Energy Justice and Community-Led Transitions: Empowering Marginalized Communities - A Focus on Ewoyaa Lithium Mining Community in Ghana

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Abstract

Introduction: Energy justice is a framework that seeks to address the social, environmental, and economic inequalities that often arise in the context of energy production, distribution, and consumption. With the global surge in demand for lithium due to its critical role in renewable energy technologies, including electric vehicles and battery storage, there is growing concern about the impacts on local communities, especially those in resource-rich but marginalized areas. This paper explores the concept of energy justice in relation to community-led transitions, focusing on the Ewoyaa lithium mining community in Ghana.

Methods: This paper critically examines the dynamics of energy justice in the Ewoyaa lithium extractive community, drawing on case studies of community-led energy transitions. It evaluates the role of inclusive decision-making, fair distribution of benefits, and sustainable practices within the context of lithium mining and the broader energy transition.

Results: The analysis reveals the potential for empowering marginalized communities through the integration of local stakeholders in the decision-making process and by ensuring the fair distribution of benefits from energy resources. Additionally, it identifies the sustainable practices necessary for minimizing the negative impacts of lithium mining on the community and the environment.

Discussion: The paper critiques the contemporary energy justice literature, proposing a model for integrating local communities into the energy transition process. This model emphasizes the importance of inclusive governance structures and sustainable practices to ensure equitable outcomes for communities affected by resource extraction, particularly in marginalized areas like the Ewoyaa community.

Keywords

Energy Justice, Energy Transition, Climate Change, Renewable Energy, Extractive Communities

1. Introduction

The global transition to renewable energy is accelerating in response to the climate crisis, with increasing reliance on critical minerals such as lithium, cobalt, and nickel-materials indispensable for battery technologies and electric mobility. These minerals play a pivotal role in enabling a low-carbon future, particularly through their use in energy storage systems that stabilize solar and wind power integration [1]. However, this shift introduces a complex paradox: while facilitating global decarbonization, the extraction and processing of critical minerals often raises concerns about energy justice, particularly in resource-rich yet economically vulnerable regions of the Global South [2]. Energy justice provides a critical lens for interrogating this paradox. As a framework, it seeks to ensure fairness in energy production, distribution and decision making, emphasizing the equitable distribution of benefits and burdens, recognition of all stakeholders, and inclusion of affected communities in governance processes [3,4]. This lens is increasingly relevant as countries pursue large-scale extraction of strategic minerals to support clean energy transitions. Yet, energy justice has often been applied in contexts such as energy access and renewable deployment, with limited integration into studies of extractive industries [4]. This gap underscores the need to examine how the principles of energy justice can inform the governance of critical mineral extraction, particularly in emerging producer nations.

Ghana's Ewoyaa Lithium Deposit, located in the Central Region and developed by Atlantic Lithium, represents a significant site in the global push for sustainable energy storage solutions. As one of the first substantial lithium projects in West Africa, Ewoyaa symbolizes both a strategic economic opportunity for Ghana and a test case for responsible resource governance in the era of decarbonization. While the project holds potential to generate foreign investment, employment, and technological advancement, it also raises critical questions about local land rights, environmental sustainability, and the procedural inclusion of host communities in decision-making [5]. In this context, a community-led transition approach becomes essential. This approach emphasizes inclusive and participatory governance that enables affected populations to influence how resource development unfolds. Drawing lessons from past experiences in Ghana's gold and bauxite sectors, where communities have often been marginalized in benefit-sharing and environmental governance, there is a pressing need to ensure that lithium mining projects do not replicate extractive injustices [6,7]. Ensuring that communities are not passive recipients but active agents in the

development of their natural resources is a cornerstone of a just energy transition. Despite the growing importance of these issues, several key research gaps hinder a comprehensive understanding of how Ghana's lithium sector can support a just energy transition.

