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Annual Review of Environment and Resources

Social Energy Futures in the Global South: Geographies, Concepts, and Praxis

Sofía Ávila-Calero,[1] Ksenija Hanaček,[2] Marcela Torres Wong,[3] Tristan Partridge,[4,5] Brototi Roy,[2] Bruno Fornillo,[6] and Arnim Scheidel[2]

[1]Institute of Social Research, National Autonomous University of Mexico (UNAM), Mexico City, Mexico; email: sofia.avilac@sociales.unam.mx

[2]Institute of Environmental Science and Technology (ICTA-UAB), Autonomous University of Barcelona, Cerdanyola del Vallès, Spain; email: ksenija.hanacek@uab.cat, brototi.roy@uab.cat, arnim.scheidel@uab.cat

[3]Latin American Faculty of Social Sciences (FLACSO Mexico), Mexico City, Mexico; email: marcela.torres@flacso.edu.mx

[4]North American Center for Post-Growth Research, Santa Barbara, California, USA

[5]Department of Global Studies, University of California, Santa Barbara, California, USA; email: tristan.partridge@ucsb.edu

[6]National Scientific and Technical Research Council (CONICET), University of Buenos Aires, Buenos Aires, Argentina; email: bmfornillo@gmail.com

Keywords

Global South, renewable energy, transitions, communities, technologies, pluriverse

Abstract

Socioenvironmental research highlights the key role of communities and organizations in promoting sustainable and democratic energy systems. However, most of this emphasis has focused on modern industrialized societies. This article reviews research on energy alternatives conceptualized and practiced by movements and communities across the Global South. Based on the surveyed literature, we propose the concept of social energy futures (SEF) as an open-ended category to reflect on the drivers and features of these alternatives. As outlined, SEF are diverse and territorially situated, commonly encompassing three components: (*a*) they are largely needs-oriented, tending to prioritize use value over exchange value; (*b*) they involve broad political processes, defining how much energy should be harvested, through which technologies, by which actors, and for which purposes; and (*c*)

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they are part of broader identity struggles, reflecting how social actors actively organize to counteract colonial and corporate relations amid the energy and climate crisis. Taking these findings together, we propose an SEF analytical toolkit and outline future research themes to continue developing across diverse academic, cultural, and geographical settings.

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1. INTRODUCTION

Over the past two decades, research within the socioenvironmental sciences has paid great attention to the growing quest for sustainable energy systems amid the climate crisis and the progressive decline of fossil-energy resources. Within this fertile body of literature, increasing interest has been given to the emerging forms of social organization around renewable energy harvesting, transformation, distribution, and consumption. These inquiries combine questions around the redistribution of political power and socioeconomic equity with the environmental dimension of energy systems. As a result, research on socially led energy initiatives has experienced a notable boom (1–4). This burgeoning field of inquiry, however, has been primarily focused on Global North contexts, either by prioritizing empirical cases on these geographies or by applying their analytical tools to other geographical locations.

As the research emphasis on this theme has been placed within the contours of modern industrialized societies, more clear understandings of the economic, political, geographic, and cultural profiles of the world's societies are required to advance into a cosmopolitan reading on

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the diversity of energy futures (5–9). This article aims to address such a need by reviewing the state of the art of energy futures claimed, practiced, and conquered by social movements and communities across the Global South. Amplifying the premises of the sociotechnical imaginaries of energy (10), we highlight that energy futures across the Global South are reported as diverse, territorially situated, and pluriversal. This means that while part of the literature reports initiatives embracing modern approaches to energy systems and technologies, an increasing number of studies are also discussing energy initiatives that embrace decolonial philosophies and alternative technologies and forms of governance.

Throughout this review, we are situating the Global South as a diverse yet distinct geographical space where energy transition pathways are highly contested, and critical literature on the matter is underdiscussed. Here, we focus on published literature over the past five years covering case studies in six regions: Mexico and Central America, South America, Africa, South Asia, Southeast Asia, and Souths in the North. In this approach, we consider China and Central Asia as regions requiring separate reviews and discussions due to their economic and energy particularities.[1]

To organize this work, we firstly consider the Global South in its traditional geographical definition, framing it as the peripheries of the most advanced economies (11). As world-systems theory postulates, peripheries have historical trajectories of colonial and neocolonial relations with the core Global North, establishing uneven relations in terms of financial and ecological exchange, but also in terms of the unequal political agency to define specific models for resource and environmental management. Based on these premises, our methodology also integrates a dynamic understanding of the Global North and South. Following Bell (12) and Pellow (13), we then use the term "Global South" as a social designation for politically, environmentally, and economically vulnerable communities that include socioeconomically underprivileged communities in rich nation contexts. In tandem, we acknowledge that the Global North may also include highly privileged communities in poor nation contexts (see also Reference 14).

Our main findings and arguments throughout this review are the following. First, the neoliberal globalization process permeating across the Global South appears as a key factor in what literature in political ecology defines as the corporate energy transition. At the same time, the corporate energy transition entails growing critiques to colonial legacies and state actors, suggesting the need to further conceptualize the energy models challenged by affected communities and social movements. Second, alternative energy futures are reflected in concrete initiatives that vary in scale, technologies, resources, and actors involved (grassroots, communitarian, public). However, they all challenge the regimes of green energy exclusion and seek to restore social control over energy flows and other associated resources. We thus propose an open-ended category of social energy futures (SEF) helping to systematize and critically discuss the diversity of social initiatives in harvesting, consumption, and/or waste management of energy flows. Finally, we conclude by proposing a SEF analytical toolkit and future themes to be developed by different academic and geographical settings.

[1]China is the second largest economy worldwide, with strong geopolitical influences, and has become a major source of outward foreign direct investment. These differences markedly distinguish China and require a specific research line around energy futures. Along with that, countries in West Asia are also considered as major economies with well-established fossil-energy regimes. Due to this region's substantial stocks of oil and gas, combined with vested geopolitical interests, we also consider that specific treatment is required to review and discuss research in the region.

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2. CHALLENGING CORPORATE APPROACHES TO RENEWABLE ENERGY TRANSITIONS

Literature in critical environmental humanities, particularly in political ecology and human geography, is pinpointing the corporate and lucrative approaches to the energy transition that permeate across the Global South (15–17). These trends are seen to work in tandem with structural adjustment and free trade measures instituted in developing economies over the past four decades (18, 19). As a result, the corporate approach to the energy transition is analyzed as processes that include the privatization of strategic sectors, the reprimarization of national economies, the commodification of natural resources, and the reinforcement of technological and financial dependency (20).

Corporate approaches to the energy transition are understood to be part of unequal forms of exchange of nature, energy, and labor, on both national and global scales (21, 24). At the same time, corporate renewable energy projects tend to disregard the local and regional needs of communities hosting infrastructures, including access to land, water, energy, and safe working environments. As such, these schemes are highly questioned for how they expose communities to new rounds of land and resource grabs while deepening precarious conditions of workers on productive and social reproductive labor (22–25). In what follows, we unpack the reported trends in the selected analytical regions of this survey (see also a summary of results in **Table 1**).

2.1. Mexico and Central America

For Mexico and Central America, research around social responses to the corporate energy transition has grown notably yet unevenly during 2019–2025. Important attention has been paid to paradigmatic cases of social movements resisting private renewable megaprojects in Mexico to produce electricity from both wind and solar technologies, particularly in energy hotspots such as Oaxaca and the Yucatán Peninsula. This trend can be explained by the policies that boosted private renewable projects in the country over the period from 2006 to 2018, coinciding with a growing interest in political ecology and environmental justice to go beyond the study of fossil fuel conflicts (26, 27). In contrast, recent research in Central America has been less frequent, with literature focusing on hydroelectric power projects and, to a lesser extent, wind and solar projects (28). Publications addressing this region are mostly led by researchers from these countries but affiliated with foreign universities and, in some relevant cases, working in tandem with local communities and organizations (27, 29).

The significant role of foreign investment in the region feeds into an important critique of the corporate model of the energy transition. Studies have analyzed the role of foreign investment in the expansion of the energy sector (28), how corporations incentivize local disputes over rent distribution (30), and approaches around business ethics and the protection of human rights (31, 32). In this sense, the analysis of privatization of resources and strategic sectors is highly present in literature, with some cases clearly linking these processes to new forms of (green) extractivism and resource grabs. Particular emphasis is placed on land and water resources that commonly sustain rural and Indigenous livelihoods (33, 34) and ontological relations (35). Other research treats territorial approaches to the extractive phenomenon (35, 36) and a critical trace on the flows of energy harvested by large infrastructures (27, 29, 34).

