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Renewable Energy as Peace Infrastructure

How Decentralized Power Shapes Peacebuilding in Fragile and Conflict-Affected Africa

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Africa has enough wind to power itself 250 times over. Yet 600 million Africans remain without electricity, and roughly 400 million of them live in conflict-affected environments. In 2025, global clean energy investment reached $2.2 trillion, of which Africa received just approximately 2.3 percent of the total,[1] despite the continent holding nearly 60 percent of the world's best solar resources and some of the strongest wind potential anywhere on Earth.[2] This convergence of abundant resource endowment, chronic underinvestment, and structural overlap between energy poverty and conflict is not coincidental. It defines the scale of the problem and the magnitude of the opportunity before investors, practitioners, and policymakers. This paper makes a direct, evidence-grounded argument: Decentralized renewable energy (DRE) systems—solar minigrids, solar home systems, and microhydro—function as peace infrastructure when designed with conflict sensitivity and governed with genuine community ownership. They do not merely deliver electricity. In fragile settings, they reduce grievances, restore social contracts, disrupt war economies, and build the kind of community resilience that traditional security programming rarely achieves at comparable cost. The paper draws on the "Powering Peace" workshop convened in Nairobi in March 2026, which brought together more than 45 participants from across the renewable energy, finance, government, and peacebuilding communities. It examines six focus geographies—Nigeria, the Sahel, Sudan, South Sudan, Kenya, and the Democratic Republic of the Congo (DRC)—each representing a distinct archetype of the energy-conflict nexus.

This paper is a field-building intervention. Conventional peacebuilding operates at the macro level: ceasefires, political settlements, governance reform. What remains significantly underdeveloped—in scholarship and practice—is systematic analysis of how renewable energy systems interact with peacebuilding outcomes at the micro level: the community, the household, the livelihood, the daily interaction between people and the infrastructure around them. This paper introduces a framework for understanding these microlevel interactions, organized around three core mechanisms and illustrates that framework through six country cases. The mechanisms constitute a conceptual foundation for further research and practice development. The cases demonstrate how those mechanisms operate in practice and provide practical entry points that can be adapted, replicated, and scaled by developers, financiers, and policymakers across fragile contexts.

For peacebuilding practitioners, the core message is this: Renewable energy is already delivering peace-relevant outcomes in the DRC, Nigeria, South Sudan, and Kenya, even where peacebuilding is not an explicit project objective. The analytical tools of the peacebuilding trade—conflict analysis, stakeholder mapping, community benefit structures, and grievance mechanisms—are also the essential operational requirements for any DRE project that hopes to survive and generate sustainable returns in a fragile setting. Energy and peacebuilding are not parallel tracks. They are the same track.

This paper is not asking policymakers, financiers, and practitioners to do more. It is asking them to do what they already do—differently, and together. The woman protecting her minigrid from armed threat in the eastern DRC is not making a distinction between her energy security and her physical security. The pastoralist in Marsabit, Kenya, whose grazing land was leased away without consent is not separating his livelihood grievance from his political one. The young man in Darfur, Sudan, charging his phone on a community solar panel is not filing his energy access under climate policy and his safety under peace and security. These are institutional distinctions, not lived ones. A peacebuilder who understands energy is more effective. An energy developer who understands conflict is better protected. The integration costs nothing that the status quo does not already cost—and the communities living at the intersection of these crises have waited long enough for institutions to catch up.

Introduction: Energy As a Peace and Security Issue

The Structural Overlap

Globally, more than 800 million people lack electricity, with approximately 86 percent living in OECD-classified fragile contexts.[3] In Africa, the numbers are concentrated and acute: Roughly 600 million people remain without power, and progress is falling far behind targets set by African governments and the international community.[4] Reaching universal electricity access will require a rapid and sustained scale-up of investment and financing to at least $15 billion per year, enabling the expansion of generation capacity, grid networks, and decentralized solutions while ensuring that the transition remains inclusive and reaches those furthest behind. The majority of those without power live in conflict-affected or governance-stressed environments, including the Democratic Republic of the Congo (DRC), Nigeria, Cameroon, Ethiopia, Sudan, South Sudan, Somalia, the Sahel, and northern Mozambique.

