient Transition is a development-centred process of constructing and transforming energy, economic and institutional systems so that they expand access to sufficient, reliable and affordable energy, support structural transformation, reduce vulnerability to climatic, economic and geopolitical shocks, and progressively lower carbon and environmental intensity in ways consistent with national circumstances and global climate goals.*

Resilient Transition extends the central policy question from *"How can decarbonisation be made fair?"* to *"What energy, economic and institutional systems must African countries build to achieve resilient structural transformation, and how can those systems progressively reduce their carbon and environmental intensity?"* This reframing retains the need for climate action and the ethical commitments of Just Transition, while recognising that durable environmental progress depends on the capabilities required to implement and sustain it.

3.3 Cross-Cutting Dimensions of Justice

Justice remains the ethical foundation of Resilient Transition. Carbon, energy, resource and development justice organise four interrelated dimensions of assessment across the framework's pillars (see Section 4). Each concerns not only the distribution of costs, benefits and opportunities, but also whose circumstances are recognised and who can participate meaningfully in decisions.

- *Carbon justice:* How should responsibility for emissions reduction and its costs be distributed in light of historical emissions and unequal capabilities?
- *Energy justice:* Who has access to sufficient, reliable and affordable energy, and to what extent does that energy support material wellbeing and productive opportunity?
- *Resource justice:* Who controls and benefits from the land, minerals, infrastructure and value chains required by changing energy systems, and who bears their social and environmental costs?
- *Development justice:* To what extent do energy and climate policies expand domestic productive capacity, employment, technological learning and long-term material wellbeing?

These dimensions are interdependent rather than discrete. Reductions in a project's operational emissions may coexist with concentrated ownership, community displacement or technological dependency. Conversely, expanded energy supply may be accompanied by unsustainable fiscal, ecological or carbon liabilities. Resilient Transition therefore assesses energy choices in terms of their combined climate, energy, resource and developmental consequences.

3.4 Distinguishing Features of Resilient Transition

As Figure 3 illustrates, Resilient Transition retains the normative core of Just Transition while extending its analytical and policy scope.



Figure 3. Resilient Transition complements the Just Transition agenda by broadening the lens from managing decline to building resilient, inclusive and progressively low-carbon development in structurally vulnerable economies. Source: Author's conceptualisation.

Four features distinguish the proposed framework from dominant applications of Just Transition. First, it encompasses both a just exit from harmful or unsustainable systems and a just entry into energy abundance and productive capability. Second, it treats developmental energy adequacy, rather than household connection alone, as a core objective. Third, it integrates mitigation and adaptation within the infrastructure, fiscal and institutional systems through which both are pursued. Fourth, it incorporates economic diversification, fiscal sustainability, technological capability and adaptive governance as substantive components of transition policy rather than external enabling conditions.

04 The Four Pillars of Resilient Transition

Four mutually reinforcing pillars provide the policy architecture of Resilient Transition: they organise the assessment of energy-system construction, structural transformation, resilience and progressively lower-carbon development. The framework treats energy, economic transformation, public finance and governance as interdependent domains, with resilience emerging through their interaction. As Figure 4 illustrates, reinforcing feedback loops connect the pillars, enabling progress in one domain to strengthen the others. Transition is therefore conceptualised as a whole-of-economy process rather than a set of separate sectoral interventions. This architecture guides contextual policy analysis rather than prescribing a uniform implementation sequence. It is particularly relevant to the continuing challenge of universal electricity access: sub-Saharan Africa accounted for 85% of the global population without electricity in 2023 (IEA et al., 2025).