Notably, the corporate energy transition is commonly analyzed as a result of public–private entanglements at different scales. This analytical approach includes questions on how policymaking defines the trajectories of a corporate energy transition (27) but also how local administrative actors benefit from operations of large private investors (30, 36). This approach, therefore, overcomes the commonplace binary division between state and corporate spheres of action and calls

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Table 1 Summary of results: challenging corporate approaches to renewable energy transitions

	Geographic emphasis	Relevant economic and political trajectories	Infrastructures and technologies	Associated impacts	Reported drivers of impacts	Claims against corporate energy transitions
Mexico and Central America	Mexico Central America	Liberalization measures in the electric and land sectors Notable violence in several countries	Wind and solar PV megaprojects in Mexico Hydropower (and, to a lesser extent, wind and solar) in Central America	Land grabbing/enclosures Water grabbing Lack of access to electricity Lack of access to affordable electricity Lack of business ethics Violation of human rights Territorial and ontological disruptions	Development Extractivism Privatization of natural resources Colonialism Capitalism (only indirectly)	States and corporations promote a nonempowering energy model for segments of the population States play a key role in facilitating profit-driven and corporate models in the energy transition Development goals justify the deployment of infrastructures that violate human and community rights Rural regions are providers of electricity to urban areas
South America	Brazil Chile Peru Colombia Ecuador	Colonial legacies in energy policies Extractivist gaze in the energy transition	Solar Wind Hydropower Geothermal	Land grabbing Racism Lack of community participation	Green capitalism Privatization of natural resources Enduring poverty	How to achieve a sustainable future is disputed Technologies are not meeting people's needs Global sustainability should not reinforce some country´s dependence on commodity exports
Africa	Africa Sub-Saharan Africa East Africa North Africa	Countries that possess fossil fuels tend to dismiss the incorporation of renewable energy Most African countries pursue energy security Africa has the natural resources to achieve an energy transition Private financing is scarce; if available, it is public	Solar Wind Hydropower Geothermal	Distributive injustice (location, resource use, employment, project objectives) Procedural and restorative injustices Ecologically unequal exchange Soil contamination Negative impacts on the health of communities Intra-African green plunder (Morocco occupying Western Sahara)	Neocolonialism (from Franafrica to Chinafrica) Green colonialism Land grabbing	The Eurocentric view of the energy transition has to be challenged, addressing issues of class, race, gender, and power Environmental and social costs are being externalized to peripheral regions An energy transition should prioritize the energy needs of local populations, based on national realities Decarbonizing African economies should ensure energy for domestic consumption
South Asia	India Nepal Bhutan Pakistan	Inadequate energy security and developmental challenges Extractivism Rising authoritarianism and religious extremism	Solar Wind Hydropower	Caste- and gender-based inequalities Undemocratic governance mechanisms and inequitable participation Land grabbing	Development Land grabbing Privatization with global pressure, partnership, and investments Capitalism (free market will bring in the solar revolution)	Centralized energy projects lack democratization Debates on ownership and distribution of benefits are absent Issues persist with implementation and monitoring An alternative model should have locally driven energy projects with an inclusive design

(*Continued*)

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Table 1 (*Continued*)

	Geographic emphasis	Relevant economic and political trajectories	Infrastructures and technologies	Associated impacts	Reported drivers of impacts	Claims against corporate energy transitions
Southeast Asia	Cambodia Indonesia Laos Malaysia Myanmar Philippines	Water bodies and hydropower historically considered a major developmental resource Rise in authoritarian states and repression	Hydropower (predominantly) Solar	Land grabbing/enclosures Water grabbing Lack of equitable access to electricity Lacking consideration of plurality of values, land use histories Territorial and ontological disruptions Problems with social–environmental safeguards (EIAs, resettlement schemes, compensation, etc.)	Development Green extractivism Privatization of resources Capitalism	State- and corporate-driven energy transition is part of a larger development agenda where local populations largely appear to be left out Developmental tools, formally intended to protect people and environments (e.g., EIAs, compensation, resettlement policies, livelihood trainings), are used as tools to legitimize energy infrastructures Politics of rent-seeking prevail over politics of social and environmental sustainability Questions of who owns and controls projects, how benefits are distributed, the plural values considered, rights, and whether technologies are propeople (rather than probusiness) emerge as key issues
Souths in the North	Arctic (Sámi territories) Rural areas in Southern Europe (Italy, Portugal) Native lands (Canada and United States)	Institutional Indigenous erasure Militarized capital fueling resource extraction	Large-scale solar/agrivoltaics Large-scale industrial wind projects Large-scale hydropower dams Expansion of fossil fuel projects (oil extraction and pipelines)	Dispossession of Native and Indigenous lands and territories Infrastructural colonization (commodification of nature and the appropriation of land)	Green colonialism Green capitalism Infrastructural colonization Green extractivism	State-backed cumulative violence over territories and peoples through mega-energy projects is counteracted by communities' counter-narratives and mobilization efforts, including onto-epistemic justice Adaptable modes of collaboration between local communities, activists, and Indigenous peoples to develop and implement community-led energy projects thereby restoring community control over territories and natural resources Bottom-up energy and territorial governance through which state-corporate and judicial systems that benefit them are questioned

Abbreviations: EIA, Environmental Impact Assessment; PV, photovoltaics.

for more nuanced understandings of neoliberal agendas in the energy transition. It also addresses how dominant framings of sustainability fail to achieve successful outcomes in the region, leading to alterative debates and constructions of meaning (26, 29, 32). Together, these aspects speak directly to the colonial dimension involved in the energy transition across the region, a theme that is increasingly debated in both anthropology and political ecology.

2.2. South America

Research challenging corporate models of energy transition in South America has grown, though in a rather fragmented manner. An explanation for this is the uneven penetration of nonconventional energy projects in the region. Nevertheless, some patterns emerge when one considers the features of many South American countries: rentier dynamics, heavily subsidized cheap energy linked to fossils, strong dependence on hydroelectric power, and persistent neoliberal policies that privatized electricity (37, 38). As renewable energy projects advance, a growing corpus of studies uncovers the extractivist dynamics produced by wind farms, solar photovoltaics (PV), geothermal energy, and green hydrogen projects in rural areas across Chile, Brazil, and Colombia (39, 40).

Based on these empirical findings, many researchers discuss that the energy transition can be an opportunity for sustainable development, yet energy technology choices must not be driven by techno-economic rationality. If so, many social demands put upon the energy transition will remain unmet (41). These works stress the importance of guaranteeing participation of historically marginalized groups—Indigenous, campesino, rural communities—through meaningful instruments ensuring that these communities share the decisions and benefits of the energy transition (42). Another body of literature engages more profoundly with local communities aiming to amplify their voices, highlighting the gap between energy projects and Indigenous livelihoods. These works shows how limited space is given for local dissent under dominant prorenewables narratives promoting green growth that frame large infrastructure as positive, concealing negative social and environmental impacts (43, 44). Despite the reduced space for contestation, however, some case studies show how energy projects mobilize the construction of alternative futures among Indigenous communities (45).

In Argentina, authors cast doubt on the starting point of incorporating renewable energy generation systems. Using economic sociology, Canafoglia (46) broadens the definition of who carries out the transition, who participates and appropriates the result, and the use and value generated. Similarly, Ise et al. (47) demonstrate how the alleviation of energy poverty in rural and periurban populations must be a central component of any transition framework, not a side concern. On the other hand, research in Ecuador demonstrates that the postextractivist/postdevelopment framework of Indigenous *buen vivir* intertwined with energy poverty perspectives creates fertile soil for integrating, promoting, and implementing energy justice within policy across national and local programs (48).

Distributional issues were peripheral to most cases, as in general the authors agree that substantive participation for local communities could bring forth sustainable development. The consistent finding is that without policy that addresses extant inequalities, energy transitions risk reproducing extractivism; rent-seeking; control over resources, infrastructure and revenue; and social exclusion. Local resistance to top-down transition exists but is still incipient, as it is mostly in the hands of foreign academics and there is not a sound grassroots mobilization based upon alternative energy futures. Based on the available literature, interesting avenues to challenge the corporate energy transition could appear from combining energy poverty frameworks with regional concepts of *buen vivir*.

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2.3. Africa

Research on the corporate energy transitions in Africa shows recent, albeit uneven, growth, touching on questions of geopolitics, justice, and equity. The literature reports that the expansion of renewable energy technologies and infrastructures varies across countries. However, states that are rich in fossil fuel deposits tend to promote an energy security approach based on these resources. This trend is seen as a major obstacle to the introduction of alternative energies (49), even though there are abundant renewable resources to transition toward a low-carbon energy matrix, particularly in East Africa (50).

Müller et al. (51) map the situation in 34 countries across the continent, showing the introduction of legislative measures promoting renewable energies and the increase in investments in the sector. However, unlike what has been observed in the Global North, renewable energy financing has not materialized on a substantial scale in many instances. As Klagge & Nweke-Eze (52) demonstrate for the case of sub-Saharan Africa, private investment is hampered by the difficulty of reproducing capital circuits aiming to obtain profits with very little margin of uncertainty. As such, public investment remains crucial to promoting an energy transition in this region. Interestingly, this work challenges common assumptions about the inevitability of financialization in energy transitions in the Global South, leaving an open discussion about the alternatives amid the corporate approach to the energy transition (see also Reference 49).

