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Original Article

Agroecology and Food and Energy Sovereignty for a Just Energy Transition in Rural Colombia

Agroecología y soberanía alimentaria y energética para una transición energética justa en la ruralidad colombiana

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Abstract

Introduction: The debate on the current global crisis and the energy transition (ET) is typically approached from a corporate and technocratic perspective that emphasizes supply and demand and the replacement of fossil fuel sources. This model overlooks the fact that 21st-century energy and food solutions must challenge power structures and promote social justice. In response, the Just Energy Transition (JET) has emerged, rooted in grassroots environmentalism and opposed to extraction models that increase the exploitation of fossil fuels and minerals in the Global South. In Colombia, the JET is expressed through energy communities, where agroecology, food sovereignty (FS), and energy sovereignty (ES) converge.
Objective: This paper reflects on the contributions of these concepts to the debate on a JET in non-interconnected zones (NIZs) in Colombia.
Methodology: To this end, the following are analyzed: i) trends in ET; ii) the Colombian context; iii) the convergence between agroecology, FS, and ES; and iv) concrete experiences in the country.
Results: The findings showed that in the energy communities, these approaches represent a commitment to peace with nature and external independence in regions such as La Guajira, Santander, Córdoba, and Nariño, where processes of self-management and community defense of the territory are present.
Conclusions: Greater political commitment is needed to expand these initiatives to additional NIZs areas, which account for 22,7% of the country and disproportionately affect rural populations, particularly women.

Keywords: Agroecology, Political Ecology, Social Justice, Food Sovereignty, Energy Sovereignty, Just Energy Transitions.

Resumen

Introducción: El debate sobre la crisis mundial actual y la transición energética (TE) suele abordarse desde un enfoque corporativo y tecnocrático que enfatiza la demanda, la oferta y el reemplazo de las matrices energéticas fósiles. Este modelo omite que las soluciones energéticas y alimentarias del siglo XXI deben cuestionar las estructuras de poder y fomentar la justicia social. Como respuesta, surge la Transición Energética Justa (TEJ), que tiene sus raíces en el ecologismo popular y se opone a los modelos de extracción que intensifican la explotación de combustibles fósiles y minerales en el Sur Global. En Colombia, la TEJ se expresa en las comunidades energéticas (CE), donde convergen la agroecología, la soberanía alimentaria (SA) y la soberanía energética (SE).
Objetivo: Este trabajo reflexiona sobre los aportes de estos conceptos al debate en torno a una TEJ en las zonas no interconectadas (ZNI) de Colombia.
Metodología: Para ello, se analizan: i) las tendencias de la TE; ii) el contexto colombiano; iii) la convergencia entre agroecología, SA y SE; y iv) experiencias concretas en el país.
Resultados: Los hallazgos evidenciaron que, en las CE, estos enfoques configuran una apuesta por la paz con la naturaleza y la independencia externa en regiones como La Guajira, Santander, Córdoba y Nariño, donde existen procesos de autogestión y de defensa comunitaria del territorio.
Conclusión: se requiere un mayor compromiso político para ampliar estas iniciativas a más ZNI, que representan el 22,7% del país, con impactos desproporcionados en las poblaciones rurales, especialmente en las mujeres.

Palabras clave: Agroecología, Ecología popular, Justicia Social, Soberanía Alimentaria, Soberanía Energética, Transiciones energéticas justas

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Why was this study conducted?
This study contributes to current debates on Just Energy Transitions (JETs) in Colombia and worldwide. It stems from the need to explicitly examine the convergence among concepts such as agroecology, food sovereignty, energy sovereignty, and energy communities. Although these concepts are sometimes presented separately, they are deeply interconnected and mutually reinforcing in the pursuit of territorial autonomy and locally managed, just energy transitions led by historically excluded rural communities..

What were the most significant findings?
The findings begin with an analysis of the Global South, with particular emphasis on Colombia's historical trajectory in relation to energy transitions and emerging trends. In Colombia, 52% of the territory faces energy deficits under the current corporate energy model. The study also identifies the theoretical and practical conditions required to advance a JETs from the perspectives of political ecology, decoloniality, phenomenology, and post-development. Furthermore, it explores the philosophical, conceptual, and practical complementarity among agroecology, food sovereignty, energy sovereignty, and energy communities, while highlighting the challenges faced by these alternative energy models in relation to the solutions proposed by the dominant modern cosmology. Finally, the study presents examples of energy communities in Colombia and elsewhere that apply this analytical framework, demonstrating their potential to strengthen territorial autonomy and support locally led JETs..

What do these results contribute?
The findings of this reflection allow us to envision a different future in terms of energy transitions and relationships between human and non-human beings. More importantly, the study identifies the internal and external transformations required to advance toward such a model, as well as the challenges it faces within the context of capitalism dominant individualistic, and extractivist cosmology.

Graphical Abstract

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Introduction

The convergence of population growth, social inequality, and the climate and energy crisis, aggravated by price volatility and market monopolization, drives a global energy transition toward renewable sources (1), (2). In this scenario, the territory and the commons become focal points of socio-environmental conflict, in which individuals, companies, and the State dispute access to and control over natural resources. Unlike conventional environmental conflicts, these emphasize cultural dimensions, rights, and the livelihoods of populations (3). In Colombia, territorial defense for a Just Energy Transition (JET) takes shape in energy communities grounded in agroecology, food sovereignty (FS), and energy sovereignty (ES). These pillars prioritize local empowerment and the construction of an ethical relationship with nature and the land to achieve territorial autonomy and sustainability (4), (5). This article analyzes the complementarity of these concepts as essential axes for consolidating the JET in the country's rural areas.

A JET must transform the fossil matrix into a diversified, clean matrix that mitigates climate change and respects community interests. This approach recognizes the nexus between water, energy, and food: agriculture consumes 72% of global water and 90% of energy production depends on it (6). Given the pressure on these resources, integrated management that balances socioecological needs is imperative to achieve the Sustainable Development Goals (7), (8).

In Latin America, agroecology emerges as a science, sociopolitical movement, and ancestral practice (5), (9). Its objective is to promote natural cycles, as well as FS and ES, and to ethically rescue the knowledge of peasant, Indigenous, and Afro-descendant communities (10), (11). In Colombia, it is currently positioned as a phenomenological alternative to the reductionism of industrial agriculture and the "green revolution" (4), (5), (12), which promotes the use of energy managed locally from the territory (10), (12), (13), (14), (15), (16). The movements that promote JET, through energy communities, converge with agroecology in their pursuit of autonomy, sovereignty, and external independence (13), (17). However, there is little research on how agroecology, energy communities, FS, and ES complement each other to achieve a JET in rural Colombia.

JET in Colombia must move beyond a technological approach to foster local, self-managed, and sovereign models. Despite the renewable energy potential of its equatorial location, critical asymmetries persist: 22.7% of households live in energy poverty, concentrated in vulnerable areas (18). Therefore, rural JET must prioritize an inclusive and transformative approach to the energy matrix, as a driver of equity, avoiding the deepening of territorial inequalities and the exclusion of the cosmologies and alternative forms of relating to the environment of Indigenous, Afro-descendant, and peasant communities (18). Energy communities exemplify the link between agroecology, FS, and ES. By managing autonomously what and how to produce, communities reduce their dependence on the global market and corporations (13), (14). This community control creates resilient systems that integrate the farm and local energy, strengthening social justice and a dignified life (4), (5), (19).

This research examines how agroecology, energy communities, FS, and ES complement one another to strengthen JET in rural areas. To answer this question, three objectives were proposed: to examine the situation of ET in the country; to reflect on how agroecology, FS, and ES are

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interrelated, highlighting their contribution to a JET. Finally, some concrete experiences from rural Colombia through energy communities are synthesized.

Methodology

This work emerged as a reflection on the community-based experiences of the Ingeniería de Recursos Hídricos y Suelos (IREHISA) research group at Universidad del Valle, Colombia, in projects related to agroecology, ES, FS, and climate variability and change in regions such as Nariño, Cauca, and Valle del Cauca. It also incorporated books, academic articles, and reports on Colombia's history, focusing on policy, institutions, agroecology, FS, ES and ET. This was carried out using specialized search engines such as Scopus, Web of Science, Redalyc, ScienceDirect, and Google Scholar, as well as reports from the Ministry of Mines and Energy and the Institute for Planning and Promotion of Energy Solutions for Non-Interconnected Zones (IPSE), and documents published in Spanish by pioneering non-governmental organizations in Colombia working on issues related to energy communities, such as CENSAT Agua Viva. This made it possible to reflect on the potential for integrating agroecology, FS, and ES to propose comprehensive alternatives to the existing challenges associated with the ET in the country.

Brief overview of the energy transition in the global south and its trends

Energy extractivism

Energy transition is a global necessity in response to the current civilizational crisis. The predominant and exclusionary discourse obscures the extractivist roots of the current energy model, which is undergoing a structural crisis due to its extreme dependence (86%) on depletable fuels and energy flows (20). Its structure, driven by public and private corporations, prioritizes interests over socio-environmental well-being (21).