Firstly, there are limited empirical data on lithium mining in West Africa. While there is robust scholarship on cobalt in the Democratic Republic of Congo and lithium in Latin America, empirical research on lithium mining in West Africa is sparse [8,9]. The Ewoyaa project thus offers an untapped opportunity to explore the socio-environmental dynamics of critical mineral extraction in a relatively new African context.

Secondly, there are inadequate analysis of community agency in resource governance. Much of the literature focuses on the role of states and corporations, overlooking how local communities organize, resist, or negotiate mining operations. This results in limited understanding of the social and political agency of affected populations in shaping resource outcomes [6,7].

Thirdly, there is absence of frameworks connecting energy justice with extractive industries. Although energy justice is increasingly applied to renewable energy systems, its application to the governance of mineral extraction, particularly in contexts where minerals support green transitions, is underdeveloped [10,11]. This paper seeks to fill that gap by connecting energy justice with extractive governance through a community-led lens.

Furthermore, there is lack of evaluation of Ghana's policy and regulatory landscape on critical minerals. Ghana's regulatory framework is historically oriented toward gold and other conventional minerals. With the emergence of lithium, there is little scholarly analysis on whether current laws and institutions are equipped to promote environmental sustainability and community equity in this new sector [12,13].

Moreover, there is insufficient longitudinal studies on post-extraction outcomes. There is a dearth of longitudinal research examining how communities fare economically, socially, and ecologically after the commencement of mining activities. This is especially true for regions like Ewoyaa, which are new to large-scale lithium mining [14,15].

This paper addresses these gaps by exploring the application of energy justice principles within Ghana's emerging lithium mining sector. It asks whether the Ewoyaa Lithium Project aligns with the principles of a just energy transition and to what extent local communities are empowered in governance processes. By examining community-led initiatives, participatory governance, and relevant policy frameworks, this research assesses whether lithium extraction in Ghana can be both economically transformative and socially equitable, and under what institutional conditions such an outcome is possible.

2. Energy Justice: Theoretical Framework

Energy justice is an emerging interdisciplinary field that seeks to address the ethical, social, and political dimensions of energy systems. It provides a theoretical framework for understanding the distributional impacts of energy policies, the procedural fairness in decision-making processes, and the recognition of diverse communities' needs, especially marginalized and vulnerable groups. The framework of energy justice connects to broader concepts of social justice, equity, and sustainability in energy systems, acknowledging that access to energy and the environmental impacts of energy production and consumption have profound implications for social well-being.

Energy justice aims to ensure that all individuals, regardless of socioeconomic status, geographical location, ethnicity, or other socio-political factors, have fair access to affordable, reliable, and clean energy services. It builds on the principle that energy production, distribution, and consumption should be equitable, inclusive, and environmentally sustainable.

The concept of energy justice was formally introduced by [16] and draws from theories of environmental justice, social justice, and human rights. It conceptualizes energy systems as systems of power that can either exacerbate or mitigate existing inequalities.

Key component of energy justice can be categorized under distributional justice, procedural justice, recognition justice and restorative justice.

Distributional justice is based on the fact that there should be fair distribution of energy benefits and burdens across society. This principle concerns the fair distribution of energy resources, benefits, and costs. In the context of resource extraction, it addresses the disproportionate impacts on marginalized communities. The idea is to ensure that the economic benefits of energy extraction are more equally shared, and that the environmental and social costs are not disproportionately borne by disadvantaged communities [4]. By this it ensures that the economic, environmental, and social costs of energy production and consumption are equitably shared across different communities, especially vulnerable and low-income groups [4].

Procedural justice maintains that there is a need for all stakeholders, especially marginalized groups, to have a voice in energy decision making. It focuses on the fairness of decision-making processes. In energy resource extraction, this means ensuring that affected communities have a meaningful say in how energy resources are extracted, regulated, and used. This includes securing free, prior, and informed consent (FPIC) from indigenous peoples and ensuring that local populations are consulted and engaged in the planning process [17]. This ensures that marginalized groups are not

excluded from energy policy discussions, planning, and implementation processes [18].