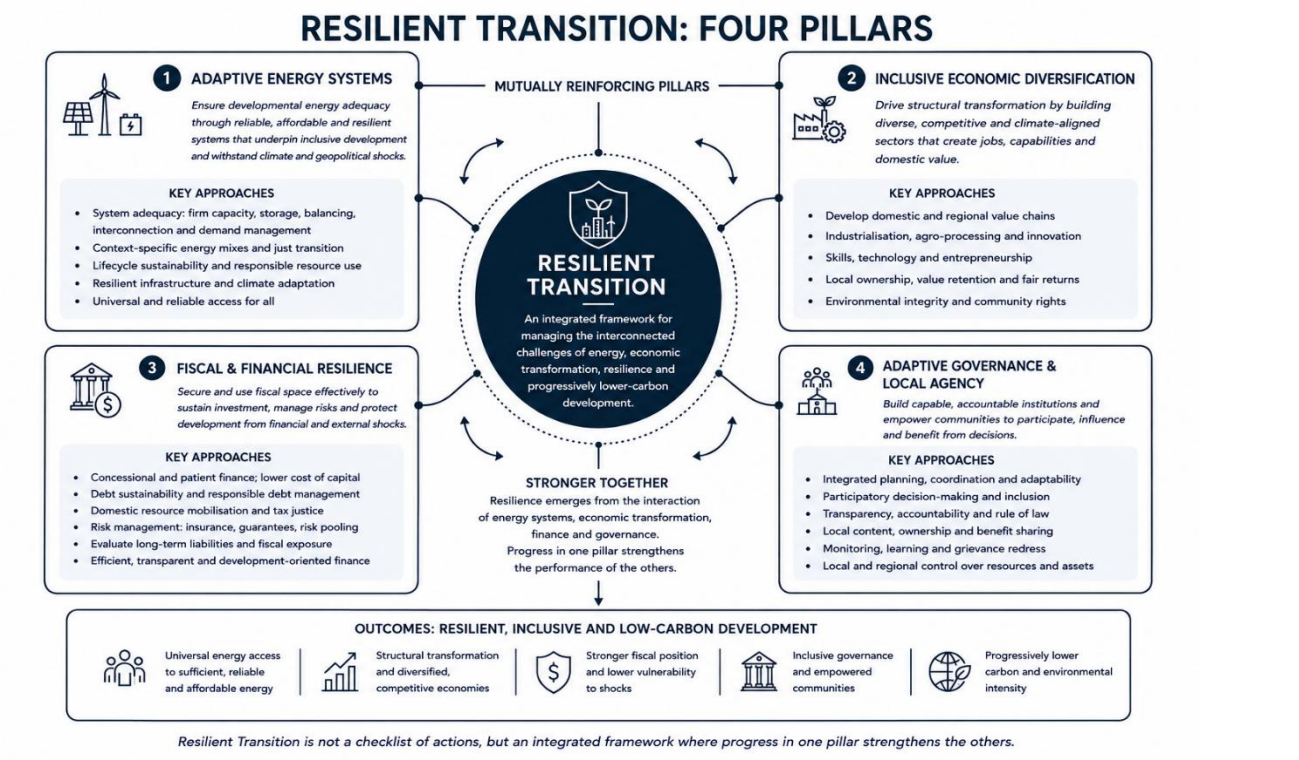


Figure 4. Resilient Transition: an integrated four-pillar framework for whole-of-economy transformation. The framework links adaptive energy systems, inclusive economic diversification, fiscal and financial resilience, and adaptive governance and local agency as mutually reinforcing pillars through which progress in one domain strengthens the others, supporting resilient, inclusive and progressively lower-carbon development. Source: Author's conceptualisation.

4.1 Adaptive Energy Systems

The first pillar, *Adaptive Energy Systems*, establishes sufficient, reliable and affordable energy as a foundation for resilience and structural transformation. Increasingly frequent and severe floods, droughts, storms and heatwaves threaten generation, transmission and distribution infrastructure. These risks coexist with substantial access deficits and unreliable or inadequate supply for many households, public institutions and firms. The policy objective therefore extends beyond generation capacity and household connections to developmental energy adequacy.

Energy-system assessment provides the organising basis for planning; individual technologies and fuels must be evaluated within that broader context. Planning must account for firm capacity, transmission and distribution requirements, storage duration, system balancing, regional interconnection, demand management and resilience under climatic or geopolitical stress. Project-level generation costs remain relevant, but alone may not capture total system costs or the capacity to provide continuous power at the scale required for industrial development.