Extractivism in the Global South was an imposed colonial model (22). In the Latin American context, the complex and hierarchical structures of Indigenous communities were instrumentalized to exploit the commons (22). Svampa (23) and Ceceña (24) argue that the expansion of extractive projects in Latin America has led to an erosion of democratic quality, characterized by the concentration of strategic decision-making, limited participation by affected communities, and the subordination of deliberative mechanisms to large-scale economic interests. Historically, these entities have supplied raw materials for the development of inclusive systems in both the Global North and China (22).

This model, historically embedded in regional institutions, consolidates a decision-making process that favors actors with political, coercive, or economic hegemony (22). The extractive nature of these institutions not only perpetuates inequality and poverty but also intensifies geopolitical disputes over energy and generates systemic socio-environmental damage that degrades biodiversity (20), (25).

doi: 10.25100/iyc.v28i2.15752

The "green extractivism"

The current energy model accelerates global warming while perpetuating mechanisms of exclusion. Within sustainable development narrative, large-scale infrastructure projects are promoted that, despite often being financed with public resources, displace communities and commodify energy (26), (27). Moreover, extractive zones, located primarily in the Global South, bear a disproportionate share of the environmental impacts (28). The Global South supplies 70% of critical minerals (lithium and copper), while 79% of investment capital and infrastructure is concentrated in the Global North and China (28). This disparity demonstrates that both the causes and solutions to the climate crisis are shaped by global inequalities in wealth and power. Under the current framework, access to energy does not translate into general well-being, but rather into benefits for the 5% of the population responsible for the highest emissions (29). Likewise, Global South's external debt, which is 30 times the cost of ensuring clean energy by 2030, acts as a systemic constraint. Therefore, without restructuring financial burdens, the current model will continue to sacrifice equity in favor of accumulation (29).

Corporate Energy Transition vs. Just Energy Transition

Humanity faces a historic crossroads between two trends: the corporate energy transition (CET) and the JET (30). The CET considers the climate crisis a new frontier for profit, adopting a patriarchal, technocratic approach and promoting weak sustainability that does not challenge growth but rather increases control through solutions such as large dams, nuclear energy, unconventional gas, and the monopolization of green infrastructure (wind and solar).

These technologies consolidate an unjust extractivism that prioritizes corporate interests over territorial needs, thereby shaping local values to perpetuate inequality. However, domestic access to solar energy or tax exemptions for self-generation, rather than concessions from the market, are victories of social movements against this exclusionary model (17), (31). In contrast, the JET goes beyond simple decarbonization, defined as the replacement of fossil fuels with renewable sources, and proposes a comprehensive transformation of the rural energy system (15), (16). This approach aims to guarantee a fair distribution of costs and benefits, protect traditional workers, and include vulnerable communities. Through a process of historical reparations, the goal is to redistribute wealth, limit disproportionate consumption, and place human rights and ecological balance above the accumulation of capital.

Although the JET is technologically viable and economically inevitable (32), it is politically fragile: the pace of technological change exceeds the capacity for social and legislative adaptation. Despite Latin America's vast energy potential, limitations persist in management and financing. Given that economies such as Colombia, Mexico, Venezuela, and Ecuador depend on hydrocarbons to finance public spending (health, education, and infrastructure), an accelerated transition without prior economic diversification would compromise the stability of public finances (16).

doi: 10.25100/iyc.v28i2.15752

Toward more just energy transition

he JET emerges, in contrast to the traditional model, intending to achieve "strong sustainability" (33), grounded in socio-environmental justice and popular ecology. This perspective maintains that, rather than being a technical process, the transition requires a restructuring of power relations to place ecological balance at the forefront of political inertia that perpetuates inequality (33), (34), (35), (36). Within this framework, the current crisis is defined as a conflict between governance and the development model (37), (38), (39).

This paradigm transcends corporate decarbonization and is articulated around three critical limits: the finite nature of fossil fuels, the material constraints of renewable infrastructure, and the capacity of the biosphere (40), (41), (42). Thus, energy and water are redefined as commons or rights-bearing entities (43), subordinating the productive system to biophysical limits and the satisfaction of fundamental social needs.

According to Miller et al. (44), achieving the JET requires coordinating strategic axes: alliances for regional autonomy in the face of oligopolies; an energy matrix linked to social equity and autonomy through inclusive public management that respects Indigenous, Afro-descendant, peasant, and community worldviews. This approach moves beyond the logic of production-consumption by incorporating the diversification of production and the democratization of wealth within a cyclical energy metabolism compatible with life, unlike what occurs with the concent

ration and privatization of CET (34), (44), (45).

Although concepts of climate, environmental, or energy justice may be invoked (41), (45), (46), they all converge on fundamental principles (45): recognition justice: inclusion and respect for diverse worldviews and knowledge systems; procedural justice: legitimacy and inclusion in decision-making for populations with diverse cultural perspectives; distributive justice: equitable distribution of burdens and benefits among people, generations, and territories; restorative justice: reparation for human and environmental damages in communities affected by extractive projects.

Characteristics of the Just Energy Transition in Rural Areas

Rural JET is grounded in a critical diagnosis of the asymmetries and structural failures of global energy systems (31). Its approach is based on building the right to energy and deprivatization to strengthen the public, participatory, and democratic spheres. This model proposes reducing aggregate consumption and defossilizing energy sources (15), (31), (43). Likewise, it proposes eradicating energy poverty through a systemic transformation: decommodification, depatriarchalization, deprivatization, decentralization, deconcentration, defossilization, and decolonization of thought. These dimensions seek to reconfigure social relations under the principles of human and nature's rights, consolidating a truly just energy system (31).

This approach redefines the energy matrix and technological selection by transforming power relations. It integrates financial, political, geopolitical, and human rights dimensions, as well as gender equity, productive diversification, and wealth distribution (15). The objective is to understand the multiplicity of factors, conceptions, and aspirations at stake (35). Likewise, the model rejects reducing the debate solely to the increase of renewable energy sources and

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advocates for an ecological and popular JET that strengthens synergies between agroecology and FS (31). It promotes movements such as agroecology, in which alternatives emerge from and are strengthened by territorial contexts (5). In this proposal, the eradication of energy poverty is the central axis, articulating scientific knowledge with ancestral knowledge to co-construct societies with social and environmental justice.

Colombia's energy landscape in the pursuit of a just energy transition

The Colombian energy system

Colombia has a hydroelectric potential of 56 GW, of which only 20% is currently utilized. La Guajira stands out, with winds exceeding the capacity of the National Interconnected System (NIS) by 1.2 times and solar radiation exceeding the global average, making it a key resource for mitigating the intermittency of solar and wind sources (46), (47), (48). However, the model is centralized and oligopolistic: three companies (Enel, Isagen, and EPM) control 77% of price-setting in a system subordinated to the export of fossil energy (18), (46).

The electricity matrix, 68% dependent on hydropower, is highly vulnerable to climate-related phenomena such as El Niño, which force reliance on polluting thermal sources to prevent blackouts (52), (50). Despite coal and oil accounting for 60% of its exports, Colombia remains one of the most unequal countries, with 52% of its territory disconnected from the national electricity grid (51). In response to the omission of cultural and environmental autonomy criteria in previous laws, the new JET model incorporates the socio-environmental dimension to guarantee territorial equity and a fair distribution of impacts and benefits (46).

Colombia's energy model shifted from a state-led approach to a free-market model following the 1992 crisis and the enactment of Laws 142 and 143 of 1994. This framework fragmented the sector into generation, transmission, distribution, and commercialization, limiting the State to a regulatory role. Although the NIS covers 96% of the population, the remaining 4% in Non-Interconnected Zones (NIZs) depend on costly fossil fuels (Figure 1).