These are not marginal geographies. They are home to some of the world's largest UN peacekeeping missions, some of the fastest-growing youth populations on the planet, and some of the most significant untapped renewable energy potential in the world.[5] Conflict is now at its highest level since the Second World War, driven by the breakdown of the international rules-based order, climate degradation, widening inequality, and mounting demographic pressure—forces that are particularly acute across sub-Saharan Africa.[6]

The intersection of these dynamics creates both urgency and opportunity. Where energy poverty and armed conflict coexist, the absence of electricity is rarely a neutral fact of life. It is experienced as abandonment—by the state, by the market, by the international community. Clinics that close at dusk, schools that cannot hold evening classes, water pumps that fail, households that spend disproportionate income on candles, kerosene, or diesel generators—these are not inconveniences. They are daily, material expressions of exclusion that feed grievance, erode trust, and hollow out the social contract. Addressing this gap is therefore not simply a development imperative. It is a peace and security imperative.

What This Paper Does and Why It Matters Now

The nexus between renewable energy and peacebuilding is increasingly recognized as both intuitive and necessary. Yet it remains significantly underdeveloped as a field of analysis and practice. Existing literature and policy frameworks treat energy access and conflict prevention as adjacent agendas rather than integrated ones. Programming is designed in silos. Measurement frameworks are calibrated to count megawatts and connections, not to capture peace dividends. Financing instruments are not structured to reward the additional stabilizing value that decentralized renewable energy (DRE) can generate in fragile settings. The result is a substantial gap between what the evidence suggests is possible and what policy, investment, and practice are currently organized to deliver.

This paper is a field-building intervention designed to begin closing that gap. It introduces an analytical framework—organized around three core mechanisms—for understanding how renewable energy systems interact with peacebuilding outcomes at the micro level: the level of the community, the livelihood, the local political economy, and the daily negotiation between people and

institutions. Most peacebuilding analysis and practice operates at the macro level of ceasefires, political transitions, and governance reform. Those processes matter enormously, but they are insufficient on their own because they often miss the material conditions—energy access, economic opportunity, service delivery, perceptions of fairness—that determine whether peace agreements translate into lived security for ordinary people.

The paper introduces a framework for understanding how renewable energy and peacebuilding interact at the micro level, and it provides practical entry points for applying this understanding. It does so by showing that decentralized renewable energy, designed with conflict sensitivity and governed with genuine community ownership, is one of the most powerful yet underutilized tools available for building peace at this scale.

To make this case, it proceeds in two analytically distinct but connected parts. The first part, organized around the three mechanisms, provides the conceptual foundation: a framework for understanding the causal pathways through which DRE contributes to peace, and a systematic account of the risks and enabling conditions associated with each pathway. The second part, the country cases, provides the operational illustrations: six contexts, each representing a distinct archetype of the energy-conflict nexus, examined not as isolated anecdotes but as practical entry points that can be adapted, replicated, and built upon by practitioners and investors working across comparable fragile settings. The paper closes with policy implications that translate the conceptual and operational insights into actionable guidance.

Methodology and Scope

This paper draws on two primary evidence sources: a comprehensive review of academic literature and gray literature on renewable energy, fragility, and peacebuilding; and a structured synthesis of discussions and working-group outputs from a "Powering Peace" workshop in Nairobi in March 2026, which convened renewable energy developers, peacebuilding experts, multilateral institution staff, and donors operating in fragile and conflict-affected states. The six focus geographies—Nigeria, the Sahel, Sudan, South Sudan, Kenya, and the DRC—were selected to represent the range of energy-conflict configurations across sub-Saharan Africa, from active civil war to postconflict reconstruction to governance stress.

The Case Against Silos

Despite the structural overlap described above, the energy and peacebuilding communities have historically operated in near-total separation. Energy planners optimize for installed capacity, connection rates, and levelized cost of electricity. Peacebuilders focus on ceasefires, mediation processes, and governance reform. Rarely do they design interventions together, share analytical frameworks, or sit in the same room. The cost of this separation is high and operates in both directions.

Renewable energy projects deployed without conflict analysis run the risk of triggering the very tensions they could have reduced: land disputes over siting, intercommunal conflict over sequenced access, elite capture of tariff revenues, and armed group interference with infrastructure. Peacebuilding programs, conversely, miss one of the most powerful stabilizing tools available: reliable, community-governed electricity that transforms daily life and gives communities something worth protecting together.

The March 2026 Nairobi workshop was one of the first gatherings to bring these communities into the same room with a shared agenda. The story that opened proceedings captures why doing so matters: When armed groups threatened a community in the eastern DRC that had recently gained solar electricity, residents did something unexpected—rather than flee, they rushed to protect their minigrid, putting themselves at risk to keep the lights on. This is evidence that when people have something worth protecting, they find reasons to protect it together.