The composition of an adaptive energy system cannot be prescribed uniformly at the continental level. It must reflect national resource endowments, grid connections, demand profiles, industrial strategies, fiscal capacity and institutional capabilities. Depending on these conditions, system adequacy may require combinations of variable renewables, hydropower, geothermal energy, storage, regional interconnection, demand management, nuclear power and, where demonstrably necessary and consistent with long-term development and climate objectives, time-bound use of natural gas or other dispatchable generation. Technology assessment should be based on contributions to adequacy, affordability, resilience, social justice and progressively declining environmental impacts, rather than predetermined preferences for particular fuels or technologies.

Renewable resource availability is not, in itself, sufficient to establish the sustainability of an energy system. Solar, wind, battery and transmission technologies depend on minerals, industrial processing, land, water, infrastructure and end-of-life management. Their climate advantages must be assessed alongside embodied emissions, material intensity, supply-chain dependencies, community impacts, durability, repairability and recycling requirements. This lifecycle approach does not imply equivalence between renewable and fossil-energy impacts. It instead recognises that low operational emissions alone do not establish social, ecological or developmental sustainability.

4.2 Inclusive Economic Diversification

The second pillar, *Inclusive Economic Diversification*, addresses vulnerability arising from dependence on a narrow range of commodities, technologies or export markets. Exposure to fluctuations in global oil, mineral and agricultural commodity prices leaves public revenues, foreign-exchange earnings and employment in many African economies vulnerable to external shocks. Transition policy must therefore support the development of productive capabilities, rather than focus exclusively on decarbonising existing activities.

Relevant priorities include domestic and regional value chains around critical minerals and energy technologies, manufacturing and agro-processing, innovation and entrepreneurship, and technical, scientific and vocational capabilities. The objective extends beyond local content and commodity exports to processing capacity, supplier networks, technological learning, ownership and skilled employment. These capabilities enable African economies to retain a greater share of the value generated by changing global energy systems.

This pillar also addresses the risk of extractivism. Increased demand for African minerals, land, renewable electricity, hydrogen or carbon credits does not, by itself, constitute structural transformation where processing, manufacturing, technological ownership and fiscal benefits remain externalised while social and environmental costs are localised. Critical mineral and green-industrial strategies should therefore be assessed against domestic value retention, community rights, environmental integrity, transparent contracting, regional industrial linkages and contributions to long-term productive capability.

4.3 Fiscal and Financial Resilience

The third pillar, *Fiscal and Financial Resilience*, addresses limited and volatile fiscal space as a central constraint on African energy transformation. High debt burdens, elevated borrowing costs, foreign-exchange shortages and repeated external shocks can interrupt public investment and undermine the continuity of energy and climate strategies. Resilient Transition therefore incorporates macroeconomic resilience within energy planning.

Policy priorities include access to concessional and patient finance, lower costs of capital, restructuring of unsustainable debt, domestic resource mobilisation, and regional risk-pooling and financing mechanisms. Debt-for-climate swaps, climate-risk insurance and blended finance may contribute in appropriate circumstances, but are neither universally suitable nor sufficient. Their contribution must be assessed in relation to scale, additionality, fiscal implications, transaction costs and national institutional capacity.

Fiscal resilience also requires assessment of the long-term liabilities associated with energy choices. These include foreign-exchange exposure, sovereign guarantees, fuel-price volatility, imported-technology dependence, stranded-asset risks and public costs of transmission, decommissioning and waste management. The objective is not simply to mobilise additional finance, but to preserve governments' capacity to sustain investment in energy, infrastructure, social protection and productive transformation.

4.4 Adaptive Governance and Local Agency

The fourth pillar, *Adaptive Governance and Local Agency*, emphasises institutional capacities for learning, coordination and responsiveness to changing conditions. Energy pathways require more than top-down technical planning: they must be adaptable and informed by evidence, local knowledge, political-economic conditions and meaningful participation by affected communities.

Policy instruments include decentralised energy planning, participatory budgeting, transparent procurement, community ownership and benefit-sharing arrangements, local content and supplier-development policies, and adaptive monitoring, evaluation and learning systems. Meaningful participation extends beyond consultation to access to information, protection of land and resource rights, grievance and redress mechanisms, and influence over decisions that impose local costs or alter livelihoods.

Local agency also encompasses national and regional control over technology, infrastructure and strategic resources. Governments and regional institutions require capabilities to negotiate investment agreements, regulate environmental and social impacts, coordinate industrial policy and prevent energy and mineral investments from reinforcing extractive dependency. Institutional capability and accountable decision-making closer to affected populations are therefore central to the legitimacy and developmental value of transition policy.