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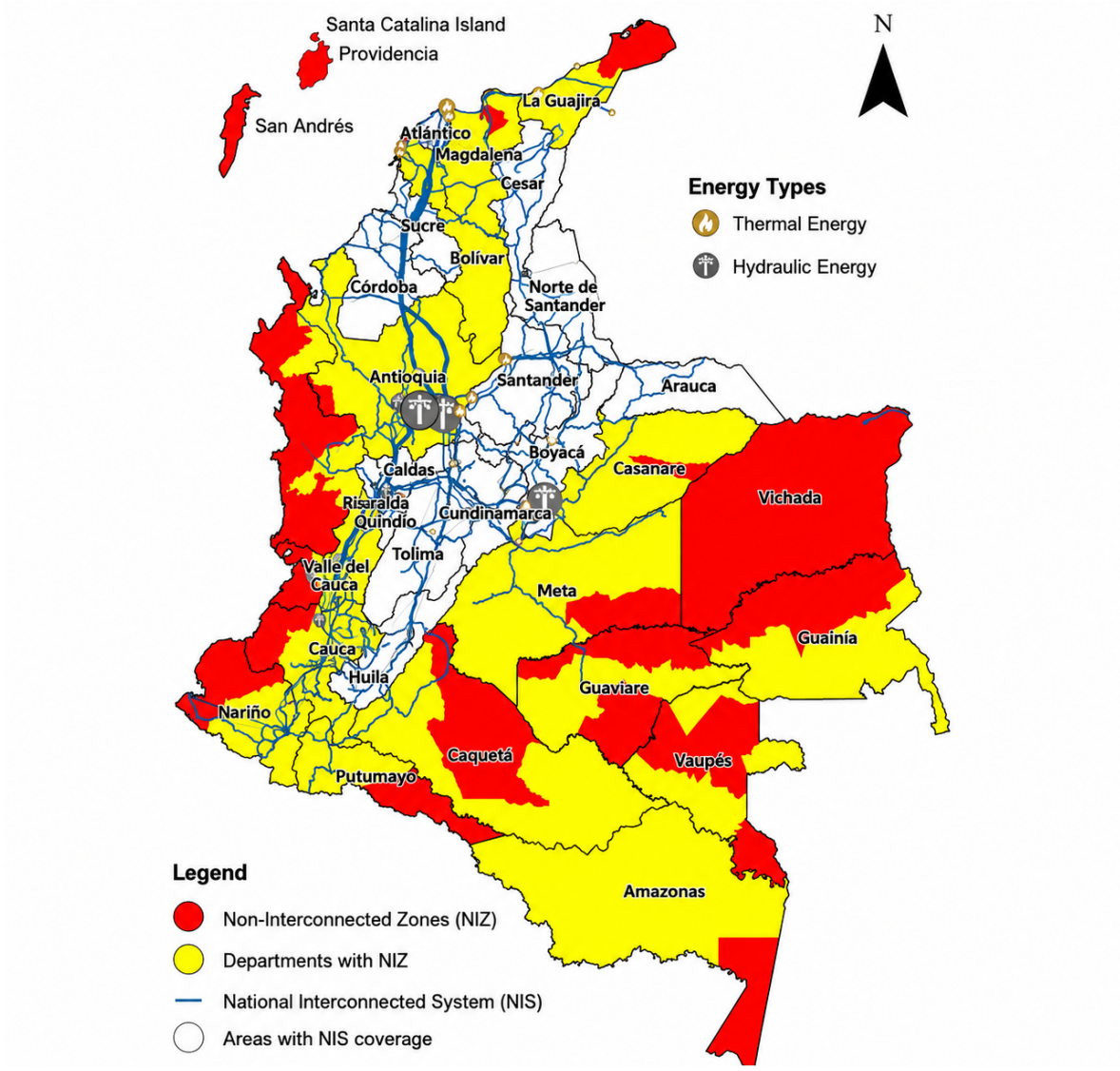

Figure 1. Non-Interconnected Zones (NIZs) in the Colombian National Interconnected System. The strip of municipalities not connected to the NIS is shown in red. The departments where these municipalities not connected to the NIS are located are shown in yellow. Source: authors, based on open data from IPSE (https://www.datos.gov.co/Minas-y-Energ-a/Estado-de-la-prestaci-n-del-servicio-de-energ-a-en/3ebi-d83g/about_data).

Although Law 1715 of 2014 promotes non-conventional renewable energy sources and self-generation (17), its impact remains marginal due to regulatory and infrastructure barriers (18). Authors such as Heffron (53) and Svampa (36) argue that the system prioritizes economic profit, perpetuating inequalities and high tariffs that hinder the JET (35), (13). By 2025, net capacity had reached 20,200 MW, with hydropower leading, followed by gas, coal, solar energy, and other sources (Figure 2). Although the matrix is predominantly "clean," its cost is subject to an oligopolistic market and climate variability. Paradoxically, in regions with the greatest solar potential, precarious infrastructure persists; thus, despite renewables accounting for nearly 14% of the energy matrix, energy poverty affects 22.7% of households (5), (18).

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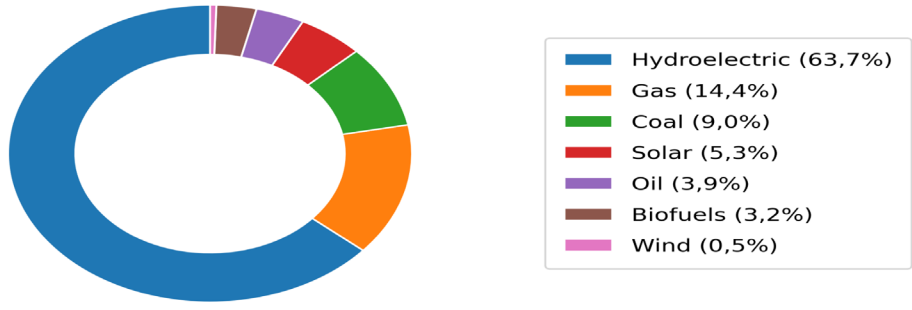

Figure 2. Colombia's net power generation capacity in 2025. Source: Author's own, based on data from Sagastume et al. (54).

The energy poverty in Colombia

Since the mid-20th century, structural factors and pressures from internal and external actors, ranging from insurgencies and traditional elites to global powers, have consolidated a deep distrust of reforms that challenge economic stability, marginalizing alternative visions of the nation (4), (55). Nevertheless, the lack of electricity is a critical barrier: without energy, the medical cold chain is disrupted, the digital divide widens, and rural areas are condemned to subsistence, preventing productive transformation (17), (18), (56), (57).

Energy poverty is unevenly distributed; while national coverage in the central part of the country is 96%, in regions such as Vichada, Chocó, Caquetá, La Guajira, and Vaupés it does not exceed 55% (Figure 1) (18). This precariousness presents gender, ethnic, and rural biases: 1.38 million households depend on firewood, exposing women to respiratory diseases and an increased time burden associated with collecting fuel (18). In critical areas, women spend up to three times as much time as men on energy-related tasks, demonstrating how patriarchal structures deepen socio-environmental conflicts (18).

This precariousness is also reflected in the lack of affordability and quality of service, with a rural gap of 47%, compared with 4.3% in urban areas (8), (15). In addition, 61.8% of affected households experience frequent interruptions that limit the productive and sanitary use of energy. This exclusion, which affects 4.5 million households, results from centralized policies, an oligopolistic market, and weak citizen participation (18). Added to this, extractivism has reinforced gender inequalities in the energy sector, where women have low participation in formal employment and decision-making, but predominate in informal and precarious activities, such as subsistence mining (58).

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Convergence between agroecology, food and energy sovereignty: toward a just energy transition in rural areas

The renewable nature of an energy source does not, by itself, guarantee a social or ecological benefit. If these technologies are deployed through centralized megaprojects, they risk replicating extractive dynamics involving mineral resources closely linked to the fossil-based model. Likewise, conceiving technology as a static set of techniques is insufficient in the face of global uncertainty (5). Thus, a transition that does not alter the ownership structure is reduced to a "simulation environmentalism." Several studies argue that many of the strategies promoted to address climate change, such as carbon markets, REDD+, climate-smart agriculture, certain emissions offset schemes, and other market-based solutions, constitute inadequate solutions because they do not transform the structural causes of the climate crisis (59), (60), (61), (62), (63); on the contrary, these initiatives tend to reinforce the dominant agroindustrial model, favor corporate expansion into territories, and displace alternatives based on FS, agroecology, and community control of resources.

Inadequate solutions to climate change are understood as interventions that seek to mitigate environmental impacts without modifying the economic and productive structures that generate them. These include carbon markets, emissions offset mechanisms, certain forms of commodified conservation, and some carbon removal technologies. These strategies may contribute to legitimizing existing accumulation models and delay deeper transformations toward socioecological sustainability.

Robinson (64) questions simplistic forest restoration strategies based solely on the mass planting of trees and warns about practices that can generate the appearance of ecological recovery supported by carbon credits, a term widely known in the English literature as "greenwashing," without fully restoring the functional and social complexity of ecosystems. This reflection approaches the concept of ecological simulacrum, understood as interventions that project an image of environmental restoration but do not necessarily recover the ecological processes, biodiversity, or original socioecological relationships; an authentic reform must subordinate capital accumulation to community autonomy and the reproduction of life (5), (38), (57). Furthermore, it is imperative to promote local, flexible, and adaptable solutions that can respond to the constant and accelerating changes in socioecosystems (5), (65), (66), (67), (68).

ES is the right of peoples to decide on the generation, distribution, and consumption of their energy in a sustainable manner and in accordance with their territorial realities. Food sovereignty (FS), for its part, promotes access to nutritious and locally produced food and asserts the right to decide over one's own productive systems (69). As OECD/FAO (70) points out, without sustainable, reliable, and local energy, rural communities remain trapped in food insecurity and poverty, deprived of the means to lead a productive life.