Akrofi et al. (53) make a seminal contribution by systematically characterizing the "injustices" in clean energy transitions in Africa. Based on a review of 27 studies across 11 countries, their work identifies four interconnected dimensions of injustice: distributive, procedural, recognition, and restorative (for energy justice policies, see also Reference 51). Distributive injustices prevail in 58% of the identified studies, manifested through inequitable project siting, resource conflicts, disparities in job creation, and the focus on prioritizing grid stability over local connectivity. Along with the limited community participation in renewable energy projects, these problems reflect how the benefits and burdens of the transition are unequally distributed in terms of social and environmental justice. Certainly, Africa remains a provider of basic resources in the globalized economy, setting a structural challenge to overcome such injustices. A comparison of France's and China's neocolonial relations with Africa (54) illustrates this point, showing that both countries engage in ecologically unequal exchanges with African economies. Albeit with different dynamics, their extractive projects generate environmental conflicts, territorial degradation, and health problems for African communities.

The book edited by Hamouchene & Sandwell (55) is also a key contribution that highlights the neocolonial undertone of the energy transition across Africa and West Asia, including Palestine. By conceptualizing emerging forms of green colonialism, contributors show that projects such as the Ouarzazate Solar Complex in Morocco benefit foreign interests and local elites, through land grabbing and the perpetuation of extractivist practices. In Moroccan-occupied Western Sahara, the authors show how renewable energy projects are instrumentalized to consolidate Morocco's illegal control over the territory and resources, excluding the local population from the energy transition's benefits (56). As several researchers propose (57, 58), it is essential to prioritize local needs, guarantee democratic access to energy, dismantle extractivist structures, and promote energy sovereignty. In this sense, the transition appears, critically, to be not only a technological challenge but also a profoundly political matter.

2.4. South Asia

Research in South Asia around social responses to the corporate energy transition has grown notably yet unevenly during our surveyed period. A strong focus remains on solar and wind, due

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to the new large-scale projects in the region and their associated contestations. There is an uneven distribution of focused areas, with the bulk of the solar-related research coming from the western and southern parts of India (59). There is also an uneven distribution of country-based literature, with most of the literature focusing on India as a case study. The main drivers for the transition are seen to be domestic politics, global pressure and partnerships, attracting investment, and energy sovereignty (60).

Notions of decentralization and democratization have been employed for challenging the corporate energy transition in Bhutan, India, Nepal, and Pakistan (61, 62), along with accounting for institutional, accountability, and sociomaterial changes, which manifest in the energy transitions across South Asia (63). The issues of development, employment, dispossession, and land grabs are central to most of the recent research being carried out (64–66).

The corporate energy transition in India replicates colonial, gender, and caste-based inequalities and oppressions, and the way to share the benefits equitably is democratic ownership and control, as Ghosh et al. (67) and Cross (68) demonstrate with empirical evidence from South and Central India, respectively. As such, authors argue that the utopian vision of the energy transition cannot be achieved without tackling the inherent inequalities and power hierarchies (60). Although there is the acknowledgment in the scholarship on the benefits of technological innovation, the focus on both macro- and micropolitics appears to be crucial for a more just energy transition in the entire region (69, 70). A notable observation for the surveyed literature on this region is that most of the research comes from universities in the Global North, with limited interaction with local communities and stakeholders.

2.5. Southeast Asia

Critical reflections on the social contestations against Southeast Asia's corporate energy transition focus largely on big hydropower, the dominant renewable of past decades, which is now regaining momentum in transition agendas (71). In-depth analyses exist at regional (72) and national levels, particularly for Laos, the self-proclaimed "battery of Southeast Asia" (71, 73), but also Cambodia (74), Myanmar (75), the Philippines (76), Indonesia (77), Malaysia (78), and Vietnam (79). Few studies address large-scale wind, solar, or geothermal projects, possibly due to their rather recent arrival in the region (80). Authorship is mixed, involving domestic and foreign authors but rarely only local authors, reflecting, to some extent, postcolonial academic relations.

The critical literature shows that state- and corporate-led energy development, often pursued in the context of rapid urbanization trends in Southeast Asia, has largely failed to account for the plurality of local groups' needs and values, representing those who are exposed to energy infrastructures in rural areas. Conflicts over dams on Myanmar's Salween River illustrate how narrow state framings of water as a commodified development resource clash with local ontologies that tie rivers to cultural identity, generating ontological conflicts (75). In Cambodia, the land and water reconfigurations caused by the Lower Sesan 2 Dam intensified struggles among ethnic groups, with migrants competing for resources and Indigenous minorities facing displacement (74). In (renewable) grid expansion programs, the narrow focus on electrification rates overlooked equity concerns and capabilities, failing to address the multidimensional nature of energy poverty in marginalized communities (81). Common developmental tools often reinforce these problems. In Malaysia's Bakun Dam, Environmental Impact Assessments (EIAs) have been used to legitimize extractivist agendas and rent-seeking (78), while for World Bank–funded showcase dam Nam Theun 2 in Laos, compensation and livelihood restoration schemes have tended to reproduce, rather than resolve, underlying conditions of poverty, injustice, and exclusion (73).

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The dynamics of green capitalism and developmentalism are not new in the region but sometimes follow a historical lineage of extractivist frontier making and enclosures. For example, the deployment of floating solar panels on dam reservoirs in Indonesia (globally promoted to avoid land conflicts) has not only intensified corporative energy extraction frontiers but also deepened historic enclosures: Locals who previously were evicted from commons to make place for the dam, and who struggled to reestablish a livelihood as fishers, are now again dispossessed from access to the water body (77). In Indonesia's Riau Islands, the development of a green ecocity with large solar parks, proclaimed a strategic national project to circumvent stricter EIAs and consultation processes, is situated in historic capitalist and extractivist processes dating back to colonial times, which challenges the notion of supporting a transition (82). Yet, there is also strong continuity of resistance and struggles from those who value the island not as a frontier, but as a home, identity, and livelihood (82). The role of historic struggles shaping current energy futures is also well documented in the Philippines, where historic Indigenous struggles against large dams have become iconic for today's resistances against the corporative energy transition, actively shaping contemporary energyscapes (76).

2.6. Souths in the North

Critical responses to corporate energy transitions are widely discussed in the so-called peripheries of the Global North, such as the Arctic and rural areas in Southern Europe. Sámi Indigenous and allied scholars analyze how certain energy projects illustrate green colonialism and green capitalism (83)—in line with Indigenous peoples' territorial struggles in Latin America—often driven by institutional demands, for example, in critiques of the European Green New Deal (84), large-scale industrial wind projects, and how the priorities of an international climate change agenda have perpetuated colonial discourses and a continued dispossession of ancestral Sámi territories and lifeways (85). The concept of green grabbing and green colonialism—embedded in both land and technology; driven by extractive corporate-led and market-based wind, solar, or hydro megaprojects; deepening processes of both the commodification of nature and the appropriation of land; ostensibly for environmental purposes but effectively realizing a form of infrastructural colonization (86)—is also widely discussed, for example, with reference to agrivoltaics megaprojects in rural Italy (87) or large-scale solar project implementation in Portugal (88).

In the North American context, recurrent themes include settler colonialism, sovereignty, and Native resistance. Notably, while our search results included work on relatively high-profile renewable projects—including the rebranding of hydroelectric power as clean and green at the Site C Dam in British Columbia, Canada, while dismissing attendant impacts of destruction and displacement (89) and the co-opting of Indigenous narratives by dominant groups in their own opposition to offshore wind in East Coast waters of the United States (90)—much critical work has focused on resistance to projects that continue to undermine the very notion of an energy transition. Well represented in our review were studies on resistance to the ongoing expansion of fossil fuel projects, primarily oil extraction and transmission (via pipelines) (91–93).

Across energy sources and projects, the case studies we found critique the dispossession of Native lands and territories under settler colonial systems of law and land rights (83, 89), institutional complicity in processes of Indigenous silencing and erasure (84, 85, 90, 91), and the role of militarized capital in expanding processes of resource extraction (92). Accounts of resistance, meanwhile, detail how Native communities and allied activists and scholars continue to develop adaptable modes of collaboration (92, 93).

Together, this literature underlines how energy extractivism and energy regimes—in the form of exclusionary systems of governance and discriminatory judicial systems, coupled with increasing

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use of state-backed violence to defend private interests—routinely undermine potential just energy transitions.

3. RESTORING SOCIAL CONTROL OF RENEWABLE ENERGY FLOWS

In contrast with the corporate energy transition, diverse initiatives across the Global South are aiming to restore the social control of energy flows, particularly over renewable energy resources and technologies (see summary of results in **Table 2**). However, a preliminary overview of the topic shows that case studies are still emerging and lack unifying analytical concepts across disciplines (94). This trend contrasts with the burgeoning literature on energy communities and energy cooperatives in the Global North, particularly after regulations and incentives have been provided by specific governments (for reviews, see References 95–97).