4.5 Pillar Interdependence and Systemic Transformation

The conceptual model in *Figure 4* treats the pillars as mutually reinforcing rather than sequential. Adaptive energy systems supply reliable power for productive investment and industrial expansion. Inclusive diversification broadens the tax base, develops technological capability and reduces exposure to external shocks. Fiscal and financial resilience sustains investment in infrastructure, skills, social protection and institutional development. Adaptive governance supports coordination, accountability and the equitable distribution of costs and benefits. These relationships also create systemic vulnerabilities: unreliable energy constrains production, extractive growth limits domestic value retention, fiscal distress interrupts infrastructure investment and unaccountable governance weakens legitimacy.

Resilient Transition is therefore an integrated framework for governing systemic change rather than a checklist of interventions. Its contribution is to position resilience alongside mitigation as a central objective of transition policy, linking climate action to expanded energy access, structural transformation, sustainable public finances and institutional capacities for managing uncertainty. For African countries, this approach situates emissions reductions within a broader assessment of resilience and development outcomes. The following section examines how this integrated framework can inform differentiated national pathways that respond to distinct energy needs, structural vulnerabilities and institutional capabilities while contributing to global climate goals.

05 Differentiated Pathways to Development and Global Climate Goals

5.1 Assessing Climate Ambition in Developmental Context

An Africa-specific transition framework should neither legitimise unrestricted fossil-fuel expansion, weak environmental governance or avoidable delay, nor define climate ambition solely by the pace of fuel elimination without regard to historical responsibility, energy deficits, developmental needs and institutional capabilities. Resilient Transition rejects both approaches. It assesses ambition in terms of the durability of emissions reductions, progress towards developmental energy adequacy, reduced vulnerability and the productive capabilities required to support progressively deeper climate action.

5.2 National Starting Conditions and Differentiated Pathways

Differentiated pathways reflect the diversity of African countries' starting conditions. A coal-dependent industrial economy, a low-access country with substantial hydropower or geothermal resources, a fossil-fuel exporter and a small import-dependent island state face distinct system requirements, risks and sequencing choices. Technology selection must therefore respond to national and regional circumstances while remaining subject to transparent assessment of adequacy, affordability, fiscal sustainability, social justice and long-term environmental performance.

These starting conditions call for different emphases within a common assessment. For a coal-dependent industrial economy, the question is how retirement and replacement can preserve system adequacy and protect affected workers and communities. For a low-access country with substantial hydropower or geothermal resources, it is how energy-system expansion can meet household and productive demand while managing climatic and fiscal exposure. For a fossil-fuel exporter, it is how diversification and public finance can reduce dependence on volatile revenues and limit stranded-asset risks. For a small import-dependent island state, it is how reliability and affordability can be strengthened while reducing exposure to imported fuels and external shocks. These are contextual questions, not predetermined technology choices.

5.3 Implementation Constraints and Enabling Mechanisms

Implementation gaps arise from interactions between external constraints and domestic conditions. Limited access to affordable finance, infrastructure and technology can constrain implementation, as can institutional weaknesses, conflicting political interests, inadequate coordination and unequal distributions of power (African Development Bank [AfDB], 2023; Riva et al., 2020; Puig et al., 2019). Nationally Determined Contributions (NDCs) across Africa include substantial mitigation and adaptation commitments, many of which depend on external financial and technical support.

Resilient Transition consequently treats capability, accountability and international support as interdependent determinants of implementation (United Nations Environment Programme [UNEP], 2024; IPCC, 2022). Its broader scope is intended to strengthen rather than reduce climate ambition by identifying multiple mechanisms through which development and climate outcomes can improve (Figure 5).