The Energy-Conflict Nexus: What the Evidence Shows

A Compelling but Underdeveloped Nexus

The Nairobi workshop produced an early consensus: The connection between renewable energy and peace is increasingly recognized as both intuitive and necessary yet remains significantly underdeveloped in policy, investment, and practice. Projects in the DRC, Nigeria, South Sudan, and Kenya are already generating peace-relevant outcomes, but those outcomes are rarely designed for, systematically measured, or explicitly financed. The argument from Nairobi is not that treating energy poverty and conflict separately is merely a missed opportunity. It is that doing so is a strategic mistake.

How Renewable Energy Contributes to Peace: Three Mechanisms

The evidence converges on three core mechanisms through which renewable energy intersects with peacebuilding. These are not isolated observations from individual projects. They constitute a conceptual framework—a structured account of the causal pathways through which DRE generates peace-relevant outcomes at the micro level of communities, households, and local political economies. Each mechanism reflects a distinct logic of change, operates through identifiable enabling conditions, and carries a specific risk profile. Together they provide the analytical foundation for understanding the energy-peace nexus and for designing interventions, measurement frameworks, and practical programming that can reliably produce the outcomes this paper argues are possible.

It is important to be explicit about what this framework does and does not claim. It does not argue that DRE automatically produces peace dividends or that energy access is a substitute for political settlements and governance reform. It argues that under specific conditions—conflict sensitivity, inclusive governance, genuine community ownership—DRE systems engage with the microlevel drivers

of conflict and peace in ways that no other development investment currently matches for reach, cost effectiveness, and community legitimacy. Understanding how this works—and when it fails—is the purpose of the framework that follows.

Mechanism 1: Service Legitimacy and the Social Contract

In areas where citizens feel abandoned or actively harmed by the state, reliable electricity for clinics, schools, water systems, and public lighting delivers something that security operations rarely can: tangible, daily evidence of a functioning social contract. The regular hum of a clinic refrigerator, school hours that are predictable because lights work, the ability to charge a phone and access information—these are not small things in settings where their absence has been the norm for generations and where that absence has been a daily reminder of exclusion and neglect. To make this concrete, consider a mother in northern Mali who has watched two children die of vaccine-preventable diseases because the clinic's refrigerator ran out of diesel and the cold chain failed. When a solar minigrid restores and sustains that cold chain, the change is not merely technical. It is political. It signals that someone—a community co-operative, a project operator, a local government—has taken responsibility for her survival. That signal, repeated daily, is the mechanism through which energy access begins to restore trust in institutions and reweave the social contract that conflict has torn apart.

Street lighting reduces the tactical cover of darkness for crime and gender-based violence. Powered health posts strengthen trust in service providers that in postconflict settings are often also the institutions through which state legitimacy is being rebuilt. Water pumps that reduce dangerous journeys reduce household tensions and exposure to armed actors along collection routes. And connectivity—the ability to charge phones and access information—brings markets, accountability, and economic participation closer to communities isolated by conflict. When communities experience these outcomes together, they build a collective stake in the infrastructure that delivers them.

The risk of this mechanism is equally important to name: When projects are implemented without community consent, when benefits are captured by elites, or when one community is connected while its neighbor is left in darkness, the same infrastructure becomes a grievance amplifier rather than a legitimacy builder. Kenya's Lake Turkana case is the most documented illustration of this dynamic. The contest was never about opposing wind power. It was about process, fairness, and inclusion.

Mechanism 2: Resilience, Decentralization, and Operational Risk Reduction

Decentralized renewable energy creates resilience by design in ways that grid infrastructure and diesel supply chains cannot match. Unlike a centralized grid or a fuel depot, distributed minigrids and solar home systems are not potential single points of failure. They cannot be easily interdicted at checkpoints, ambushed on supply routes, or leveraged by armed actors controlling a single access point.

From a technical standpoint, solar PV paired with battery energy storage systems represents the most cost-effective configuration for eliminating the majority of diesel use in FCAS settings. The Baidoa, Somalia, analysis is instructive: A hybrid configuration accepting a 50 percent diesel reduction delivers an optimal outcome for communities, operators, and missions at manageable cost and infrastructure scale. The lesson is as important for renewable energy engineers as it is for peacebuilders: Perfect technical solutions that are politically, financially, or logistically unrealistic are no solutions at all in fragile settings. Good-enough systems that communities can trust, maintain, and protect are the actual operational objective.