This section develops a cohesive review of the scattered set of studies reflecting on the alternative initiatives of energy management emerging in the Global South. We here explore the social practices implemented in harnessing, storing, consuming, and waste-managing renewable energy resources. The diversity and commonalities of these initiatives enable us to propose an open-ended definition of SEF in Section 4.

3.1. Mexico and Central America

As reviewed in the previous section, social opposition to corporate energy transition schemes has been of clear interest in international academic journals. However, our review indicates that energy alternatives in the Global South have been less discussed. For the cases of Mexico and Central America, we observe that national and regional journals have more publications on this theme, showing a slow increase over the analyzed period. Here, debates tend to move slowly from cases of opposition to exploring alternatives, discussing how different communities are controlling or can regain control over energy at different scales.

Most of the publications on this sample provide analyses of empirical cases and/or novel concepts prefiguring pathways to achieve them. The notion of pluriverse appears, in this sense, as a recurrent category (98, 99) along with the notion of communitarian projects (98–100). The former notion derives from the Zapatista movement that, since 1994, has become a flagship experience for local alternatives based on autonomous practices. Along with this category, we then find complementary concepts such as communitarian energies (100), energy sovereignty (98), and energy autonomy (99), all of them providing situated concepts that illuminate pathways for research on SEF in the Global South (see the **Supplemental Materials**).

Supplemental Material >

Regarding the empirical cases, literature largely privileges experiences in Mexico. These include the paradigmatic experience of Tosepan Union of Cooperatives in Sierra Norte de Puebla (98) and other initiatives deriving from the government program Pronaces Energía (Programas Nacionales Estratégicos), which promoted the articulation of different actors in the field of energy alternatives (98, 99). Additional studies focus on measuring the sustainability of recycling solar panels (101) and applying value chain analysis for small-scale technologies (102). Costa Rica also receives some attention in literature, providing insightful analysis on gender-based initiatives (103) and the possibilities of community–public alliances to propel energy alternatives (104). We include here one case from Colombia (105), a country that has strongly emerged as a fertile geography where multiple debates have led to grassroots alternatives to energy production (100).

The analyzed cases of Mexico and Central America are generally motivated by overcoming corporate approaches to energy but discursively focusing on satisfying local needs and democratic process. While some of these initiatives derive from conflicts against energy and mining projects (98, 100), others come directly from public efforts to provide different energy schemes (99, 100)

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Table 2 Summary of results: restoring social control of renewable energy flows

	Geographical emphasis	Technologies reported in empirical studies	Concepts reported in studies	Collectivities and institutions guiding the initiative	Motivations for the initiatives	Challenges discussed	Replicability discussed (of 10 studies reviewed)
Mexico and Central America	Mexico Costa Rica	Solar PV Hydropower LED lights Efficient combustion stoves Wind power Biofuels	Energy for *yeknemillis* Pluriversal technologies	Indigenous and rural communities Cooperatives Academics Civil society organizations Private organizations	Enhancing self-governing institutions/empowering communities Resisting extractive projects Tackling local energy needs Rethinking the energy transition model Reducing risks of exposure to energy-related waste	Dialogue between techno-scientific and other forms of knowledge Patriarchy/gender Racism, folklorization, and romanticization of Indigenous communities Financial sustainability Project scope Negotiating with the state Defining "community"	09/10
South America	Argentina Colombia Peru Bolivia Ecuador	Solar Biogas Minihydropower	Energy communities Environmental governance	Cooperatives Private organizations Academics Government	Transforming the way of producing and consuming goods Expanding energy communities Alleviating energy poverty Enhancing labor rights Advancing energy autonomy Increasing environmental protection	Replicability in heterogenous contexts Lack of resources and technical capacities Lack of social participation Neoliberal legacies in policy	6/10
Africa	Africa as a continent South Africa Marginal urban areas Sub-Saharan Africa	Technology mix Hydropower (with attention to water stress) Solar Wind	Energy communities Transdisciplinary codesign Sociotechnical learning Energy ecofeminism Postcarbon imaginaries	Communities Academics as facilitators between communities and politicians Local politicians International funding	Eliminating energy poverty, lack of electricity supply, and access to energy Moving toward energy democratization Resisting extractivism Resisting patriarchy Reducing emissions Increasing energy sustainability	Lack of resources in communities Need for genuine engagement between politicians and communities Need for international cooperation Water stress and the impact of energy projects on agriculture Electrical interconnection between regions with unequal energy production Community acceptance for project viability Need for environmental, economic, and other impact studies	7/10

(*Continued*)

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Table 2 (*Continued*)

	Geographical emphasis	Technologies reported in empirical studies	Concepts reported in studies	Collectivities and institutions guiding the initiative	Motivations for the initiatives	Challenges discussed	Replicability discussed (of 10 studies reviewed)
South Asia	Bangladesh Bhutan India Nepal Pakistan Sri Lanka	Solar (home systems and microgrids) Wind Hydropower Biogas	Community (owned) renewable energy Energy justice Recognition-based justice Environmental governance for energy transition	Local communities, including self-help groups Women Government institutions (national, regional and local) Industries including manufacturing and installing companies and consulting companies Village energy committees NGOs and civil society	Fostering ownership-including financial and institutional autonomy at local level Improving quality control and reliability Addressing energy poverty and social justice concerns such as equal distribution of benefits Empowering women Supporting counter-movements engaged in antiauthoritarian and anticolonial resistance and self-defense by those unjustly affected by solar infrastructures Ensuring long-term sustainability of the projects Decentering capitalism's grip over energy futures	Lack of trust Nonawareness about the technology Need for deeper engagement with knowledge politics and agency of vulnerable groups Priorities for energy for marginalized communities framed based on their everyday experiences of marginalization Techno-capitalism versus solidaric solarities (modalities of harnessing solar energy to advance empowerment, interconnectedness, and community wealth for victims of energy injustices, toward redistributive and emancipatory solar development) Weak local governance, financial, and technical capabilities	8/10

(*Continued*)

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Table 2 (*Continued*)

	Geographical emphasis	Technologies reported in empirical studies	Concepts reported in studies	Collectivities and institutions guiding the initiative	Motivations for the initiatives	Challenges discussed	Replicability discussed (of 10 studies reviewed)
Southeast Asia	Thailand Indonesia Vietnam Cambodia Malaysia Taiwan	Biogas Hydropower Wind Solar Batteries and electricity storage	Sufficiency economy Community renewable energy Prefigurative activism Sociotechnical imaginaries for energy futures Identity politics and place-making Energy justice	Local communities and (MOSO) networks Cooperatives Local NGOs Village-owned enterprises Local government Donors Academics Corporate actors	Moving toward enhanced and more affordable energy access, including enhanced electricity grid Decreasing dependence on expensive (e.g., kerosine) and prohibited (e.g., firewood in national parks) energy sources Increasing energy self-sufficiency and independence Reducing air pollution, reducing environmental pressures (e.g., deforestation), and improving access to purified drinking water Resisting petrochemical industries Struggling for (tribal) autonomy, decolonization, and cultural revitalization	Replicability and scaling up Kinship societies are potentially problematic when involving nontransparent business practices Micropolitics and local contexts could lead to reproduced and reinforced injustices in energy communities, uneven access, and top-down implementation Knowledge, financial, policy, and technological support need to be considered Patriarchal cultures limit women's access to energy control Long-term sustainability of projects Unclear legal relations for ensuring energy access Local projects can foster consumer/producer relationships, where producers claim income, while consumers want a cheap product at high quality	6/10
Souths in the North	Indigenous lands (Canada and United States) Puerto Rico Māori land (Iwi Indigenous geothermal energy initiative in New Zealand) New York New Orleans	Geothermal Solar PV Wind power Energy self-provision initiatives	Energy democracy Energy sovereignty Local energy justice	Anticolonial ecologies and movements Bottom-up community energy initiatives Self-sufficiency Indigenous-led energy sovereignty	Increasing community energy projects as means for increasing democratic participation and fairness Supporting Indigenous leadership and control via energy development Exploring the reparative potential of community solar Recasting individuals as participatory citizens (rather than consumers) within energy transitions	(Energy) provisioning within low-income Black and Latinx communities in New York Sustaining Indigenous sovereignty, self-determination, and autonomy over land resources and energy Disaster-recovery funds/processes Unionizing the solar workforce	6/10

Abbreviations: LED, light-emitting diode; MOSO, moderation society; NGO, nongovernmental organization; PV, photovoltaics.

and to enhance the capacity of vulnerable communities amid the energy transition. This latter category is the most recurrent motivation and covers intentions to attend to basic local needs, such as access to electricity through hydro, wind, and solar, or heat using biomass (101, 102, 104, 106, 107).