- *System capability strengthens implementation*. Investment in generation alone is insufficient to deliver energy adequacy or durable mitigation. Concessional finance, risk-sharing and public investment should support transmission, distribution, storage, system balancing, regional interconnection and institutional capability alongside new generation. Financing should be assessed by its contribution to whole-system performance rather than solely by the volume of capital mobilised.
- *Resilience supports the durability of development and climate gains*. Diversified and well-interconnected energy systems designed to withstand climatic, fiscal and geopolitical shocks are less vulnerable to interruption and policy reversal. Resilience therefore protects public services, productive activity and the long-term performance of energy investments.
- *Legitimacy supports implementation and distributional outcomes*. Transparent, participatory policies responsive to local conditions are more likely to sustain public support. Adaptive governance enables governments to identify emerging harms, revise poorly performing interventions and ensure that communities share in the benefits of energy and mineral development.
- *Productive capability expands future climate options*. Domestic skills, industrial capacity, public revenue and technological learning enable countries to adopt, maintain and adapt lower-carbon technologies over time. Developmental capability thus forms part of the foundation for sustained climate ambition.

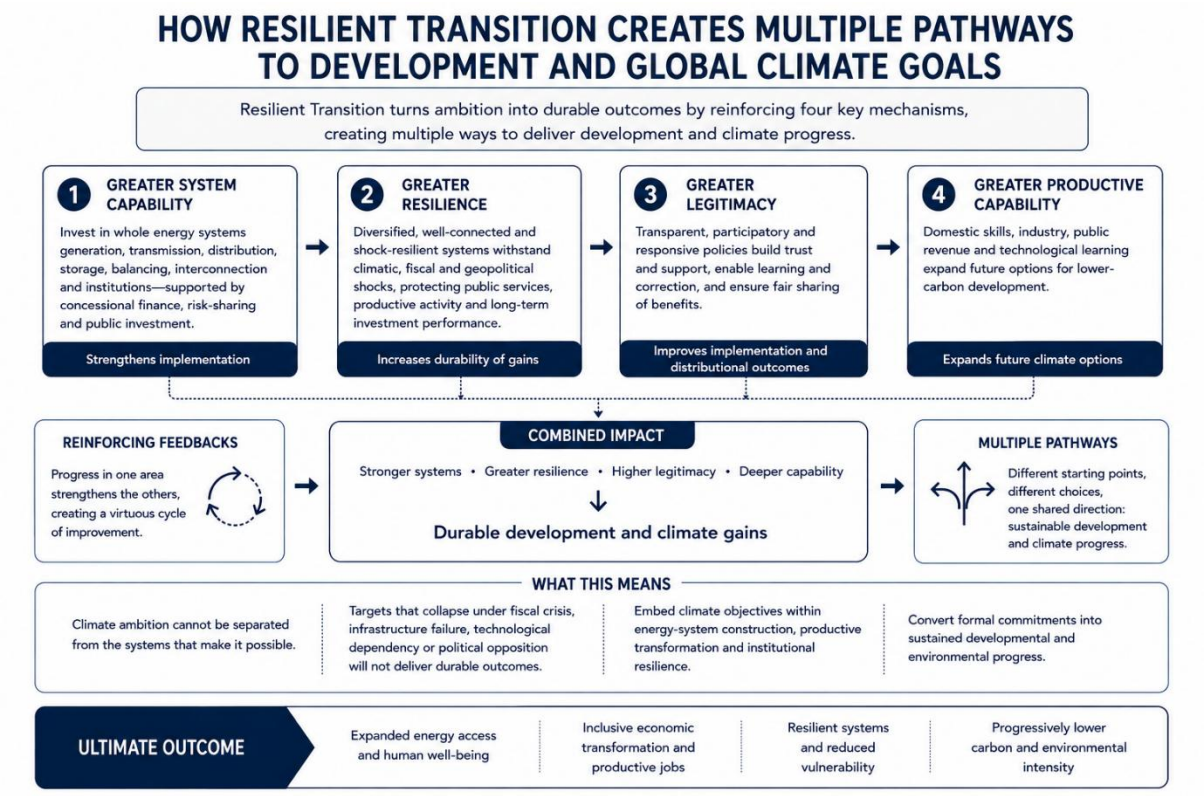


Figure 5. Multiple pathways through which Resilient Transition advances development and global climate goals. Greater system capability, resilience, legitimacy and productive capability interact through reinforcing feedback to strengthen implementation and generate durable development and climate gains. Rather than prescribing a single transition pathway, it links differentiated national choices to shared outcomes: expanded energy access and human well-being, inclusive economic transformation, reduced vulnerability, and progressively lower carbon and environmental intensity. Source: Author's conceptualisation.