Sudan's experience adds a dimension that the preconflict literature rarely addresses: The spontaneous solar adoption across Darfur, Sudan, following the collapse of the centralized grid demonstrates that communities in active conflict can and do self-organize around DRE when the conditions are right—and that this organic resilience should be supported and formalized rather than supplanted by externally designed systems. The risk profile of this mechanism is specific and quantifiable in more-stable contexts: Conflict shocks can and do interrupt operations, even in well-designed projects. Nuru Energy's experience in Goma, DRC—where conflict-induced shutdowns have cost approximately $3.4 million per restart—demonstrates that resilience is not the same as invulnerability. This figure is not an argument against investment. It is an argument for treating shock-buffer financing, political risk insurance, and interruption reserves as structural requirements of every FCAS investment thesis.

Mechanism 3: Political Economy Transformation

The third mechanism is the most powerful and the most dangerous if mishandled. Renewable energy has the potential to fundamentally transform the political economies of conflict by disrupting the economic systems in which armed groups are embedded. Charcoal economies that fund militias, diesel rackets that enrich checkpoint gatekeepers, fuel-subsidy regimes that serve political elites while extracting from the poor—all are structurally threatened by a shift to local, decentralized, community-governed energy systems. Virunga in the DRC demonstrates this potential at scale. Wind and solar are now the cheapest sources of new power generation globally.[7] Diesel generation in fragile contexts is not merely expensive—it is structurally regressive, with costs borne disproportionately by the poorest communities while profits flow to intermediaries embedded in conflict economies. Every minigrid that reduces diesel dependency simultaneously reduces the revenue base of those intermediaries. This is what participants at Nairobi meant when they called for a fundamental narrative flip: Renewable energy is not the high-cost, high-risk option in FCAS—diesel is. Failing to make this argument clearly and repeatedly in

investment conversations leaves one of the most powerful components of the investment thesis entirely on the table.

The risk dimension of this mechanism is equally explicit: If energy projects create new concentrations of benefit, they reproduce exactly the structural grievances that drive conflict. Africa's position as a major source of transition minerals—cobalt, lithium, and copper—means the clean energy supply chain introduces a structural risk of reproducing the extractive dynamics it is meant to displace. Scholars and practitioners have increasingly termed this "green colonialism": the extension of relations of dispossession and extraction into the era of the green transition, in which the environmental and economic costs of decarbonization in the Global North are borne disproportionately by communities and states in the Global South.[8] Responsible sourcing standards, local value chain development, and supply chain oversight are core to the integrity of the energy-peace agenda.

Country Case Evidence: The Nexus in Practice

The six cases that follow are not a comprehensive survey of the energy-conflict landscape. They are illustrative cases, selected because each one illuminates a distinct dimension of the microlevel interactions described in the three-mechanism framework above, and because each one generates practical lessons that can be adapted, replicated, or scaled in comparable contexts. The cases are organized to move from the most fully developed model (DRC/Virunga) through variants of the nexus in Nigeria, South Sudan, Kenya, and Sudan, to the frontier conditions represented by the Sahel. Readers should approach them as a portfolio of entry points, not as a sequence of unique events. The dynamics they illustrate recur across the continent wherever the structural overlap of energy poverty and conflict exists.

DRC: The Virunga Model

Perhaps nowhere is the connection between renewable energy and peacebuilding more visceral—or more carefully documented—than in Virunga National Park in the eastern DRC.[9] For years, the area around Virunga was caught in a devastating political economy of violence whose primary driver was charcoal. Goma, North Kivu's capital with over 2 million people, depended on charcoal as its primary energy source. The forests of Virunga were cleared to supply that demand, destroying habitat for mountain gorillas and funding armed groups—including the Democratic Forces for the Liberation of Rwanda (FDLR)—responsible for some of the region's worst atrocities. At least 214 park staff have been killed in the line of duty.

The Virunga Foundation's response was a bold, sustained investment in hydroelectric infrastructure: over $120 million invested since 2013, bringing online more than 60 megawatts of run-of-river hydropower across four plants, supplying Goma with approximately 80 percent of its electricity. The results have been transformative. For every megawatt brought online, between 800 and 1,000 jobs were created. In total, more than 21,000 jobs have been generated, with 11 percent of new workers being young men and women who had previously been members of armed militias transitioning into the energy economy. Over 30,000 farming families have seen revenues increase through productive-use opportunities created by reliable electricity, including cold chains, agricultural processing, and new service enterprises.[10]

The Virunga case is the most powerful illustration available of what this paper means by disrupting conflict-linked fuel economies. Renewable energy in Virunga did not merely replace dirty fuel—it dismantled a war economy and rebuilt an alternative, simultaneously reducing the revenue base of armed groups, creating dignified livelihoods for those transitioning out, and restoring a UNESCO World Heritage Site.[11] To put this in the terms of the framework above: All three mechanisms were operating simultaneously—social contract restoration through services, resilience through decentralized infrastructure, and political economy transformation through the systematic displacement of the charcoal economy. The threat horizon has not disappeared, however; the specter of illegal oil exploration threatens to reverse these gains, demonstrating that rule of law, state capacity, and responsible natural resource governance are not adjuncts but core pillars of sustainable peace.[12]