Recognition justice is found on the principle of acknowledging and respecting the diverse energy needs and perspectives of different communities. This principle stresses the importance of acknowledging the cultural, social, and historical contexts of the communities involved. For many indigenous peoples, energy justice means not only having a voice in the extraction process but also having their spiritual and cultural connections to the land recognized and respected [19]. This principle highlights the importance of dismantling the structures of historical oppression and ensuring that affected groups are seen and heard in the energy justice discourse, especially those who are historically excluded or underserved by conventional energy systems [20].

Restorative justice posits that past harms relating to energy policies should be addressed, particularly in communities that have historically been disadvantaged by energy practices (e.g., communities affected by fossil fuel extraction or disproportionately impacted by energy poverty). This principle advocates for repairing past harms done by unjust energy policies, such as pollution or environmental degradation in certain communities, by restoring equity and addressing historical grievances [21].

Energy justice provides us with several theoretical theories that support it from several angles.

Among these theories is environmental justice theory. Energy justice is closely linked to environmental justice (EJ)theory, which highlights how environmental harm disproportionately affects low-income and minority communities. In the energy context, energy justice highlights issues such as disproportionate exposure of vulnerable populations to the negative impacts of energy production (e.g., air pollution, water contamination from fossil fuel extraction); unequal access to clean and affordable energy; and energy poverty, where certain populations cannot afford adequate energy services.

Another theory is the social justice theory. The social justice approach to energy justice builds on Rawls' Theory of Justice, [22] which advocates for fairness in the distribution of resources. According to Rawls, principles of justice should be established in a manner that benefits the most disadvantaged in society. In the energy sector, this translates to ensuring equitable access to energy services (especially electricity, heating, and transportation) for the poorest populations as well as providing energy as a basic human right, where lack of energy access is seen as a violation of fundamental rights' whiles addressing the energy needs of marginalized groups through policy, including Indigenous populations, women, and rural communities.

The Capabilities Approach, developed by philosopher Martha Nussbaum, [23], and economist Amartya Sen [24], focuses on the idea that justice should be concerned with expanding people's capabilities to live the lives they value. In the context of energy, this means ensuring that energy systems provide individuals with the freedom to access basic energy needs, which is central to their social and economic participation. The lack of access to clean, reliable energy is a capability deprivation, hindering individuals' ability to live a flourishing life.

On the theory of justice as fairness, John Rawl draws from the notion that justice as fairness is applied to the allocation of energy resources and services [22]. It stipulates that institutions should be organized in a way that benefits the least advantaged, which is particularly relevant when considering the unequal distribution of energy services. Policies like universal energy access are seen as essential for ensuring fairness.

3. Dimensions of Energy Justice

Several key dimensions of energy justice have been outlined by scholars, which include energy access, energy affordability, energy equity, and environmental sustainability. These dimensions are interrelated and collectively address the ethical, social, and political implications of energy systems at local, national, and global levels [25]. Energy access refers to the availability and accessibility of modern energy services, such as electricity and clean cooking technologies, to all individuals and communities, particularly those in marginalized or underserved regions. The absence of energy access is often associated with poverty and social exclusion, which impacts quality of life, economic development, and social well-being. The United Nations defines energy access as the ability to obtain clean, reliable, and affordable energy services [26].

Energy access is fundamental for achieving broader development goals, such as poverty alleviation, education, and healthcare. According to the International Energy Agency (IEA), over 750 million people worldwide still lack access to electricity, and more than 2.6 billion people rely on traditional biomass for cooking, which has significant health, economic, and environmental implications [26].

Energy affordability is another central component of energy justice, which involves ensuring that all individuals can access energy services without undue financial hardship [27]. In many regions, the cost of energy, particularly electricity, has been rising due to market forces, the privatization of energy utilities, and the increasing costs of renewable energy transition. This has led to energy poverty, where households are forced to spend disproportionate amounts of their income on energy, or to forgo basic energy needs like heating, cooling, and lighting [28].