ES and FS converge with the agroecological philosophy by seeking to produce food without resorting to false reductionist solutions that merely introduce new products into capital markets (54), (71). At the same time, it contributes to understanding the regenerative dynamics of nature and promoting diverse forms of sovereignty. More importantly, agroecology challenges the

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Parmenidean, Platonic, metaphysical, Cartesian, and reductionist modes of thought that have dominated modern currents of thought (5), (72).

Its simplified vision of development as linear progress, together with its failed attempt to analyze the infinite and complex elements that make life possible, has undermined the ethical, interdependent, and collaborative relationships between people and ecosystems (5, 38). As a result, human alienation emerges, in which existence becomes insignificant, usable, and replaceable. The social environment, through a power internalized in language and desires, directs thought toward capitalist reasoning that promises a technological and extractive future, without suffering and with individualized well-being (5), (39), (40). Desires are translated into objects, symbols, and unattainable aspirations for power and freedom, which lock us into an endless cycle of accumulation and consumption that sustains the system, destroys the planet, and limits our aspiration to act toward the necessary structural change (73).

Escobar (74) argues that contemporary crises are not solely environmental or economic, but also civilizational, due to the exclusion of some social groups by others. From his perspective, modern thought forms part of a universalist model that imposes a single vision of progress, development, and the relationship between society and nature, relegating other forms of existence and knowledge. As an alternative, he proposes a pluriversal politics based on the coexistence of multiple worlds, ontologies, and ways of life, especially those defended by Indigenous and Afro-descendant communities and territorial movements.

Agroecology in the Global South challenges the logics of development, emerging as a post-development sociopolitical movement that directs our gaze toward a future in which it is possible to achieve social justice, collectivity, and love for the land and for people, while respecting the limits and cyclicality of nature (75), (76). Its principles include nutrient recycling, strengthening of the social fabric and dialogue among different forms of knowledge, recovery of ethical values (solidarity, respect, love) between human and non-human beings, cyclicality of energy and water flows, FS, ES, and biological and cultural diversity in agroecosystems (4), (11), (77), (78).

The convergence between FS and ES is grounded in structural independence from global markets (see Table 1). This synergy resonates with the principles of social transformation in agroecology, oriented toward reducing external inputs and building an ethically sustainable environment (4), (11), (78).

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Table 1. Convergence between energy sovereignty and food sovereignty. Source: own elaboration based on data from Giraldo (5), FGN (69), and Altieri et al. (77)

Similarity	Energy sovereignty	Food sovereignty	Convergences
Self-determination	The right of communities to decide on energy generation, distribution, and consumption.	The right of peoples to define their own food and production systems.	Focused on who makes decisions, who benefits, and who bears the risks that are essential to sustaining life.
Economic paradigm	Challenges energy as a commodity; seeks its decommodification and recognition as a human right.	Emphasizes that food is more than a commodity and should be removed from the logic of the World Trade Organization.	Reject the capitalist-extractivist model that prioritizes profit over the satisfaction of basic needs.
Scale and management	Promotes decentralized, local, and small-scale models (such as energy communities).	Prioritizes family, ethnic, and community-based agriculture, local markets, and local production systems.	Both defend the idea that control should remain in the hands of local producers and consumers, rather than remote corporations.
Resilience and crisis	Reduces dependence on international conditions and the volatility of fossil fuel prices.	Creates short supply chains that provide protection against shortages and external trade crises.	Seek territorial autonomy in the face of geopolitical or global economic shocks.
Relationship with nature	Promotes 100% renewable energy sources that respect biophysical limits and the Earth's cycles.	Based on agroecology to restore soils, protect seeds, and conserve biodiversity.	Both integrate human processes into natural cycles, from extraction to regeneration.
Gender justice	Recognizes that women experience greater energy poverty and seeks their leadership in technical and political management.	Highlights the central role of women in seed conservation and household food provision.	Place care work and women's leadership at the center of the transition in order to democratize both private and public life.
Knowledge and expertise	Values traditional knowledge and technological sovereignty (social appropriation of technology).	Grounded in ancestral knowledge, seed exchange, and dialogue at the origins of peasant knowledge.	Reject top-down technocratic planning and the corporate monopoly over knowledge.

FS complements ES, since food production requires energy for processes such as irrigation, drying, milling, and preservation. While industrial agriculture consumes approximately 30% of global energy, peasant farming systems demonstrate greater energy efficiency. Traditional systems such as milpas achieve a 15:1 ratio, compared with 1:10 in industrial agriculture in the USA (77). Likewise, technologies such as biodigesters articulate both sovereignties by transforming agricultural waste into biogas and biofertilizer (78). In this sense, land redistribution, together with the development of community-managed clean energy, makes it possible to simultaneously address the climate crisis and hunger by reducing dependence on fossil fuels and strengthening territorial autonomy.

The convergence between FS and ES proposes an integrated response based on community energy management through assemblies, agricultural unions, and cooperatives, oriented toward the needs of the territory. From an agroecological perspective, this transformation is constructed by integrating scientific knowledge with other forms of knowledge through participatory processes (79). Within this framework, family, peasant, and community agriculture (AFCYC) is consolidated as a productive model rooted in rural and peri-urban environments, focused on the sovereign management of common goods such as soil, water, energy, and genetic heritage, and oriented toward social well-being and the dignification of rural work (80).

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For this transition to move beyond the theoretical level, it is necessary to reconfigure public policies by dismantling subsidies that benefit fossil-based agribusiness and extractive megaprojects and redirecting them toward community self-management. Likewise, energy policy must be articulated with comprehensive agrarian reform that democratizes access to land (74). According to Svampa (2), strengthening AFCYC could triple rural employment and reduce forced migration, contributing to societies based on environmental justice, in which energy and food support the reproduction of life rather than capital.

African experiences such as solar mini-grids for grain processing in Uganda, food preservation by women's collectives in Kenya, and biogas production in Ghana are examples of JET. These initiatives, together with micro-hydropower systems in Ethiopia, operate under an agroecological logic that articulates rural infrastructure, social justice, and territorial sovereignty (81). In Latin America, the Varzea Comprida dos Oliveiras Community Bakery uses solar ovens and biogas, while in Rio de Janeiro's favelas, such as Complexo do Alemão, solar cooperatives strengthen autonomy amid high energy costs (82). In addition, there are other cases in Mexico, Ecuador, and Guatemala (83).

Energy communities, agroecology and sovereignty: a necessary convergence for more just energy transitions in rural colombia

Addressing current crises from different political and ideological perspectives shares several points in common with ET, food production, reducing rural poverty, and the need to reduce greenhouse gas emissions; however, this has led to overlooking the responsibility of agribusiness and agrofuels for the climate crisis and other crises. The dominant productive paradigm, represented by agribusiness, exclusively prioritizes the optimization of economic returns, omitting vital dimensions such as biodiversity integrity, management, and public health, among others (54), (84). This reductionist view has turned industrial agriculture into one of the greatest threats to climate resilience and the continuity of the planet's biological systems (2).

ES is integrated with FS, guaranteeing autonomous, reliable, and community-managed agricultural processes. There are examples of energy communities in Colombia, from FS, such as agroecological proposals toward JET that represent local and self-managed ways of managing, exchanging, and generating energy from sources alternative to fossil fuels (13), (14). This sovereignty approach, in addition to focusing on energy production, positions FS as a fundamental strategy to mitigate the impacts of fossil energy use, advancing the decommodification of energy, community well-being, the construction of social fabric, and food production (13). Among the proposals for alternative energy and production models are (13), (17): family and community biodigesters, biomass gasification, small biodiesel plants, solar collectors, wood-burning stoves with associated forests, solar and biogas dehydrators, water harvesting, mixed gardens for human and animal food, health gardens, and bicycle machines, among others (Figure 3).