Beyond Virunga, Nuru operates the largest minigrid in Africa from Goma and has articulated a vision to power 10 million Congolese by 2030, a target requiring roughly $1 billion in capital. Yet conflict shocks and supply-chain disruptions have forced costly restarts—estimated at approximately $3.4 million after major incidents—demonstrating that community protection, political risk insurance, and contingency financing are not optional add-ons but core design requirements in FCAS investments. In one documented case, electrifying one village while a neighboring one remained in darkness generated immediate intercommunal tension because sequencing was interpreted as a political judgment rather than a technical decision. The lesson is generalizable: The microlevel social dynamics of energy deployment matter as much as the technical and financial ones.

Nigeria: From Diesel Culture to Minigrid Promise

Nigeria's energy story is one of profound structural frustration and enormous untapped potential. In a country where one in three people lack access to electricity,[13] decades of grid dysfunction under the National Electric Power Authority—whose acronym, NEPA, has been bitterly reinterpreted as "Never Expect Power Again"—has created a culture of costly diesel generator dependence deeply embedded in the commercial and domestic fabric of Nigerian life. In northern Nigeria, this is compounded by active insurgency, kidnappings, and broader insecurity that elevate the operational risk of any infrastructure project. The result is a population trapped in an energy poverty that is expensive, dangerous, and structurally connected to the instability around it: diesel supply lines running through insecure territory, generator fuel costs consuming disproportionate shares of household income, and a grid too unreliable to anchor economic activity.

Consider what this means at the household level: a small business owner in Maiduguri spending the equivalent of 30 percent of monthly turnover on diesel fuel to keep a refrigerator running, with no certainty that the fuel will arrive and no alternative if it does not. That is not an abstract market inefficiency. It is a daily experience of economic precarity that erodes resilience and contributes to the social conditions in which recruitment by armed groups becomes economically rational. Every minigrid that replaces that diesel generator with reliable, affordable solar power is not only an energy intervention. It is an economic stability intervention.

Against this backdrop, Nigeria's Rural Electrification Agency (REA) has pioneered a data-driven, public-private approach to minigrid expansion, backed by performance-based grant mechanisms, that represents one of the most sophisticated FCAS energy financing models currently operating on the continent. The REA model demonstrates concretely that clean power can be made cheaper than instability—that with the right financing architecture and regulatory environment, minigrids in insecure northern Nigerian communities can be commercially viable, serving household, commercial, and productive loads simultaneously.

The 350-kW solar minigrid documented in the workshop proceedings illustrates the potential and the fragility of this model. The project was shut down after armed vigilantes attacked the community, killed several people, and burned a nearby warehouse. For four months, there was no power, no revenue, and no benefit to the communities the project was designed to serve. The company eventually returned, but only after community leaders engaged local authorities, and only after deep community dialogue that reframed the plant not as an external asset to be managed but as a shared community resource to be protected. That four-month shutdown was not an engineering failure. It was a conflict-sensitivity failure that a structured, prefeasibility conflict analysis and a meaningful community benefit agreement (CBA) might have anticipated and prevented.

South Sudan: Diesel Dependency as a War Economy

South Sudan presents the starkest illustration of how fossil-fuel dependence becomes architecturally embedded in conflict economies. The country has no domestic refining capacity for diesel, and fuel supply routes are costly, insecure, and mediated by taxation, armed checkpoints, and corruption.[14] The country exports all crude oil while importing all refined fuel, leaving the entire energy supply chain exposed to the same checkpoint economy and elite diversion that characterizes the broader political economy of conflict. The United Nations mission itself represents approximately 20 percent of energy access in South Sudan, demonstrating the scale of external footprints and the degree to which diesel logistics drain resources, distort local energy markets, and indirectly finance the actors controlling supply routes.

To understand the microlevel stakes: In displacement settings across South Sudan, access to electricity determines whether a child can study after dark, whether a woman entrepreneur can operate a mobile money kiosk, whether a clinic can maintain a vaccine cold chain that keeps children alive. When that electricity depends on a diesel supply chain running through armed checkpoints, each liter of fuel purchased is, in effect, a contribution to the political economy of war. Substituting solar for diesel in these settings is therefore not a technical optimization. It is a structural intervention in the economics of conflict.