Energy affordability is a critical concern for low-income households and vulnerable populations, where high energy costs can exacerbate economic inequality and social exclusion [29]. Governments and utilities often implement subsidy schemes or social tariffs to mitigate energy affordability issues, but the effectiveness of these interventions can vary, and

sometimes they perpetuate inequities or fail to reach the most vulnerable groups [30].

Energy equity involves ensuring that the benefits and burdens of energy systems are distributed fairly among all societal groups, taking into account historical, social, and economic factors that affect different populations. This includes both procedural equity-where all people have a voice in energy decision-making-and distributional equity-where energy resources and opportunities are allocated in a way that reduces inequalities [31].

Energy equity encompasses issues of race, class, gender, and geography, recognizing that marginalized communities often bear disproportionate burdens in terms of both energy provision and environmental harms [10]. This dimension of energy justice calls for inclusive decision-making processes, where vulnerable populations are not only recipients of energy policies but active participants in shaping energy systems.

Environmental sustainability in energy justice refers to the long-term viability of energy systems that do not harm the environment or future generations [32]. This dimension emphasizes the need for energy systems that promote renewable energy sources, reduce greenhouse gas emissions, and support ecosystem preservation. Energy justice requires that these sustainable systems are accessible and beneficial to all communities, especially those historically impacted by environmental degradation and pollution. The transition to a low-carbon energy future is a central goal of environmental sustainability, but it is essential that this transition is just, meaning that it does not disproportionately burden low-income communities or workers in fossil fuel industries [33].

Energy access, affordability, equity, and environmental sustainability are not isolated dimensions; they are deeply interwoven. For instance, a sustainable energy system that prioritizes renewable energy sources may improve energy access and affordability over the long term, while simultaneously addressing environmental concerns [34]. However, without careful policy design, the transition to renewables may exacerbate existing inequalities, particularly if vulnerable populations are not included in decision-making processes or if energy prices rise too quickly. Energy justice requires holistic approaches that address all these dimensions in tandem. It is not enough to simply provide access to energy without ensuring that it is affordable, that the distribution of energy resources is equitable, and that the environmental impacts of energy systems are sustainable for future generations.

4. Energy Justice in the Context of Resource Extraction

In the context of resource extraction, energy justice critically examines how the exploitation of natural resources for energy production impacts local communities, indigenous groups, and ecosystems, while also considering issues of fairness, access, and sustainability. This exploration involves addressing historical and ongoing inequities related to who benefits from energy resources and who bears the costs of extraction and environmental degradation.

Historically, the extraction of energy resources-such as coal, oil, natural gas, and minerals-has often been concentrated in certain geographic regions and communities, with limited benefits reaching those living closest to the extraction sites. The phenomenon of resource extraction colonialism(also referred to as extractivism describes how wealth generated from resource-rich areas rarely stays within those regions, often enriching distant elites or multinational corporations while leaving local communities impoverished or displaced [35]. Indigenous communities, in particular, have experienced marginalization as their lands are appropriated for resource extraction without fair compensation or recognition of their cultural ties to the land [36].

This inequitable distribution of benefits often exacerbates broader issues of environmental injustice, where lower-income or minority communities bear disproportionate environmental burdens. For example, communities situated near mining operations, oil extraction sites, or large-scale hydroelectric dams are often exposed to toxic air and water pollution, habitat destruction, and displacement. These outcomes can exacerbate health problems and lead to long-term socio-economic instability [37]. Resource extraction often results in several key negative impacts on local communities, particularly when those communities are indigenous or impoverished. Firstly is the impact on health and environment. Extraction processes like mining, fracking, and drilling contribute to air and water pollution, soil degradation, and biodiversity loss. Communities living near these extraction sites may suffer from respiratory issues, waterborne diseases, and other health problems related to pollution [37]. For example, in the Niger Delta, decades of oil extraction have led to serious health problems, including cancers, respiratory diseases, and reproductive problems [38]. Secondly is the impact of displacement and land grabbing. The construction of large energy extraction projects such as hydroelectric dams or oil pipelines can displace local populations, often with little regard for the rights of indigenous or rural communities. The displacement process tends to be marked by the violation of land rights and inadequate compensation, leaving affected people with limited recourse [38]. Thirdly is the impact of economic exploitation and dependency. While resource-rich countries and regions may appear to benefit economically from extraction, the wealth generated often does not reach the local populations. Instead, multinational corporations and elites may extract the majority of the profits, leaving local communities with few tangible benefits. This creates a dependency on the extractive industry, which often fails to diversify the local economy [39].