doi: 10.25100/iyc.v28i2.15752

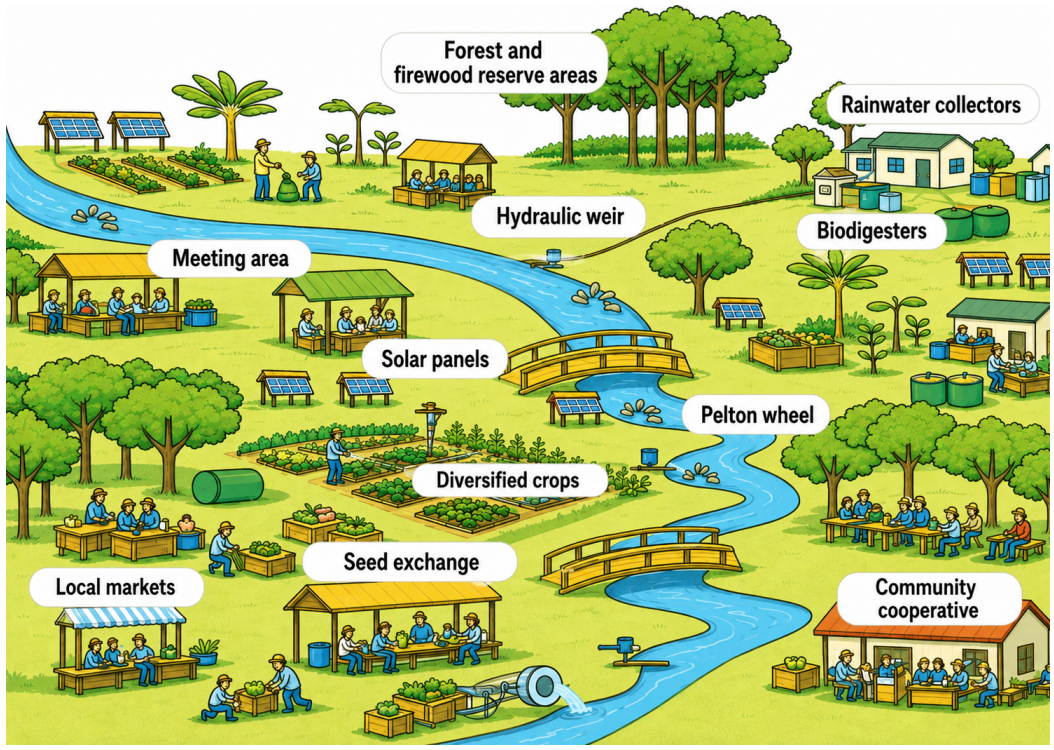

Figure 3. Principles and elements of an agroecological energy community with ecotechnologies that promote ES for a JET. Source: authors based on data from Censat (17).

Table 2 presents examples of popular energy communities and projects in Colombia. The analysis integrates the technological dimension with the structural change that these experiences promote in their respective territories. It is worth noting that several of these advances are the result of 10 years of learning from Censat Agua Viva. This environmental organization advocates for the construction of environmental justice, JET, agroecology, respect for pluriverses, and the care of life (17).

Table 2. Energy Community Projects in Colombia and Territorial Transformation Projects

Project	Approach Description	Socio-environmental Impact	Key actors	Location	Highlighted practice	Success Factors	Limitations	Replicability	Source
Michicai (Mikaï) Strategy	Energy democratization in excluded areas through decentralized solutions.	24/7 access to energy for 550 users; refrigeration of vaccines and food.	IPSE, Ministry of Mines and Energy, Wayuu authorities.	La Guajira	Solar photovoltaic nano-grids and microgrids.	High solar potential in the region and institutional support for coverage.	Low initial community participation and lack of adaptation to Wayuu housing typologies.	High in Non-Interconnected Zones, with adjustments for cultural relevance.	Eras-Almeida et al. (52), Preciado-Ochoa (14)
Miskan Ckak Recovery	Energy sovereignty is linked to historical memory and Indigenous autonomy.	Revitalization of wheat production and strengthening of the local economy.	Miskan Chak Association of the Misak People.	Silvia, Cauca	Rehabilitation of a small hydropower plant.	Strong cultural identity and recovery of ancestral infrastructure dating from 1915.	Technical challenges due to the age of the infrastructure and regulatory barriers to	Medium requires specific water resources and similar organizational cohesion.	CENSAT (17), Roa (15)

doi: 10.25100/iyc.v28i2.15752

Energy School	Popular education for technological sovereignty and knowledge dialogue.	Training of local technicians and decommodification of technical knowledge.	Censat Agua Viva, Ríos Vivos,	Antioquia, Santander, Córdoba	Technology packages: biodigesters and efficient cookstoves.	"Farmer-to-farmer" methodology and focus on appropriate social technologies.	Regulatory uncertainty regarding self-generation and lack of municipal-level data.	High; modular model based on local knowledge and applicable to diverse contexts.	Preciado-Ochoa (14), Censat (17), Roa (15)
Community Peasant Reserves of Santander	Autonomous territorial management based on "Buen Vivir" and the protection of the commons.	Climate resilience and autonomous protection of 35 Andean reserves.	Collective of Peasant Reserves of Santander.	Santander	Rainwater harvesting and solar-powered irrigation pumping.	Strong leadership by women and productive diversification in response to monoculture.	Tensions with environmental authorities and coercive regulations concerning livestock raising.	High; the autonomous reserve declaration model is already a national reference.	Roa (15)
Asoagrar Agroecological Transition	Replacement of illicit economies through agroecology and food sovereignty.	Complete replacement of coca cultivation and strengthening of the social fabric.	Asociación Agropecuaria Arboleda (Asoagrar).		Integrated agroecological systems and diversified plots.	Emerges from community opposition to forced eradication; strong family unity.	Structural challenges related to fair marketing and access to land.	Medium; it requires a high level of political maturity to withstand pressure from armed groups.	Roa (15)
CE of Peace Signatories	Socioeconomic reintegration of former combatants through energy self-management.	Energy democratization in conflict-affected territories; access to basic rights.	Peace signatories and local communities.	Tumaco, Nariño	Photovoltaic systems for housing and productive projects.	Territorial peace approach and support for economic reintegration.	Persistent security risks and long-term financial sustainability challenges.	High in PDET and ZOMAC areas, provided leadership protection is ensured.	García et al. (18)
Gaia Ecological Village Project	Technological autonomy based on hands-on learning and bioconstruction.	Drastic reduction in dependence on external technologies.	Bioconstruction collectives and residents.	Santa Sofía, Boyacá	Local production of solar panels and natural walls.	Low-cost local innovation and participatory training workshops.	Difficulties in scaling technological production to industrial levels.	High for communities seeking small-scale, gradual, and self-managed solutions.	Roa (15)
Lower Sinú Processes	Water and energy sovereignty linked to wetland defense.	Resistance to extractivism and recovery of sustainable river mobility.	Asprocig and local communities.	Córdoba (Sinú Basin)	Solar mobility (solar-powered barges) y Zenú agroecosystems.	Recovery of the Zenú people 's ancestral hydraulic knowledge (SADA).	Negative impacts from dams (Urrá) and recurrent flooding.	High for floodplain ecosystems and river-transport areas.	Roa (15), Boelens et al. (85)

In Colombia, energy communities represent a commitment to popular sovereignty and JET, transforming inhabitants from passive consumers into managers of their own energy resources (13), (4), (17), (18). Energy community initiatives and autonomous projects offer advantages for addressing the climate crisis and advancing toward a JET (13), (17), (43). The Michicai strategy, "La Casa del Sol" (Alta Guajira), combines nanogrids, microgrids, and solar systems, guaranteeing continuous energy for 2,000 Wayúu families and essential services (65). The Energy School

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(Antioquia, Santander, and Córdoba), led by Censat Agua Viva and the Ríos Vivos Movement, trains peasant technicians who implement solar pumping and dehydration systems, as well as biodigesters (15). In the Los Naunos Reserve (Lebrija, Santander), rainwater harvesting and solar pumping strengthen local production (15). Finally, the Gaia project (Boyacá) demonstrates technological self-management through the manufacture of artisanal solar panels (52).

The implementation of JET in Colombia faces structural economic, political, and social barriers, as dependence on fossil revenues is high: oil and coal account for 60% of exports. There is a regulatory lag: technological change outpaces the capacity of laws to adapt, delaying their implementation (43), meaning that a transition without diversification could affect public finances. At the international level, financing allocated to the Global South is unequal and prioritizes loans over grants, increasing external debt (37). Internally, regulatory frameworks favor large corporations to the detriment of community participation (18). Likewise, the lack of grids in areas such as La Guajira and the shortage of local technical personnel reinforce external dependence (13, 14). Finally, the imposition of projects without the prior consent of communities reproduces dynamics of dispossession.

When contrasting the experiences of energy communities, differences can be identified in their management and sustainability by analyzing the two approaches, CET and JET, as well as their management mechanisms and territorial impacts. In terms of governance, the fundamental contrast lies in the logic of emergence and decision-making: government-driven energy communities focus on meeting massive coverage targets (a target of 20,000 collectives) and require legal status to commercialize surpluses in accordance with the regulations of the Energy and Gas Regulatory Commission (CREG). Projects such as the Michicai Strategy (Mikaï) in La Guajira are led by the IPSE and have a vertical design that, although it guarantees 24/7 access, is questioned due to the low level of community engagement during its initial phase. Popular-oriented community energy initiatives emerge from historical processes of resistance and self-management, such as the Miskan Cchak Recovery or the Energy School; in these, energy, rather than an end in itself, is a strategy for FS and the defense of territory. Decisions are made in assemblies and Mingas, prioritizing dialogue among different forms of knowledge over purely technical criteria. Regarding the technological paradigm, the corporate and institutional model tends to favor standardized solutions, mainly large-scale wind or solar farms that feed energy into the NIZs but usually do not directly benefit local inhabitants, creating “green sacrifice zones”; meanwhile, popular experiences implement technological portfolios adapted to the rural context: biodigesters to generate biogas and biofertilizers, bicycle machines to process food, and solar dehydrators to add value to harvests. Experiences such as the Gaia Ecological Village Project stand out for the local manufacture of solar panels, generating independence from foreign patents.