In terms of challenges, the governance of energy initiatives is clearly mentioned as a main concern when dealing with power relations between state and communitarian actors (98). These tensions are also found between traditional communitarian institutions on one side and modern approaches to govern territories and resources on the other (99), leading to calls for postcolonial approaches to the energy transition. The literature on the financial side addresses these aspects, but not as a central concern, leaving an important gap to address in future research. Finally, there is notable attention paid to the appropriation of technologies, with studies to understand the unequal access of technical capacitation in terms of race and gender (106), as well as the importance of local appropriation of technologies (103, 107) and of creating pluriversal devices for local communities (99).

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3.2. South America

Research on local initiatives to regain social control over energy in South America remains limited. Throughout the twenty-first century, energy policies across the region have largely prioritized market liberalization and private investment, leaving little space for community or cooperative ownership models. However, persistent energy inequality—especially in rural and periurban areas—creates conditions for grassroots organizing and alternative energy governance. Research shows that electric cooperatives in Brazil and Argentina have managed to endure despite several waves of privatization (108). In Brazil, historical rural cooperatives—particularly in the Amazon—have played a crucial role in mitigating energy poverty through small-scale hydropower, diesel, or biomass-based mini-grids. In Argentina, cooperatives not only provide essential services but also show potential to contribute to a popular energy transition at the local level. Although these efforts face financial and technological constraints, they demonstrate the feasibility of bottom-up alternatives that can improve health, education, income, and overall quality of life (109).

In Peru, Bolivia, and Ecuador, rural electrification—especially via off-grid solar systems—has been pursued through public, private, and cooperative-led initiatives. Among these, cooperatives have shown the most consistent success, primarily due to their emphasis on local empowerment and self-organization. For this reason, researchers recommend that policymakers prioritize cooperative-based models as a strategic path toward equitable, resilient energy systems (110). Yet the neoliberal trend of current governments in these three countries make this less likely in the years to come. In Colombia, as mentioned before, Gustavo Petro's administration has opened a political window to advance local energy control. According to the Minister of Mines and Energy of this country, the government has sought to promote community-led renewable energy projects, allowing families to create associations and generate their own power (111). However, although research demonstrates the country's potential for energy generation from renewable sources (112), little is known about the actual outcomes of this policy so far.

Much of the research on energy communities focuses on bureaucratic obstacles and how policy frameworks can either support or hinder the transition to local energy production (113, 114). In the case of Chile, studies evaluate the impact of slowly emerging energy communities on the national grid, comparing the benefits of collective participation versus individual net-billing schemes. Nonetheless, there are few authors who point out the potential for energy system design that considers cultural and ecological contexts to improve livelihood and empower vulnerable communities (115). Interesting techno-productive experiences led by universities and local communities

in Argentina shed light on how this type of collaboration could engender locally driven transitions in which the community's well-being and social control of their development is the main goal (46).

Moving forward, research must examine how energy communities in South America survive in hostile regulatory environments, and under what conditions energy cooperatives can move beyond poverty alleviation to lead broader socioecological transitions. Emancipatory potential of frameworks like *buen vivir* could serve to redefine renewable energy as part of community autonomy and sustainability. This will require reimagining energy not as a commodity, but as a commons—anchored in community control, equity, and sustainability.

3.3. Africa

The outlook for Africa's energy future is characterized by the prevalence of energy poverty, or even a complete lack of supply, depending on the subregions and countries. This provides both opportunities and challenges to promote social control over renewable energy flows. According to estimates by the International Energy Agency, nearly 600 million people in sub-Saharan Africa still lacked access to electricity in 2021. However, renewable energy consumption in Africa is among the highest in the world when biomass resources and technologies are considered (116). In Ethiopia, for example, electricity accounts for just 3% of the total energy supply; only 44% of households have access to electricity; and in 2019, biomass fuels accounted for approximately 86% of total energy consumption, compared with the African average of 51% (116). These data indicate that as traditional and renewable sources of energy are prevalent, the development and use of safe energy technologies are required. As Masera and colleagues (117) point out, user-centered energy systems can considerably reduce the health impacts associated with biomass burning (including cardiovascular, respiratory and reproductive diseases) while assuring low-carbon fuel consumption.

Another set of studies focus on the potential of the region to achieve universal access to electricity (118). Research shows that Africa has great conditions for mixing hydro, solar, and wind energy (119), opening an opportunity to address chronic energy poverty and reconfigure socioeconomic structures at different scales (120). The concept of a just transition thus emerges strongly in the literature, but its meaning is problematized. In his analysis of South Africa, for example, Barnes (121) identifies two competing postcarbon imaginaries: one focused on distributive net justice at the national level, centered on reducing emissions and mitigating economic impacts, and another that prioritizes addressing specific historical and localized injustices. This divergence raises the crucial question: "Justice for whom?"

The answer, according to several authors, lies in promoting energy democracy by empowering energy communities, promoting codesign schemes, and reinforcing an ecofeminist vision for the future. Studies on energy communities in sub-Saharan Africa are a case in point, suggesting that these initiatives hold potential. However, these initiatives face obstacles that include a lack of resources and the cooptation of projects by external interests, such as companies, governments, or local elites (122, 123). To counter these problems, Ambole et al. (124) propose codesign as a mechanism for engaging with communities, fostering participatory governance and a sense of ownership. Their work in informal urban settlements in Kenya, Uganda, and South Africa advocates for a transdisciplinary approach to such codesign schemes. This research also reveals that energy in African urban contexts is deeply intertwined with other services, such as housing, health, and security, requiring holistic and contextualized solutions.

Bloem et al. (125) highlight the potential for sociotechnical learning in communities based on a survey of multiple experiences. Also, Antwi & Ley (126) identify community acceptance as a determining factor for the sustainability of alternative projects. Their research affirms that

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ignoring sociocultural dynamics, local leadership structures, and community perceptions often leads to failure. Together, this research proposes a path that combines technical planning with community participation and socioecological justice. Along those lines, Hargreaves (127) advocates for an African ecofeminist approach that is not limited to changing energy sources but extends to transforming power relations. She proposes a transition guided by community sovereignty, Indigenous knowledge, and the radical democratization of decision-making, prioritizing women's rights and the reproduction of life over capital accumulation as an inevitable path.

3.4. South Asia

In the South Asian context, there is a disproportionately larger literature focusing on India and solar energy. In most cases, the literature demonstrates how solar energy has been deployed at household levels in different countries of South Asia with varying successes based on social context (128) as well as how technological innovation and top-down policy recommendations can be useful for renewable energy transition, such as in the case of twinning solar power with hydropower in Sri Lanka (129), or microhydropower in Nepal (130).

In tandem, restoration of social control has been analyzed as part of an older history of grassroots innovation movements in India dating back to the 1970s (131). The focus here is on how grassroots innovations can lead to better community empowerment and sustainability, including gender empowerment (132).

Using empirical case studies, the literature demonstrates that despite the claims that large-scale renewable energy projects lead to poverty alleviation and development of ecoeconomies in remote areas, the research shows that it leads to tensions in communities through unjust implementation procedures and excluding socioculturally marginalized groups in all decisions (133, 134). This calls for different types of institutional arrangements that allow for a transparent decision-making process along with community control (63, 130). As both private and public players provide renewable energy, what the mechanisms for social control are is a significant question in the literature, with a focus on different axes of injustices.

Community energy projects are often possible with informal networks of academics, women's self-help groups, and other citizen initiatives and philanthropies for sharing technical know-how and local innovations, such as in the case of Rajasthan (131). Strong community ownership from an early stage, including ensuring financial and technical capabilities at the local level, is crucial for the long-term sustainability of community-led projects (69). In the rural context, such as in the case of rural Rajasthan, social and political marginality must be considered for restoring just control (63, 135).

3.5. Southeast Asia

Diverse bottom-up initiatives exist in Southeast Asia that put community energy control and local needs at the center. Such initiatives aim mainly at enhanced electricity and natural biogas production. The underlying technologies comprise biodigesters (136, 137); solar (138–141), sometimes integrated with water purification (142); microhydropower (143); and wind (138, 139), as well as different on- and off-grid electricity options (144). Most of the literature focuses on case studies, often with a practical, technical focus, while critical social science reflections are limited. Authorship is mixed, yet with a higher share of domestic than foreign scholars.

The social organization of community renewables usually involves local associations, cooperatives, and governments (village and commune chiefs), but also small, village-based enterprises. Support from nongovernmental organizations, academic institutions, and governmental programs has been central in most cases. The motivations behind the initiatives are diverse, ranging from

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enhancing access to energy and clean water to reducing costs from expensive alternatives such as liquified petroleum and gas, reducing pollution from biowaste and diesel generators, and lowering deforestation pressures from firewood use. Yet, these energy models represent much more than enhanced access and efficiency in resource use. In Thailand, they have been embedded in the sufficiency economy philosophy (136, 138).