Energy justice, in the context of resource extraction, requires a holistic approach that considers both the benefits and burdens of energy production. The disproportionate impact of extraction on marginalized communities must be addressed through equitable distribution of resources, inclusive decision-making processes, and the recognition of cultural and land rights. By integrating energy justice principles into resource extraction, it is possible to create a more

sustainable and fair energy system for the future.

5. Ewoyaa Lithium and the Impacts on Local Communities

The Ewoyaa Lithium Project, spearheaded by Atlantic Lithium Limited, represents a significant development in Ghana's mining sector. As the nation's inaugural lithium mining endeavor, it holds promise for economic advancement. However, its implications for local communities warrant a comprehensive examination to balance national interests with local well-being.

Economically, the project is poised to generate substantial employment opportunities, with projections indicating the creation of over 800 jobs. This influx of employment can stimulate local economies, enhance livelihoods, and reduce unemployment rates. Additionally, the establishment of a community development fund, into which 1% of the project's revenue will be allocated, aims to finance local infrastructure and social initiatives, further benefiting the communities [40].

Furthermore, mining activities inherently pose environmental challenges, including land degradation, water resource contamination, and biodiversity loss. Recognizing these potential risks, Ghana's Environmental Protection Agency (EPA) has mandated a thorough Environmental Impact Assessment (EIA) to identify and mitigate adverse effects. Public hearings conducted in communities such as Ewoyaa and Krofu have been integral to this process, ensuring that community concerns are addressed and that sustainable practices are prioritized [40].

Moreover, one of the most pressing concerns is the potential displacement of communities, notably Krampakrom. Residents face uncertainty regarding resettlement plans and compensation, leading to anxiety about their future livelihoods and cultural dislocation. Transparent communication and fair compensation are essential to mitigate the social upheaval associated with such transitions [41].

Furthermore, the impact of government policies on community benefit is crucial. The Ghanaian government has implemented policies to maximize local benefits from the Ewoyaa project. These include an increased royalty rate of 10% and a 13% free carried interest in the mining operation. Furthermore, the project is expected to contribute to local development through the community development fund, which will support initiatives in education, healthcare, and infrastructure [40,42].

The Ewoyaa Lithium Project stands at the intersection of economic development and community welfare. While it offers promising economic benefits, careful attention to environmental stewardship and social equity is imperative. Ensuring that local communities are active participants in decision-making processes, receive fair compensation, and benefit from infrastructural developments will be crucial for the project's success and sustainability.

6. The Role of Energy Justice in Empowering Communities

Energy justice has emerged as a critical framework for understanding the relationship between energy production, distribution, and consumption, particularly in terms of fairness, equity, and access. It emphasizes the right of individuals and communities to not only access affordable, reliable, and clean energy but also to have a say in energy policy decisions that affect their lives. The concept of energy justice is inherently tied to social justice, aiming to empower communities, especially marginalized groups, through equitable energy transitions and decision-making processes. Energy justice can be used as a tool for empowering communities. This can be done through addressing the issues of energy poverty, promoting community-driven energy solutions, fostering a just energy transition and enhancing environmental justice and health [43].