Regarding financing and sustainability, Asproinca has community revolving funds and flexible lines of credit adapted to the cycles of peasant agriculture. Meanwhile, FENOGE/IPSE is based on public resources, tax incentives, and state subsidies subject to cumbersome bureaucratic procedures for grassroots organizations. It is necessary to consider that the contrast in outcomes is measured by the capacity to transform structural realities, such as the substitution of illicit economies (Asoagrar), an emblematic case in which energy and agroecology enabled the complete substitution of coca

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cultivation, strengthening the social fabric and food autonomy. On the other hand, while the conventional model has masculinized energy technology, projects such as La Comunera (Popular Women's Organization) in Santander have empowered more than 2,500 women, reducing their time poverty and increasing their income by 30% through the use of appropriate energy for care and processing tasks. Regarding climate resilience, the collective of reserves in Santander uses solar energy to pump water in areas of extreme drought (Lebrija), enabling the recovery of wetlands and community water security in the face of agroindustrial land and water grabbing.

Beyond technological change, these experiences transform power relations and territorial well-being; cases such as Michicai, Los Naunos, or the Energy School provide concrete mitigation and adaptation solutions; for example, replacing diesel plants in NIZs with locally managed renewable sources (solar, wind, and biomass) reduces environmental pollution (48), and decreases dependence on large hydropower plants, whose vulnerability increases in the face of extreme droughts resulting from the El Niño phenomenon (49); these communities promote energy sobriety, prioritizing necessary consumption over waste, a vital stance in the face of the planet's biophysical limits. At the same time, they demonstrate that energy is a tool for equity and historical reparation, e.g., in the case of La Guajira. Under this scheme, citizens become managers of their own resources. Energy autonomy also promotes local productive linkages, bakeries, artisanal workshops, and irrigation systems, ensuring that wealth remains in the territory. In post-conflict contexts, JET includes peace signatories and rural communities and uses energy to facilitate reconciliation and the transition away from illicit economies. Experiences such as the Gaia Project foster a dialogue among different forms of knowledge in which technological appropriation, local manufacturing, and maintenance eliminate dependence on external patents. Finally, these cases confirm that a transition is truly just when it prioritizes the sustainability of life over corporate profit.

Conclusions and final reflections

This reflection explores the convergence between agroecology, FS, and ES to enrich the debate surrounding a JET. In Colombia, JET transcends the technical and constitutes a structural reform: peasant production demands energy for irrigation, communication, and transportation. Technologies such as biodigesters, biomass gasification, biodiesel plants, solar collectors and dehydrators, together with efficient wood-burning stoves and water harvesting, enable energy recirculation cycles. This integration replaces reductionist solutions that commodify energy. ES challenges linear thinking that fragments ecosystems and weakens the ethical relationship between human beings and nature. Nevertheless, the implementation of JET faces barriers such as dependence on fossil fuels, weak political support, exclusion of communities from decision-making, and a lack of training, all of which compromise the sustainability of projects.

Operationalizing these reflections requires translating theory into territorial actions that articulate local knowledge, community management, and a political approach through: a) participatory processes that identify real energy needs linked to agroecology (irrigation, processing, transportation, and communication) under a territorial co-design model, b) decentralized systems that implement appropriate technologies based on closed cycles of energy and matter, c) capacity building through technical and management training so that communities can build, maintain,

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and adapt their technologies, integrating traditional knowledge with local innovation to eliminate external dependence, and d) political advocacy, linking local processes with government programs to position agroecological-energy hybrid systems as pillars of the transition, moving beyond centralized or purely technological approaches.

JET in rural Colombia must prioritize life over profit and be strengthened as an essential right for health, education, and FS. This model links technological sovereignty to community justice which conceives infrastructure as collective property. Replacing energy sources without altering corporate logic results in an ecological simulacrum: megaprojects that displace communities and perpetuate dispossession. Instead, small-scale decentralized solutions should be strengthened, which, through agroecological markets and short circuits, reduce global dependence and the carbon footprint.

In Colombia, JET must integrate gender equity; 1.38 million families depend on firewood, exposing women to respiratory diseases and pronounced time poverty. In response, energy communities constitute a solution for reducing care burdens and strengthening women's economic autonomy. From a human rights perspective, energy is an enabler of health, education, and decent work. Energy communities enable rural and ethnic territories to transition from passive consumers to energy managers. Examples in La Guajira, Nariño, and Cauca demonstrate the feasibility of integrating agroecology and food sovereignty, while underscoring the urgency of binding participatory processes. Legal barriers favoring the traditional model persist, while 52% of the national territory remains without interconnection. To prevent renewable energies from replicating logics of dispossession, it is necessary to guarantee prior consultation and free, prior, and informed consent. Finally, the State must simplify regulation and finance local research to consolidate energy as a tool for buen vivir and the sustainability of life.

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References

1. Brannstrom C. La transición energética en la Argentina: una hoja de ruta para entender los proyectos en pugna y las falsas soluciones, ed. by Maristella Svampa y Pablo Bertinat. J Lat Am Geogr. 2023;22(3):203-206.

https://doi.org/10.1353/lag.2023.a915682

2. Svampa M, Acosta A, Viale E, Bringel B, Lang M, Hoetmer R, Aliaga C, Buitrago L. Transiciones justas para América Latina desde el Pacto Ecosocial del Sur. Ecología Política. 2022;(64):61-70. https://doi.org/10.53368/EP64NPVep04

3. Bocarejo Suescún D, Ordóñez Díaz L, Sarmiento Jaramillo AC, Revelo Rebolledo J, Uribe Martínez S, Vásquez González M. ¿Qué es un conflicto socioambiental? Universidad del Rosario; 2022. https://doi.org/10.48713/10336_41120

4. León-Sicard T, Sánchez de Prager M, Rojas LJ, Ortiz JC, Bermúdez Alviar JA, Acevedo Osorio A, Angarita Leiton A. Hacia una historia de la agroecología en Colombia. Agroecología. 2015;10(2):39-53.: https://revistas.um.es/agroecologia/article/view/300811

5. Giraldo OF. Ecología política de la agricultura: agroecología y posdesarrollo. México: El Colegio de la Frontera Sur; 2018.

6. Organización de las Naciones Unidas para la Educación, la Ciencia y la Cultura. Informe mundial de las Naciones Unidas sobre el Desarrollo de los Recursos Hídricos 2023 [Internet]. París: UNESCO; 2023 [citado 19 mar. 2026].

https://unesdoc.unesco.org/ark:/48223/pf0000384655

7. Food and Agriculture Organization of the United Nations. The water-energy-food nexus: a new approach in support of food security and sustainable agriculture. Rome: FAO; 2014. 20 p.

https://openknowledge.fao.org/handle/20.500.14283/bl496e

8. The United Nations World Water Development Report 2025, Mountains and glaciers: water towers París: UNESCO; 2025.

https://doi.org/10.54679/OWAG1841

9. Wezel A, Bellon S, Doré T, Francis C, Vallod D, David C. Agroecology as a science, a movement and a practice: a review. Agron Sustain Dev. 2009;29(4):503-15.

https://doi.org/10.1051/agro/2009004

10. Nicholls CI, Altieri MA, Vázquez LL. Agroecology: principles for the conversion and redesign of farming systems. Ecosyst. Ecogr. 2016; S5:010.

https://doi.org/10.4172/2157-7625.S5-010

11. Wezel A, Herren BG, Kerr RB, Barrios E, Gonçalves ALR, Sinclair F. Agroecological principles and elements and their implications for transitioning to sustainable food systems. Agron Sustain Dev. 2020;40(6):40.

https://doi.org/10.1007/s13593-020-00646-z

12. Acevedo-Osorio Á, Chohan JK. Agroecology as a social movement and practice in Cabrera's peasant reserve zone, Colombia. Agroecol Sustain Food Syst. 2020;44(3):331-51.

https://doi.org/10.1080/21683565.2019.1623359

13. Soler-Villamizar JP, Rankin AJ. Energías comunitarias para la transición justa. Gest Ambient. 2021;24(Supl 2):252-66.

https://doi.org/10.15446/ga.v24nSupl2.92941

14. Preciado-Ochoa I. Las energías comunitarias les hablan a las comunidades energéticas. Bogotá: Censat Agua Viva; 2025.

https://censat.org/wp-content/uploads/2025/05/EC-le-hablan-a-CE_3Marzo2025.pdf

15. Roa Avendaño T. Energías para la transición: reflexiones y relatos. Bogotá: Censat Agua Viva-Amigos de la Tierra Colombia, Fundación Heinrich Böll; 2021. h

ttps://co.boell.org/es/2021/06/30/energias-para-la-transicion-reflexiones-y-relatos