In Vietnam, some energy models are linked to identity politics, as when biogas digesters were promoted to support community activities and build "the most beautiful village" (137, p. 1). They may support community and female empowerment (for Indonesia, see Reference 143) and independence from the high prices of corporate energy providers taking advantage of the lack of grid connectivity (141). In a neighboring region of Taiwan, some models were also strongly linked to identity struggles and movements for (Indigenous) autonomy and decolonization (145). Also, hidden agendas can be at play. A case study in Indonesia describes how a wind–solar PV project was actually intended to test new, domestic, corporate-produced turbine motor technology prior to patenting, and no long-term community engagement was planned (139).

The social configurations driving these projects challenge, in many ways, the paradigms underlying the corporate energy transition. They are driven by needs rather than profit, thus putting the energy use value over its exchange value. While most projects focus mainly on electricity, some also involve natural biogas production, which illustrates a slow diversification beyond the current widespread focus on electricity. Most community projects contain elements of collective social organization and decision-making responsive to local social and environmental concerns (138). For example, when prices are established for electricity access or battery recharge, local social considerations are more important than profit and market opportunities (137, 141). Generated income is often used to support community activities (143). Project establishment and maintenance are based on collective efforts rather than external service suppliers, where community infrastructure, as well as local labor and land, is frequently contributed to the renewable energy systems (137, 140). Energy self-sufficiency (136, 140) contrasts with the surplus extraction agendas that dominate the corporate energy transition.

However, considering that communities are socially differentiated, just and equal energy access for all is not necessarily guaranteed, and local histories, contexts, and social structures need to be accounted for (139). For instance, a paper on microhydropower in Indonesia highlights the importance of less-patriarchal cultures for successfully increasing cooperative and female-led energy control (143).

3.6. Souths in the North

On the social control of green energy projects (mostly wind, solar, and geothermal in the peripheral Global North), much of the literature critiques top-down megainitiatives or policy proposals—primarily those labeled as green—with fewer meta-analyses or articles discussing participatory projects, and relatively scarce literature on bottom-up community initiatives. Analyses focus on issues of justice, power, and property as determinants of any transition's outcome and pace, including inequalities related to energy poverty and land ownership—particularly when they obstruct the potential for local energy justice by excluding citizens without land-ownership status (146, 147). Studies in the United Kingdom and Germany highlight the framing of community energy projects as increasing democratic participation and fairness, emphasizing the need for widespread consultation and buy-in from energy system stakeholders for such initiatives to be successful, and the importance for energy transitions of including individuals as participatory citizens rather than merely consumers (146, 148). Berka et al. (149) analyze several projects in New Zealand, including the Iwi Indigenous geothermal energy initiative, highlighting strong

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community involvement in project design, political motivation for self-sufficiency, and support for socioeconomic development on ancestrally owned Māori land.

Similarly, energy democracy and energy sovereignty are key goals in the North American context, with community solar as a primary strategy in Indigenous communities, communities of color, and low-income urban contexts (150, 151). The Piitapan Solar Project in Alberta has been analyzed in political terms (as asserting Indigenous self-determination and autonomy over land) and in sociotechnological terms (as localizing energy generation and supporting local economies) (152). The ongoing Oceti Sakowin Power Authority community wind projects on reservation lands in South Dakota also aim to boost Indigenous-led energy development, leveraging the federal Clean Electricity Production Tax Credit and financing in partnership with a commercial wind energy developer, but this model's dependence on a particular element of federal tax policy, at a time of great national volatility, reveals new forms of precarity (153).

In Puerto Rico, energy self-provision initiatives include community-owned solar, funded in part by redirecting disaster-recovery funds (151). In a low-income Black and Latinx community in New York, Lennon (150) describes the "Solarize" model, an approach to residential solar that leverages collective consumer power to secure below-market installation costs, but which remains rooted in exploitative and unequal free market logics. In New Orleans, calls have been made for the reparative potential of a community solar rule (to support subsidized commercial solar for working-class residents) to be realized by also redistributing the profits of renewable energy, unionizing the solar workforce, and ensuring participatory governance of utilities (154). Together, this literature contextualizes, within structures of inequality, any claims made for the liberatory or transformative potential of community energy projects.

4. DISCUSSION: TRENDS AND ANALYTICAL PATHWAYS

Following critical questions on "whose futures are at stake and whose futures need to be given premium in scholarship and practices" (6, p. 1), this review has centered on debates and concrete energy experiences discussed in literature from across the Global South. With the aim of going beyond the themes already prioritized in dominant research, we discuss our survey in terms of the empirical trends as well as emerging concepts and praxis. As further explained below, alternative energy futures across the Global South are reflected in concrete initiatives that vary in scale, technologies, resources, and actors involved (grassroots, communitarian, public). However, they all seek to restore social control over energy flows and other associated resources.

In what follows, we use the term "regimes of energy exclusion" to condense the dominant patterns of renewable energy implementation and its social contestations across the Global South. Then, we propose and unpack the term SEF, providing an open-ended category and analytical tool to further expand and deepen this research in different geographical contexts.

4.1. Regimes of Green Energy Exclusion

The regime reconfiguration toward green energy aims to shift from the fossil-energy regime to one that is mainly led by renewable energies, bringing questions on the political, social, and justice-related challenges that accompany such a change (155). This regime reconfiguration might be mainly technologically oriented, aiming to sustain the current economic and political structures, or else geared toward structural changes (see 156). As sociotechnical webs with an inherently political nature, energy systems present a stark choice for the future: Any debated and practiced pathway either will serve to reinforce the existing order or will necessitate social mobilization to achieve transformation (6).

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Recent academic literature shows that the prefiguration of alternative energy futures across the Global South stems from claims and discourses challenging the corporate model for the energy transition. Notably, however, such critiques include not only the role of private corporations empowered by neoliberal globalization but, in many cases, the role of the state itself. This trend is mainly observed when national states benefit powerful actors in energy transition initiatives or replicate continuous colonial relations over Indigenous and local communities. Based on the observations in this review, therefore, a broader conceptualization of the dominant models of renewable energy implementation and their social contestations is called for.

The term "regimes of green energy exclusion" reflects the series of technologies, infrastructures, markets, and practices that are leading to the concentration of resources and political power in the energy transition. This term helps us to reflect how the progressive shift from a predominantly fossil-energy regime to a renewable-led one is involving diverse forms of social exclusion in the Global South, including questions on energy access, technological dependence, and the erasure of cultural and territorial dynamics around energy and other resources.

Regimes of green energy exclusion foreground not only neoliberal arrangements but also the dialectic between capitalism and modern colonialism as complementary forms of dispossession and accumulation (24, 99, 164). Prevalent dynamics between state actors and private interests (particularly foreign ones) thus translate in the privileged low carbon consumption of certain geographies, industries, and social groups at the expense of the symbolic and material exclusion of historically marginalized others (see also Reference 157). These regimes are clearly observed in cases of communities claiming that energy projects labeled as green are not aimed at alleviating basic energy needs and socioecological inequalities where projects are installed. Simultaneously, the literature shows how the appropriation of energy resources comes along with the appropriation of land, water, air, and solar radiation, excluding certain users and cultural forms while providing energy and power excess to others (24). As such, state and private corporations are seen to coconstitute the problematic paradigm of green development.

Within these trends, clear distributional aspects over material and cultural representation emerge as analytical problems for political ecologists and critical socioenvironmental scholars (158–160). Critiques of state policies promoting private investments, profits, and interests in the energy transition are widely reported in literature. There are also a notable number of cases denouncing corruption across the basic state responsibilities with local communities, including the three tenets of environmental and energy justice: recognition, participation, and distribution.

Critical social theory appears here as key to building a multiscale perspective on the regimes of green energy exclusion. On the international scale, economic and ecologic unequal exchanges between the Global North and South are seen as central drivers of global capitalism and the associated colonial responses to the climate crisis (16, 24, 54). At national and local scales, detailed analyses also illuminate how elites in the Global South become key actors in reproducing a modernizing ethos for the energy transition, promoting—directly or indirectly—regimes of energy privilege and exclusion. This leads to what Mexican sociologist Casanova (161) defined as "internal colonialism," suggesting that colonial-capitalist dynamics can also be traced in postcolonial states through the interests and behaviors of elites exerting an "imperial mode of living" (162).

As further discussed in the next section, these observations suggest that emancipatory approaches to energy transitions in the Global South might benefit from broader explorations between energy access, postcolonial politics, and alternatives to sustainable development.