Evidence from Baidoa, Somalia—a context closely analogous to South Sudan's displacement and garrison settings—underlines a practical design principle: Pursuing a 50 percent diesel reduction through solar PV and battery storage is far more feasible and cost effective than aiming for near-total diesel elimination from the outset. In fragile settings, resilience often depends on optimizing trade-offs rather than maximizing technical purity. For South Sudan, this means targeting hybrid solar-diesel systems for UNMISS bases, humanitarian hubs, and displacement-camp settings first, using UN procurement as an anchor-client mechanism to catalyze broader minigrid investment. Every diesel convoy eliminated from a UN mission also eliminates a revenue stream for checkpoint gatekeepers and reduces the risk of armed incidents along supply corridors.

Kenya: Land, Consent, and the Architecture of Trust

Kenya provides cautionary lessons on land governance and benefit sharing that should constitute nonnegotiable industry standards across all FCAS contexts, and indeed across all large-scale renewable energy deployment. The Lake Turkana Wind Power project—Africa's largest wind farm at 310 MW, representing one of the largest single private investments in Kenya's history at approximately $782 million (€678 million)—became emblematic of how technically excellent infrastructure can be paralyzed and politically delegitimized by governance failure at the land-allocation stage.[15]

In 2009, 150,000 acres of communally held trust land in Marsabit County were leased to the project without public consultation, without notice to residents, and without compensation, a process the Kenyan Environment and Land Court ruled unlawful in a landmark October 2021 judgment[16]. Four Indigenous pastoralist communities—the El Molo, Turkana, Samburu, and Rendille—pursued litigation from 2014 onward, arguing that the land was their ancestral and grazing land held under intergenerational trust, that its privatization disrupted camel corridors and severed access to Lake Turkana, and that their cultural practices at the site had been rendered impossible.[17] The full measure of the governance failure is captured in a single fact: The project supplies approximately 17 percent of Kenya's national electricity, yet the communities whose land it occupies remain unconnected to the national grid.[18]

The microlevel impact is worth dwelling on. A Rendille pastoralist whose camel corridor was severed by a wind farm fence has not experienced "a land governance dispute." He has experienced the loss of his family's livelihood, the disruption of a seasonal migration route established over generations, and the severing of his community's relationship with a body of water that is simultaneously a practical resource and a cultural anchor. That

experience generates grievance at a depth that legal proceedings cannot easily resolve. It is precisely the kind of microlevel harm that conflict-sensitive design—genuine free, prior, and informed consent, and transparent benefit sharing from project inception—is meant to prevent.

In both the Lake Turkana case and the Kakuma refugee camp—where access rules and perceived inequities between refugees and host communities can turn electrification into another site of tension—the fundamental error was identical: Communities were treated as passive recipients of benefits rather than as codesigners and coowners of infrastructure that would shape their lives for decades. The principle is consistent across all FCAS contexts: "Do no harm" in energy deployment effectively means "Do not surprise communities."

Sudan: Destruction and Adaptation

Sudan represents the sharpest illustration of what this paper means when it warns that some contexts require conflict resolution as a precondition for large-scale energy investment, but also the most compelling argument for why planning for postconflict reconstruction must begin now. The war between the Sudanese Armed Forces and the Rapid Support Forces, which began in April 2023, has caused catastrophic and deliberate damage to the country's energy infrastructure. According to official estimates from the Sudanese Electricity Company, the conflict has destroyed approximately 40 percent of Sudan's total generation capacity, leaving only two of fifteen thermal power plants operational, destroying over 100,000 transformers, and triggering prolonged or total blackouts across multiple states, including a complete blackout in Northern State since April 2025.[19] The Al Jili oil refinery, which previously supplied approximately 60 percent of Sudan's gasoline, has sustained an estimated $3 billion in damages and has ceased operations.[20]

What makes the Sudan case analytically striking for the purposes of this paper, however, is not only the scale of destruction but the paradoxical community response it has generated. Across Darfur—a region where, even before the war, some 80 percent of the population lacked access to grid electricity—the collapse of centralized power infrastructure has driven an extraordinary and largely spontaneous shift toward small-scale solar. In Nyala, the capital of South Darfur, residents report that approximately 90 percent of the population now depends on solar energy for essential needs, including water pumps, hospital operations, and internet access—a transformation driven not by donor programming or government planning but by necessity, affordability, and Darfur's abundant sunlight.[21] This is Mechanism 2—community resilience through decentralization—operating not as a designed intervention but as a community-driven adaptation to catastrophic state failure.