16. García Parra GI, Amezquita G, Aguilar Sánchez CG. Transiciones justas. Una agenda de cambios para América Latina y el Caribe. 1a ed. Ciudad Autónoma de Buenos Aires: CLACSO; OXFAM; 2023.

https://www.clacso.org/wpcontent/uploads/2023/06/Transiciones-justas.pdf

17. CENSAT Agua Viva. Somos la energía: guía para la planeación de proyectos de energía a escala comunitaria en Colombia [Internet]. 2a ed. Bogotá: CENSAT Agua Viva-Amigos de la Tierra Colombia; 2025 [citado 19 mar. 2026].

https://censat.org/wpcontent/uploads/2024/02/Cartilla_SomosLaEnergia_2025_05-1.pdf

18. García CLE, Toro-García GL. Multidimensional energy poverty in Colombia: A department-level review from 2018 to 2022. Heliyon. 2024;10(14):e34395.

https://doi.org/10.1016/j.heliyon.2024.e34395

19. Pimbert MP, Claeys P. Food sovereignty. En: Oxford Research Encyclopedia of Anthropology [Internet]. Oxford: Oxford University Press; 2024.

https://doi.org/10.1093/acrefore/9780190854584.013.297

20. ETC Group. ¿Quién nos alimentará? ¿La red campesina alimentaria o la cadena agroindustrial? [Internet]. 2017 [citado 19 mar. 2026].

http://www.etcgroup.org/sites/www.etcgroup.org/files/files/etc-quiennosalimentara-2017-es.pdf

21. Vélez-Henao JA, García-Mazo CM, Freire-González J, Vivanco DF. Environmental rebound effect of energy efficiency improvements in Colombian households. Energy Policy. 2020;145:111697.

https://doi.org/10.1016/j.enpol.2020.111697

22. Acemoglu D, Robinson JA. Why nations fail: the origins of power, prosperity, and poverty. New York: Crown Currency; 2013.

23. Svampa M. Consenso de los commodities y lenguajes de valoración en América Latina. Nueva Soc. 2013;(244):30-46.

https://library.fes.de/pdf-files/nuso/nuso-244.pdf

24. Ceceña AE. Dominación de espectro completo sobre Estados Unidos. Novos Rumos. 2016;53(2):156-79.

https://doi.org/10.36311/0102-5864.2016.v53n2.09.p156

25. Bertinat P, Chemes J, Arelovich L. Aportes para pensar el cambio del sistema energético: ¿cambio de matriz o cambio de sistema? Ecuador Debate. 2014;(92):85-101.

http://hdl.handle.net/10469/9485

26. Duarte-Abadía B, Boelens R, Roa-Avendaño T. Hydropower, encroachment and the re-patterning of hydrosocial territory: The case of Hidrosogamoso in Colombia. Hum Organ. 2015;74(3):243-254.

https://doi.org/10.17730/0018-7259-74.3.243

27. Alarcón, P. Old and new challenges of the energy transition: Insights from South America. South African Journal of International Affairs. 2023;30(2):263-278.

https://doi.org/10.1080/10220461.2023.2221227

28. Adarve Zuluaga M, Shortall N. Transición injusta: recuperar nuestro futuro energético frente al colonialismo climático. Oxfam Internacional; 2025 [citado 19 mar. 2026].

https://doi.org/10.21201/2025.000086

29. Oswald Y, Owen A, Steinberger JK. Large inequality in international and intranational energy footprints between income groups and across consumption categories. Nat Energy. 2020;5:231-9.

https://doi.org/10.1038/s41560-020-0579-8

30. Svampa M. Neo-extractivism in Latin America: socio-environmental conflicts, the territorial turn, and new political narratives. Cambridge: Cambridge University Press; 2019.

https://doi.org/10.1017/9781108752589

31. Bertinat P, Chemes J, Forero LF. Transición energética: aportes para la reflexión colectiva. Transnational Institute; 2020.

https://www.tni.org/es/publicaci%C3%B3n/transicion-energetica

32. Restrepo-Álvarez AF, Bolívar-Chaves OF, Muñoz-Arias C, Villamil-Villar B. Desarrollo de un sistema de iluminación portátil alimentado por energía solar fotovoltaica: caso de aplicación en la comunidad de Chucheros-Buenaventura. Ing Compet. 2021;23(2).

https://doi.org/10.25100/iyc.v23i2.10806

33. Beckerman W. Sustainable development: is it a useful concept? Environ Values. 1994;3(3):191-209.

https://www.jstor.org/stable/30301447

34. Lampis A, Ibañez Martín MM, Zabaloy MF, Schirmer Soares R, Guzowski C, Mandai SS, Benites Lazaro LL, Hermsdorff SMGL, Bermann C. Energy transition or energy diversification? Critical thoughts from Argentina and Brazil. Energy Policy. 2022;171:113246.

https://doi.org/10.1016/j.enpol.2022.113246

35. Burke MJ, Stephens JC. Energy democracy: Goals and policy instruments for sociotechnical transitions. Energy Research & Social Science. 2017;33:35-48.

https://doi.org/10.1016/j.erss.2017.09.024

36. Svampa M. Las fronteras del neoextractivismo en América Latina. Buenos Aires: CALAS, 2019.

https://doi.org/10.14361/9783839445266

37. Baker SH. Fighting for a just transition: climate change mitigation does not guarantee social justice. NACLA Rep Am. 2020;52(2):144-51.

https://doi.org/10.1080/10714839.2020.1768732

38. Darmaun M, Chevallier T, Hossard L, Lairez J, Scopel E, Chotte JL, et al. Multidimensional and multiscale assessment of agroecological transitions: a review. Int J Agric Sustain. 2023;21(1):2193028.

https://doi.org/10.1080/14735903.2023.2193028

39. Hoyos S, Ruiz S, Montoya Rendón AF, Gutiérrez Y, Barrientos Marín JH, Ramírez MA. Effects of energy communities: a case study in Colombia. Int J Energy Econ Policy. 2026;16(2):854-64.

https://doi.org/10.32479/ijeep.22644

40. Adarve Zuluaga M, Shortall N, Stroot H, Wayand N, Ruiz V, Fadel Diop M, et al. Unjust transition: reclaiming the energy future from climate colonialism [Internet]. Oxford: Oxfam International; 2025. 76 p. https://doi.org/10.21201/2025.000086

41. Martinez-Alier J. The environmentalism of the poor: a study of ecological conflicts and valuation. Cheltenham: Edward Elgar Publishing; 2002. 328 p.

https://doi.org/10.4337/9781843765486

42. Kallis G, Hickel J, O'Neill DW, Jackson T, Victor PA, Raworth K, et al. Post-growth: the science of wellbeing within planetary boundaries. Lancet Planet Health. 2025;9(1):e62-e78.

https://doi.org/10.1016/S2542-5196(24)00310-3

43. Escobar A. Sentipensar con la tierra: las luchas territoriales y la dimensión ontológica de las epistemologías del sur. AIBR Rev Antropol Iberoam. 2016;11(1):11-32.

https://doi.org/10.11156/aibr.110102

44. Miller CA, Iles A, Jones CF. The social dimensions of energy transitions. Sci Cult. 2013;22(2):135-148.

https://doi.org/10.1080/09505431.2013.786989

45. Heffron RJ, McCauley D. The concept of energy justice across the disciplines. Energy Policy. 2017; 105:658-67.

https://doi.org/10.1016/j.enpol.2017.03.018

46. Ministerio de Minas y Energía. Diagnóstico base para la transición energética justa [Internet]. Bogotá: Ministerio de Minas y Energía; 2024.

https://www.minenergia.gov.co/documents/10439/2._Diagn%C3%B3stico_base_para_la_TEJ.pdf

47. Pardo-Martínez CI, Cotte-Poveda A. Identifying the determinants of the energy transition in departments in Colombia: an analysis with spatial econometrics. Global Sustain. 2025;8:e48.

https://doi.org/10.1017/sus.2025.10034

48. Sagastume Gutiérrez A, Cabello Eras JJ, Hens L, Vandecasteele C. The energy potential of agriculture, agroindustrial, livestock, and slaughterhouse biomass wastes through direct combustion and anaerobic digestion: The case of Colombia. J Clean Prod. 2020;261:122317.

https://doi.org/10.1016/j.jclepro.2020.122317

49. Tovar Romero EL, Jaramillo Gómez LA, Lizcano Caro JA, Monsalve EA. El Niño y la crisis hídrica en Colombia: una revisión cronológica de su impacto y de las respuestas gubernamentales. Tecnogestión. 2025;22(1):4-23.

https://revistas.udistrital.edu.co/index.php/tecges/article/view/23322

50. Andrade-Ayala AP, Osorio-Garcés CE, Martínez-Idrobo JP. Reflexión sobre la visión de la gestión integral de la vulnerabilidad por desabastecimiento de agua en la zona rural de Colombia. Ing Compet. 2019;21(2):1-14.