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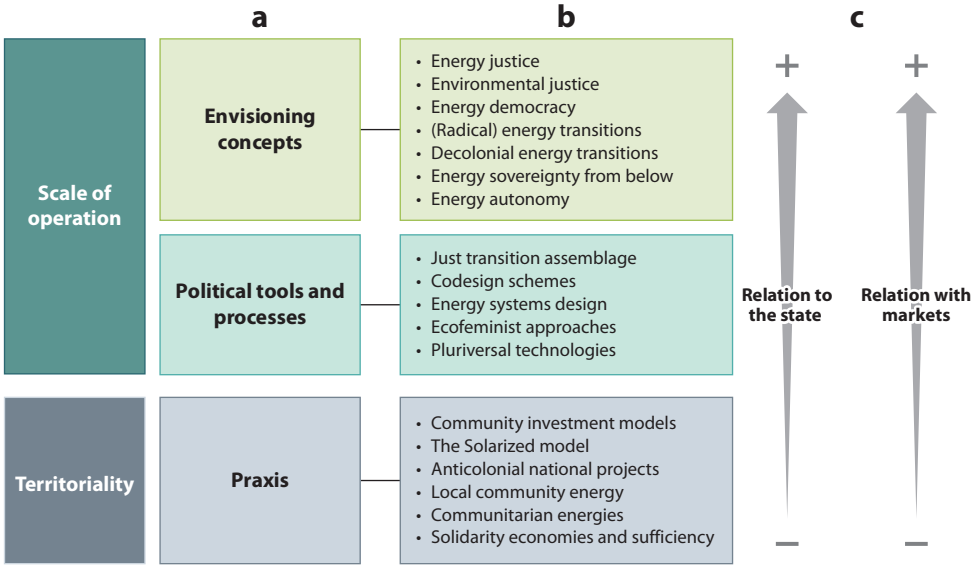


Figure 1

Social energy futures (SEF): concepts, processes and practices reported in literature. This figure condenses different dimensions of SEF claimed and conquered in the Global South. (*a*) Dimensions include concepts, political tools/processes, and practices. (*b*) Each of these dimensions encompasses a diversity of instances and experiences that reflect (*c*) varying degrees of rejection, cooperation, or negotiation with states and markets. This figure also indicates the scale of operation of SEF (*left column*), at national, regional, or local scales, and the specific territorialities that define the socioecological contexts where praxis/initiatives take place.

4.2. Social Energy Futures: Concepts, Processes, Practices

Academic research across the Global South reports a diversity of initiatives restoring the social control over energy flows. These alternatives do not follow a predefined scheme but rather vary across geographies and situated experiences. If SEF are diverse rather than homogeneous, we must then ask, what basic tenets constitute a social energy initiative?

Across geographies, insights reported in literature suggest that SEF entail concepts, processes, and praxis. These dimensions, even when diverse, share three basic attributes. First, they are largely needs oriented: They tend to prioritize use value over exchange value. As such, energy resources are not seen as mere commodities but as broader socioecological relations. Second, they involve broader political discussions: Key questions are democratically debated to define how much energy should be harvested, where to harvest it, by whom, and for which purposes/needs. Third, they are part of broader identity struggles: Social actors organize at different scales to counteract colonial and corporate relations amid the energy and climate crisis.

As illustrated in **Figure 1**, each of these dimensions (**Figure 1*a***) integrate a diversity of instances (**Figure 1*b***) that reflect varying degrees of rejection, cooperation, or negotiation with states and markets (**Figure 1*c***) (see also details in the **Supplemental Materials**). **Figure 1*a*** also indicates the scale of operation, at national, regional or local scales, and the specific territorialities that define the socioecological contexts where SEF praxis take place. These include if cases unfold in rural, urban, or periurban settings, as well as the land tenure, land cover, and availability of human and natural resources involved.

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For example, the recent wave of national popular governments in Africa, particularly in former French colonies, is promoting decolonization and resource sovereignty at national scales. By

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directly permeating the state, recent initiatives like Burkina Faso's Indigenous electric mobility plans seek to strengthen public control over resources and technologies (163) and leverage the abundant solar radiation of its national territory. Another set of examples are instances where energy sovereignty appears as a clear political project of rural and Indigenous communities at local scales. Such is the case of the decolonial initiative *Energía para el yeknemillis* built by the Masewal and Totonaca communities in Central Mexico. As they state (98), energy sovereignty means negotiating freely with the state to promote energy autonomy in their territories. Similarly, the Solarize model promoted in the United States seeks to use markets to emancipate communities from fossil energy–oriented models that are lived as colonial and racist (150). Interestingly, when broadening the scale of their political debates, these solarized initiatives emphasized the need of antiexploitative approaches for technology production abroad.

On the bottom row of **Figure 1**, we find instances promoting a more radical detachment from modern states and markets (164). These include concepts such as decolonial energy transitions and energy autonomy initiatives, promoting pluriversal technologies. As Velázco-Herrejón and colleagues (99, p. 11) point out, pluriversal technologies "embrace ontological and epistemological diversity by being codesigned, coproduced and co-owned by the inhabitants of the sociocultural territory in which they are embedded." Equally, praxis of sufficiency and solidarity are present at local-scale initiatives, such as in moderation society (MOSO) networks in Thailand. Based on Buddhist values, these networks allow people to live in self-sufficiency without overexploitation of natural resources, including energy ones (136).

4.3. Social Energy Futures Analytical Toolkit

Drawing on our review and moving to our second question (What dimensions come into play when studying SEF initiatives?), we propose an analytical toolkit to further promote research on energy alternatives across the Global South. As shown in **Figure 2**, systematic studies around SEF initiatives can benefit by exploring a combination of six analytical dimensions. The first four are ① political ontology, ② energy technologies, ③ resources and scale, and ④ uses and energy needs satisfied by studied initiatives. At the center of this analysis, we position ⑤ the organized collectives promoting the studied initiative, and sustaining all dimensions are ⑥ the governing institutions that rule such initiatives.

This toolkit can be understood as an inductive map that is based on the existing literature and aims to facilitate interdisciplinary and comprehensive studies on the diversity of SEF in the Global South. For instance, our review clearly illuminates that social energy initiatives are commonly driven by organized collectives with communitarian, public, and nongovernmental actors playing a central role. As discussed, these initiatives tend to stand in contrast with the profit-driven energy projects and, instead, seek to satisfy local energy needs for heat, electricity, and fuel through different resources, governing institutions, and infrastructural scales. As such, analyzing together the compound of analytical dimensions proposed in the toolkit is key to examining the diversity, potentials, and challenges of SEF experiences.

Going further, our review shows that SEF also tend to challenge ecomodern principles and strategies, mainly those concerned with the political ontologies and technologies involved in what are seen as successful transitions toward low-carbon energy systems. Therefore, integrating this dimension in the toolkit is central to understanding SEF's worldview framing and its consequent ordering of needs, technologies, and resources. As proposed by Sokolova (165), political ontologies play a crucial role in defining the knowledge, actors, and pathways considered acceptable to build a postfossil era. In particular, she stresses the tensions between modern ontologies and those ontologies that resist their means and ends. For analytical purposes, we divide political ontologies into modern and pluriversal ones. This distinction, developed by anthropologists like Escobar

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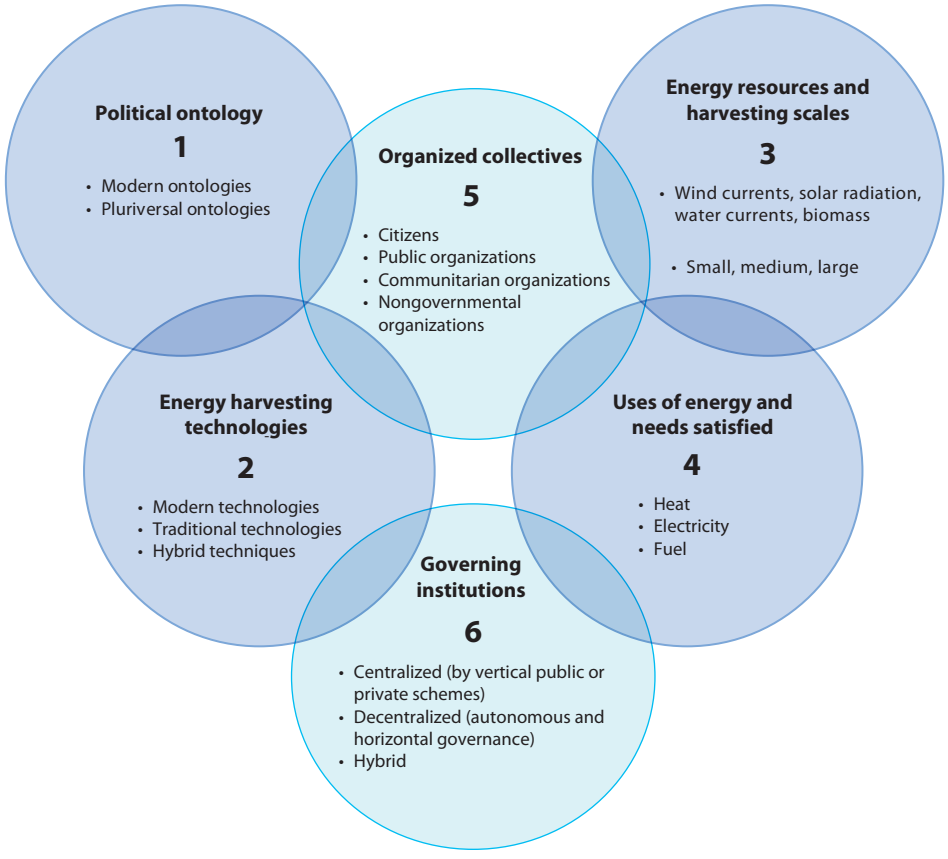


Figure 2

Social energy futures toolkit for analysis. This figure illustrates the analytical toolkit favoring systematic research on energy alternatives across the Global South. The toolkit includes six dimensions to be considered in future studies: ① political ontology of studied initiatives, ② energy technologies used, ③ resources and scale of operation of the initiative, ④ energy uses and needs satisfied by the initiative, ⑤ organized collectives promoting the initiative, and ⑥ governing institutions that rule such initiatives.