The microlevel significance is considerable. A woman in Nyala who purchases a small solar panel to charge her phone and run a lamp has made an economic and security calculation: Solar is available, affordable, and free from the checkpoint dynamics that govern fuel supply. Her choice, multiplied across hundreds of thousands of households, constitutes a structural shift in the local energy economy that is more rapid, more community embedded, and more conflict resilient than any donor program could have engineered from the outside.

This grassroots solar expansion is fragile and uneven: Solar installations across North Darfur have been systematically looted, and planned solar water infrastructure for El Fasher could not begin because of active fighting. Nevertheless, the pattern demonstrates that communities in conflict can and do develop their own energy resilience when centralized systems fail them—and that the postconflict reconstruction window in Sudan is precisely the moment at which the international community should invest in decentralized, conflict-sensitive, and community-governed renewable infrastructure rather than rebuilding the same centralized systems that proved so catastrophically vulnerable to attack.

The Sahel: Fragility at the Frontier

The Sahel represents the furthest frontier of the energy-peace agenda—where the conditions for investment are most constrained but the cost of inaction is highest. Workshop participants described Mali, Niger, and Burkina Faso as places where donor-driven solar efforts continue in the shadow of coups, insurgency, and grid fragility. In each of these contexts, the dynamics identified across the other five cases are present in their most acute form: extreme energy poverty, active armed conflict, collapsed state legitimacy, and communities whose daily lives are organized around the absence of the services that electricity would provide.

The Sahel cases also illustrate a dimension of Mechanism 1—service legitimacy—that is particularly significant in contexts of jihadist insurgency. In communities where the state has been entirely absent for years, and where armed groups have partially filled governance vacuums by providing rudimentary dispute resolution and distributing resources, a DRE project that brings reliable services—clinic power, school lighting, water pumps—is entering a highly contested legitimacy landscape. Getting the governance architecture right is not a program design consideration. It is a conflict prevention imperative. A project that connects a clinic to electricity and attributes it to an external donor has a different legitimacy impact than one that attributes it to community cogovernance. The difference matters enormously in environments where the attribution of authority is itself a political act.

These contexts illustrate a fundamental challenge of fragile-state investment: The political risk premium applied to FCAS settings—even those with functioning, if constrained, institutional environments—often renders viable projects unfinanceable under commercial terms. Planning for Sahel energy reconstruction, and ensuring that DRE systems are designed for resilience and inclusion from day one, is a strategic priority that the international community should advance in parallel with political and security engagement.

What Makes Projects Work: The Operational Blueprint

Conflict Analysis as Foundational Intelligence

Before a single pole is sunk or a panel installed, projects must invest in a structured conflict analysis. This is not a bureaucratic compliance exercise. It is the foundational intelligence that determines whether a project stabilizes or destabilizes the communities it enters. In the DRC case where a minigrid lacked capacity to serve two neighboring villages and the decision to prioritize one triggered tension between them, the error was not technical—it was the absence of prior analysis of intercommunal relationships and the failure to anticipate how a sequencing decision would be read across community lines.

Conflict analysis in FCAS energy contexts should map the root causes of local conflict—natural resource competition, historic ethnic or clan disputes, inequality in service access—and identify conflict actors and marginalized groups at risk of reading a new energy project as another expression of exclusion. It should determine potential spoilers—those with economic or political stakes in the status quo—and identify champions, including local authorities, traditional leaders, and civil society actors who can protect and advocate for the project. The experience from Darfur and the Sudan-South Sudan borderlands is instructive: Even in active war zones, local agreements can create functioning markets, and energy infrastructure deliberately woven into those local peace processes can shift incentives for combatants as well as civilians..

Community Benefit Agreements with Substance

CBAs are the contractual expression of the conflict analysis, and their quality is a direct predictor of project sustainability in FCAS. Done well, they convert potential grievances into shared stakes and give communities a material and legal reason to protect the infrastructure they cogovern. Done poorly, they are paper legitimacy—signatures collected for compliance, without the substance communities need to believe the project is genuinely for them.

Effective CBAs must specify local employment and supplier development targets with explicit provisions for youth, women, and ex-combatants; a clear schedule for social load electrification (clinics, water pumps, schools, and street lighting) that prioritizes community needs over commercial loads so that benefits are visible early; transparent tariff rules with explicit protections for essential services so that global commodity price shocks do not transmit into unaffordable bills; and a grievance mechanism with real authority, clear timelines, and independence from project proponents. The northern Nigeria shutdown—four months of no power following vigilante violence—demonstrates precisely what the absence of these provisions costs. A meaningful CBA, established before operations began, might have built the community-protection relationships that could have prevented the incident.