5.4 Sustaining Climate Outcomes and Broader Policy Implications

The reinforcing relationships described here do not eliminate trade-offs. A pathway may expand energy supply while increasing fiscal exposure, or strengthen domestic value addition while imposing local ecological and social costs. Assessment therefore requires explicit consideration of who gains, who bears risks, which liabilities persist over time, and whether those affected can influence the decision. Where objectives conflict, the four pillars and cross-cutting justice dimensions provide a basis for transparent comparison and adaptive review, rather than an assumption that progress in one domain necessarily improves every other outcome.

These mechanisms indicate that climate ambition must be assessed in relation to the systems required for its implementation and continuity. Targets undermined by fiscal crises, infrastructure failure, technological dependency or political opposition are unlikely to yield durable outcomes. By integrating climate objectives with energy-system construction, productive transformation and institutional resilience, the framework seeks to translate formal commitments into sustained developmental and environmental progress.

The analytical implications extend beyond Africa. Intensifying climate impacts and geopolitical uncertainty affecting energy, technology and development finance increase the importance of resilience and productive capability for sustaining transitions. Resilient Transition is therefore proposed not as a regional exemption from global climate policy, but as a framework through which differentiated national pathways can contribute to global climate goals while addressing energy deficits, development priorities and structural vulnerabilities.

06 Conclusion

Just Transition has reshaped climate policy by establishing equity, participation and social protection as essential dimensions of decarbonisation. It provides an indispensable ethical foundation for addressing the distributional consequences of economic and energy change. Its dominant policy applications, however, reflect contexts characterised by established energy systems, formal labour markets and comparatively strong fiscal capacity. Without substantial contextual adaptation, these applications may insufficiently address the structural conditions shaping energy transformation across much of Africa.

Across much of Africa, the principal challenge is not the managed decline of mature carbon-intensive industries, but building and transforming energy systems that expand household access, supply productive sectors, support industrialisation, and withstand climatic and economic shocks. These objectives must be pursued alongside progressively lower carbon and environmental intensity. The policy problem therefore extends beyond the equitable management of decarbonisation to securing a just entry into energy abundance and productive capability within a climate-constrained world.

This paper has proposed Resilient Transition as a complementary framework that extends the scope of transition policy while retaining its ethical and climate commitments. It integrates four mutually reinforcing pillars: Adaptive Energy Systems, Inclusive Economic Diversification, Fiscal and Financial Resilience, and Adaptive Governance and Local Agency. Carbon, energy, resource and development justice provide cross-cutting criteria for assessing energy choices across these pillars.

The framework advances two broader analytical claims. First, energy policy requires system-level rather than solely technology-level assessment. Adequacy, reliability, transmission, balancing, material inputs and fiscal exposure must be considered alongside generation costs and operational emissions. Second, renewable resources do not, by themselves, establish the justice or sustainability of energy systems. All technologies require lifecycle assessment and evaluation of their contributions to resilience, productive capability, community rights and progressively declining environmental harm.

The framework's contribution is conceptual rather than evidence of its effectiveness across national contexts. Further research is needed to examine how the four pillars interact in practice, how competing objectives are negotiated, and which indicators can distinguish expanded electricity access from

developmental energy adequacy. Comparative application could also assess whether improvements in resilience, productive capability and governance translate into sustained reductions in carbon and environmental intensity. These questions define an agenda for testing and refining the framework rather than treating it as a settled implementation model.

Resilient Transition is therefore proposed not simply as a means of making African decarbonisation more feasible, but as a framework for governing the construction and transformation of resilient, energy-adequate and increasingly low-carbon economies. It extends the focus of Just Transition from the distribution of decarbonisation costs to questions of what countries must build, who controls and benefits from that process, and how environmental intensity can decline over time. For African policymakers, this means incorporating energy adequacy, productive transformation, fiscal sustainability, resource justice, and adaptive governance into the core architecture of energy and climate policy. For international partners, finance, technology access and policy space should be understood not as concessions to reduced ambition, but as components of an equitable and durable global climate response.

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