(159), argues that modernity created a dominant one-world ontology based on dualisms such as nature versus culture, mind versus body, and fact versus value. Modern ontology assumes that nature is a set of resources for extraction, and a singular universal reality can be controlled through scientific knowledge.

Modern ontology informs the dominant narrative of ecomodernism, which epitomizes the idea that any given society can engineer its way to a fossil-free future through the right use of modern technologies, regulations, and investments (166). In the ecomodernist narratives, technologies and their usages tend to focus on modern renewables (solar PV, wind power) and electrification of all energy uses.

Pluriversal ontologies, on its turn, argue against the singular modern world, asserting that many worlds exist simultaneously. Pluriversal ontologies view ecopolitical conflicts, such as land disputes with Indigenous communities, not as cultural misunderstandings but as ontological struggles between fundamentally different realities. A clear example of a pluriversal ontology is that proposed by Indigenous communities in North Puebla, Mexico, arguing that energy is not a resource but

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rather a relation for *yeknemillis* (98). Other instances are the variety of communitarian energy initiatives across Latin America that promote a cultural transformation around the understanding of energy, its uses, and its generation (167). These ontologies might also play a key role in resolving tensions around knowledge production and the knowledge exchange process in the energy transition.

While the tensions between modern and pluriversal ontologies do not directly define the use of technology to harvest energy, the proximity to certain political ontology clearly reflects the ways in which technologies are appropriated and governed. While in many cases corporate technologies create dependencies on knowledge and material aspects of alternatives, other initiatives revert such trends. As the case of Costa Rica shows, the alliance of Indigenous women with local universities and South–South cooperation agencies enables them to appropriate solar PV installations and illuminate alternative relationalities with gender, equity, and energy (103).

In turn, SEF strongly promote the implementation of pluriversal technologies: those that "embrace ontological and epistemological diversity by being codesigned, coproduced and co-owned by the inhabitants of the sociocultural territory in which they are embedded" (99, p.11). In these cases, SEF go beyond the target of electrification through modern technologies to promote, instead, radical approaches to decolonial knowledge and practices. These include ecotechnologies for sustainable biomass production and use (168) as well as many practices to appropriate energy flows for drying food crops, cooking, heating, and cooling (100).

5. CONCLUSIONS: TOWARD FUTURE RESEARCH AGENDAS

Initiatives promoting just and sustainable energy transitions in the Global South involve deeply sociopolitical and environmental questions. As reported in the literature, technocratic paths promoted by corporate and state powers are prioritizing decarbonization through regimes of green energy exclusion. These paths, largely challenged by critical scholars in socioenvironmental studies, are capital and technology intensive, and tend to reproduce dependencies and colonial relations at different scales. These regimes also involve superfluous community participation and, therefore, reproduce inequalities in energy access and democracy around resource management. In contrast, SEF are slowly emerging as a diversity of alternatives that integrate transformations from national to local scales. These alternatives are geographically situated and place social organizations at the center of cultural and economic transformations in the energy transition. Based on these findings, we conclude our review with some notes to further develop a research agenda on SEF across the Global South.

First, the prominence of research studies around regimes of green energy exclusion in certain geographies suggests that space for further fieldwork is, across the Global South, still available (for reported case studies, readers are directed to **https://www.ejatlas.org**). Attention to how green energy agendas are implemented (or not) in understudied geographical locations might be key to further understanding aspects such as the geopolitics of the green transitions and the links between violence, war, and green energy (for example, in Central America, certain regions of Africa, and West Asia).

Second, a notable number of studies on SEF are focused on the technical opportunities for developing decentralized energy production and consumption in the Global South, contrasting with fewer studies analyzing specific experiences and their socioenvironmental features. This suggests that there is an important empirical gap to be developed by scholars across environmental humanities. Many cases available in the gray literature can be developed as case studies in academic settings. In this process, there is great opportunity for Global South scholars (internationally and locally based) to disseminate SEF initiatives through systematic studies and the coproduction of knowledge with local organizations and communities.

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Third, when analyzing practical examples of SEF on the ground, questions of finance and scalability of initiatives appear as central challenges. In terms of financing, SEF initiatives usually require a starting investment, either provided by states, nongovernmental organizations, or banks. While our review shows varying degrees of responses to this dilemma (as reflected in **Figure 1**), there is still a wide space to explore alternatives to be implemented within the circuits of solidarity economies. The issue of scalability is also central, bringing questions on when, how, and whether national states should participate in the promotion and support of SEF initiatives. In this realm, we suggest that research on pluriversal transitions would benefit from fostering broader debates about the democratic potential of the public sphere to articulate diverse alternatives. Fourth, the SEF toolkit presented in this article seeks to contribute to such research opportunities by providing a clear analytical route when analyzing concepts, processes, and practices around alternative energy initiatives. The toolkit can still accommodate the inclusion of additional dimensions such as financial schemes and replicability models.

SUMMARY POINTS

1. A dominant trend in energy transitions across the Global South is promoted by foreign corporate interests and national elites, who commonly occupy key positions in nation-states.
2. The corporate model of the energy transition is capital and technology intensive: It reproduces dependencies in the global economy and replicates colonial dynamics over socioecological systems at different scales.
3. The primary consequence of this model is the formation of new regimes of green energy exclusion. In these, key problems around energy access and energy poverty affecting societies in the Global South are unresolved, and democratic management of resources is absent.
4. Social energy futures (SEF) in the Global South are propelled by communities and social movements at different scales. They all challenge regimes of green energy exclusion and seek to restore social and public control over energy flows and other associated resources.
5. SEF are diverse across geographies. They involve a variety of conceptual postulates around energy; technologies, political tools, and processes; and praxis on the ground. These alternatives have varying degrees of distance and permeation over states and markets.
6. SEF are context specific. However, common criteria of analysis and political praxis include political ontology, technologies, resources harvested, scale, social actors leading initiatives, and governing institutions.

FUTURE ISSUES

1. There are understudied geographical locations regarding the implementation of corporate models in the energy transition. The Global Atlas of Environmental Justice is an open-access research tool available to bridge this research gap.

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2. Attention to how regimes of green energy exclusion are implemented (or not) in understudied geographical locations might be key to further understand aspects such as climate geopolitics and the links between violence, war, and green energy (for example, in Central America, certain regions of Africa, and West Asia).
3. There is great opportunity for Global South scholars to study and disseminate SEF initiatives through systematic research and the coproduction of knowledge with local practitioners and organizations. In these efforts, it will be key to integrate postcolonial approaches and bridge critical environmental humanities with commonly available technical analysis.
4. Multiple questions around the role of the state are key to advancing SEF. Here, a constructive debate must take place about the possibilities of the state in facilitating decolonial and pluriversal transitions, as well as facilitating public spaces for energy democratization.
5. The question of financing SEF initiatives must be further studied. Systematic reviews on different financial schemes, cooperation models, and solidarity economies will be key to ensure the launching and long-term sustenance of these initiatives.
6. Sharing experiences on existing SEF initiatives where multiple actors are involved might be key to overcoming common problems such as the hierarchy of knowledge production, technical training, and democratic participation.
7. Further exploring the rural–urban dynamics in energy transitions across the Global South might be a fertile avenue to address key challenges in energy and resource inequalities within national studies.

DISCLOSURE STATEMENT

S.Á.-C. participated in 2022 as researcher in the Pronaces Energía Project mentioned in Section 3.1. The Pronaces Energía Project is mentioned as an example of a project encompassing different alternative energy initiatives. Otherwise, the authors are not aware of any affiliations, memberships, funding, or financial holdings that might be perceived as affecting the objectivity of this review.

AUTHORSHIP STATEMENT

S.Á.-C. provided research design and coordination; the written introduction, discussion, and conclusion; and written results on Mexico and Central America. All coauthors contributed to discussions. K.H. provided active support throughout the research process, as well as review and written results on Souths in the North and Africa. M.T.W. provided review and written results on South America. T.P. provided review and written results on Souths in the North. B.R. provided review and written results on South Asia. B.F. provided review and written results on Africa. A.S. provided active support throughout the research process, review, and written results on Southeast Asia.

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