https://doi.org/10.25100/iyc.v21i2.8342

51. Departamento Administrativo Nacional de Estadística. Pobreza multidimensional [Internet]. Bogotá: DANE; 2024 [citado 24 mar. 2026].

https://www.dane.gov.co/index.php/estadisticas-por-tema/pobreza-y-condiciones-de-vida/pobreza-multidimensional

52. Eras-Almeida AA, Vásquez-Hernández T, Hurtado-Moncada MJ, Egido-Aguilera MA. A comprehensive evaluation of off-grid photovoltaic experiences in non-interconnected zones of Colombia: integrating a sustainable perspective. Energies. 2023;16(5):2292.

https://doi.org/10.3390/en16052292

53. Heffron RJ. Applying energy justice into the energy transition. Renew Sustain Energy Rev. 2022;156:111936.

https://doi.org/10.1016/j.rser.2021.111936

54. Sagastume Gutiérrez A, Cabello Eras JJ, Otero Meza DD. The energy transition in Colombia: government projections and realistic scenarios. Clean Technol. 2025;7(4):96.

https://doi.org/10.3390/cleantechnol7040096

Gutiérrez-Sanín F. Democracy, oligarchy and institutionalised violence: the Colombian experience. Third World Q. 2025:1-16.

https://doi.org/10.1080/01436597.2025.2589415

56. Garcia ES, Quaresma N, Aemro YB, Coimbra AP, de Almeida AT. Cooling with the sun: Empowering off-grid communities in developing countries with solar-powered cold storage systems. Energy Res Soc Sci. 2024;117:103686.

https://doi.org/10.1016/j.erss.2024.103686

57. Reina-Rozo JD, Castro A, Zambrano-Caviedes F, Epieyu AN. Technologies to embrace the sun: solarpunk-based project as an exploration for a just energy transition. Rev Iberoam Estud Desarro. 2024;13(1):162-187.

https://doi.org/10.26754/ojs_ried/ijds.871

58. Aladekomo AS. Trends in gender, feminism and energy transition in the Global South. J Sustain Dev Law Policy. 2025;16(2):53-73.

https://doi.org/10.4314/jsdlp.v16i2.4

59. McAfee K. Green economy and carbon markets for conservation and development: a critical view. Int Environ Agreem. 2016;16(3):333-53.

https://doi.org/10.1007/s10784-015-9295-4

60. Büscher B, Fletcher R. Towards convivial conservation. Conserv Soc. 2019;17(3):283-296. https://doi.org/10.4103/cs.cs_19_75

61. Ceddia MG, Boillat S, Jacobi J. Transforming food systems through agroecology: enhancing farmers' autonomy for a safe and just transition. Lancet Planet Health. 2024;8(11):e958-e965.

https://doi.org/10.1016/S2542-5196(24)00234-1

62. Carton W, Asiyanbi A, Beck S, Buck HJ, Lund JF. Negative emissions and the long history of carbon removal. WIREs Clim Change. 2020;11(6):e671.

https://doi.org/10.1002/wcc.671

63. Giraldo OF, Rosset PM. Emancipatory agroecologies: social and political principles. J Peasant Stud. 2023;50(3):820-50.

https://doi.org/10.1080/03066150.2022.2120808

64. Robinson JM. Treewilding: our past, present, and future relationship with forests. Exeter: Pelagic Publishing; 2024.

https://doi.org/10.1080/03071375.2025.2556385

65. Molina Castro J, Buitrago LF, Téllez S, Giraldo S, Zapata J. Comunidades energéticas: modelos para el empoderamiento de los usuarios en Colombia. ENERLAC. 2023;7(1):110-33.

https://enerlac.olade.org/index.php/ENERLAC/article/view/249

66. Duran Prieto J, Donado HM, Mendez AV, Reina JD, Useche C. Energy communities: a model to strengthen climate resilience in Colombia [Internet]. Washington (DC): World Resources Institute; 2026 [citado 19 mar 2026]. 19 p.

https://doi.org/10.46830/wriwp.24.00123

67. Transforma. Just energy transition in Colombia: analysis of the partnership model for financing and its applicability [Internet]. Bogotá: Transforma; 2024.

https://observatorio-tej-transforma.com/assets/documentos_analisis/archivos/20240802.pdf

68. United Nations Development Program. Colombia's just energy transition: a people-centered cost-benefit analysis [Internet]. New York: UNDP; 2024.

https://www.undp.org/sites/g/files/zskgke326/files/2024-08/undp_co_pub_11-colombias-just-energy-transition.pdf

69. Foro Global Nyéléni. Declaración de Kandy: desde el 3.er Foro Global Nyéléni, en Sri Lanka [Internet]. 2025.

https://nyeleniglobalforum.org/wp-content/uploads/2025/11/ES_KANDY-DECLARATION.pdf

70. Organización para la Cooperación y el Desarrollo Económicos, Organización de las Naciones Unidas para la Alimentación y la Agricultura. OCDE-FAO Perspectivas agrícolas 2019-2028 [Internet]. París: OECD Publishing; Roma: FAO; 2019.

https://doi.org/10.1787/7b2e8ba3-es

71.Foster JB, Clark B. The Dialectical Ecologist: Richard Levins and the Science and Praxis of the Human-Nature Metabolism. Socialism and Democracy. 2023;37(1-2):14-34. _

https://doi.org/10.14452/MR-076-08-2025-01_1

72. Rosset PM, Ule Muñoz CL. Repeasantization and socio-territorial movements. J Peasant Stud. 2025;52(3):649-64.

https://doi.org/10.1080/03066150.2024.2434851

73. Fletcher R. Degrowing desire. Polit Geogr. 2026; 128:103540.

https://doi.org/10.1016/j.polgeo.2026.103540

74. Escobar A. Pluriversal politics: the real and the possible. Durham (NC): Duke University Press; 2020.

https://doi.org/10.2307/j.ctv11315v0

75. Giraldo OF, Rosset PM. La agroecología en una encrucijada: entre la institucionalidad y los movimientos sociales. Guaju. 2017;2(1):14-37.

https://doi.org/10.5380/guaju.v2i1.48521

76. Altieri MA, Nicholls CI, Montalba R, Vieli L, Vázquez LL. Agroecology and the limits to resilience: extending the adaptation capacity of agroecosystems to drought. Front Agron. 2025; 7:1534370. https://doi.org/10.3389/fagro.2025.1534370

77. Altieri MA. Escalonando la propuesta agroecológica para la soberanía alimentaria en América Latina. Agroecología. 2009; 4:39-48.

https://revistas.um.es/agroecologia/article/view/117171

78. Casadiego-Arévalo FF, Carvajal-Escobar Y, García-Meneses PM, Molina AM, Triana-Madrid JC. Socioecological resilience and the use of agroecological practices in coffee farming in the face of climate change and variability: a case study in Trujillo, Colombia. Agroecol Sustain Food Syst. 2026;1-29. https://doi.org/10.1080/21683565.2026.2699109

79. Altieri MA, Toledo VM. The agroecological revolution of Latin America: rescuing nature, securing food sovereignty and empowering peasants. J Peasant Stud. 2011;38(3):587-612.

https://doi.org/10.1080/03066150.2011.582947

80. Da Silva V, Martín F. Soberanía alimentaria y cambio climático [Internet]. América Latina en Movimiento; 2016 [citado el 19 mar.]. 2026].

https://www.alainet.org/es/articulo/177050

81. Movimiento Mundial por los Bosques Tropicales. Recuperar la soberanía energética y alimentaria mediante la agroecología [Internet]. 2024 mar. 1 [citado 25 mar. 2026].

https://www.wrm.org.uy/es/articulos-del-boletin/recuperar-la-soberania-energetica-y-alimentaria-a-traves-de-la-agroecologia

82. Alves EEC, de Paiva Silva HI. From global to local: empirical findings of socioecological effects of photovoltaic energy promotion in Brazilian Outback. In: Dalei NN, Gupta A, editors. Economics and Policy of Energy and Environmental Sustainability. Singapore: Springer; 2022.

https://doi.org/10.1007/978-981-19-5061-2_5

83. Furtado F, Sodateli E. Energía en América Latina: del negocio a lo común [Internet]. 2019 [citado 25 mar. 2026].

https://www.rosalux.org.ec/energia-en-america-latina-del-negocio-a-lo-comun/

84. Rosset PM, Fernandes IF, Barbosa LP, dos Santos Damasceno C, Wisartsakul W. Unlearning the green revolution: inventory of agroecological practices in Ceará, Brazil, an instrument for decolonizing territory and (re)valuing peasant knowledge. Environ Sci Policy. 2025; 165:104022. https://doi.org/10.1016/j.envsci.2025.104022

85. Boelens R, Escobar A, Bakker K, Hommes L, Swyngedouw E, Hogenboom B, et al. Riverhood: political ecologies of socionature commoning and translocal struggles for water justice. The Journal of Peasant Studies. 2023;50(3):1125-1156.

https://doi.org/10.1080/03066150.2022.2120810