The Twin-Track Operational Model

The most consistently successful DRE deployments in FCAS follow a twin-track operational model that addresses the social and commercial dimensions of project viability simultaneously. Track one prioritizes social loads—clinics, water pumps, schools, and street lighting—that earn community legitimacy and build trust in the project operator. This is the track that generates the political protection that keeps assets safe. Track two enables productive use—connecting cold chains, milling equipment, welding bays, digital kiosks, and irrigation systems that convert kilowatts into incomes and make the commercial logic of the project self-reinforcing.

When community members can see and touch the prosperity loop—when the electricity bill is offset by a new business, when cold storage enables food security and market participation—the value of the asset becomes self-evident, and community protection becomes a rational economic act as well as a civic one. OffGridBox's modular containerized systems, which integrate purified water delivery and solar energy for communities including refugee settlements across East Africa, demonstrate that this twin-track logic can be embedded in project design from inception. The company's evolution toward electrifying institutional buildings—health facilities, schools, and community centers—across more than 20 countries and 50 projects with over 40 partners illustrates how institutional electrification converts energy access into legitimacy, service continuity, and local trust..

The Social License to Operate: A Business Requirement

For energy investors and developers, conflict sensitivity is not a corporate social responsibility add-on. It is a core business requirement for asset protection and long-term return on investment. The experience across Nigeria, Kenya, and the DRC is unambiguous: Projects that lack social legitimacy face security incidents, forced shutdowns, and restart costs that can total millions of dollars per event. A 350-kW minigrid that sits idle for four months generates no revenue, destroys trust with the communities it is meant to serve, and signals to investors that the model is unreliable. A $3.4 million restart cost at Nuru is not a development anecdote. It is a line item in an investment thesis.

Conversely, projects with genuine community ownership—where communities have codesigned the CBA, understand the tariff structure, trust the grievance mechanism, and see daily evidence of benefit—have demonstrated the ability to withstand conflict shocks that would destroy less deeply embedded projects. The residents of the eastern DRC who protected their minigrid from armed threat did so not because they were instructed to but

because the infrastructure was genuinely theirs. That is what social license looks like in practice, and it is the single most cost-effective security investment an energy developer can make in a fragile setting.

Policy Implications

For energy developers, the implications are immediate. Conflict sensitivity should be treated as a standard predevelopment requirement, not a post hoc mitigation measure. Communities must be engaged from the start through genuine free, prior, and informed consent, explicit benefit sharing, and grievance mechanisms with real authority. DRE projects in FCAS should be designed with social and productive loads in mind because legitimacy and revenue depend on both.

For policymakers, the priority is to remove barriers that prevent decentralized energy systems from operating in fragile environments. That includes enabling regulation, land-access clarity, procurement reform, and support for minigrid integration into national electrification strategies. In fragile settings, policy should make it easier to build local legitimacy and harder to externalize social costs.

For peacebuilders, the challenge is to treat energy as a central part of the peace toolkit. Energy access is not a substitute for mediation or governance reform, but it shapes the conditions under which those processes succeed or fail. Peace practitioners who understand energy are better positioned to design durable interventions.

For development partners and donors, the practical task is to support the kinds of project conditions that make DRE socially durable: long-term community engagement, local grievance resolution, conflict-sensitive planning, and procurement arrangements that prioritize resilience over narrow least-cost logic. In fragile settings, the value of a project should be judged not only by how many connections it creates but also whether communities continue to protect and use it when conditions deteriorate.

Conclusion

The core claim of this paper is simple: Renewable energy is not only compatible with peacebuilding in fragile and conflict-affected settings; in many contexts it is an essential part of how peace is made durable at the micro level. DRE systems can restore service legitimacy, reduce operational vulnerability, and transform the political economy of conflict when they are designed with inclusion, ownership, and conflict sensitivity.

That does not mean every solar panel is a peacebuilding instrument. It means the peace potential of energy systems is real, but contingent. The field now needs a more disciplined way to analyze and scale that potential. This paper offers one: a framework grounded in three mechanisms, illustrated through six cases, and translated into practical guidance for developers, policymakers, peacebuilders, and development partners.

The task ahead is not to invent a new agenda from scratch. It is to connect agendas that already exist but too often remain apart. Energy developers, policymakers, peacebuilders, and communities already possess many of the tools needed to make this work. What has been missing is a framework that shows how those tools fit together at the level where people actually live, work, and survive. This paper is intended as a starting point for that broader field-building effort.

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Cover photo: Virunga National Park in eastern Democratic Republic of the Congo is Africa's oldest national park and home to the endangered mountain gorilla. It has long been surrounded by regional violent conflict, but the park's innovations in renewable energy show promise for peace. Courtesy of Sandra Mutuku.

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