In addressing the issue of energy poverty, energy poverty is defined as the inability to access sufficient, afford able, and reliable energy, disproportionately affects low-income households and marginalized communities [44]. Energy justice can empower these communities by focusing on improving energy access and affordability through targeted policies. For example, the installation of subsidized or community-owned renewable energy projects can alleviate the financial burden of energy costs for low-income households, while creating local job opportunities in the renewable energy sector [45]. However, through the lens of energy justice, energy poverty is not merely seen as a technical issue of energy supply but as an urgent social justice concern that demands a holistic, participatory, and inclusive approach. According to the International Energy Agency (IEA), approximately 770 million people globally still lack access to electricity, while over 2.6 billion people rely on traditional biomass for cooking [46]. Energy justice, an emerging concept in the field of energy policy, aims to address these inequalities by ensuring that all individuals, regardless of their socio-economic status, have access to energy services that are fair, equitable, and sustainable. In alleviating energy poverty, energy justice ensures affordable energy access. One of the primary goals of energy justice is to ensure that all individuals, particularly those living in poverty, have access to affordable energy services. This involves addressing the high costs of energy, which are often a barrier to access in both rural and urban poor communities. In many developing countries, the cost of energy is disproportionate to the income of low-income households, forcing them to make difficult choices between paying for energy or other basic needs such as food or healthcare. Energy justice promotes policies such as subsidies, energy price regulation, or income-based assistance programs that reduce energy costs for disadvantaged communities [47].

Energy justice can address energy poverty by promoting energy efficiency and sustainable solution. Energy justice

emphasizes the need for sustainable and energy-efficient technologies that can help reduce the burden of energy costs. For instance, renewable energy technologies such as solar and wind power can provide affordable and reliable energy solutions, especially in off-grid areas. By prioritizing renewable energy in energy justice frameworks, governments can simultaneously address energy poverty and mitigate the environmental impacts of fossil fuel-based energy systems [48].

Furthermore, energy justice can address energy poverty by ensuring participation in key decision making. A key component of energy justice is procedural justice, which ensures that energy decisions are made with the involvement of those who are directly affected by energy poverty [49]. In many cases, energy policies are developed without adequate consultation with marginalized communities, leading to solutions that are ill-suited to their needs. Involving these communities in energy planning and policy formulation can help tailor interventions that are more effective in addressing local energy poverty and ensuring that energy systems are more inclusive and sustainable [50].

Moreover, energy poverty can be address by energy justice by attending to culturally sensitive and context specific solutions. Recognition justice highlights the importance of culturally sensitive and context-specific energy solutions. Energy systems and policies that ignore local cultural practices and needs can exacerbate energy poverty by failing to provide practical and acceptable solutions. For example, in rural areas where access to electricity is limited, community-based renewable energy projects or decentralized mini-grids can offer sustainable and culturally appropriate alternatives to conventional energy systems [51].

Several countries have taken steps to integrate energy justice principles into their energy policies to address energy poverty. The South African government has implemented a number of energy justice-oriented policies in response to its high levels of energy poverty, particularly in rural and informal urban settlements. The country's Renewable Energy Independent Power Producer Procurement Program (REIPPPP) has been instrumental in promoting clean, renewable energy while also ensuring that local communities benefit from employment opportunities and skills development. In addition, the government has introduced the Free Basic Electricity (FBE) policy, which provides low-income households with a monthly allocation of electricity at no cost, helping to reduce the energy burden on vulnerable populations [52]. Furthermore in India, the Pradhan Mantri Sahaj Bijli Har Ghar Yojana (Saubhagya Scheme), launched in 2017, aims to provide electricity connections to all households, particularly in rural and remote areas. The scheme has been designed to address both the infrastructural and socio-economic barriers to energy access by ensuring that marginalized communities receive priority for electrification. Additionally, India's emphasis on solar mini-grids for rural electrification serves as a model for integrating renewable energy with energy justice, ensuring that the energy solutions are both sustainable and locally relevant [53].

In promoting community-driven energy solutions to alleviate energy poverty, energy justice, administered through procedural justice, advocates for community participation in energy decision-making processes. Community-driven energy solutions refer to decentralized, locally managed energy systems that are designed and operated with active participation from the community members. These solutions can include a variety of technologies such as solar microgrids, biomass systems, and community wind farms. Community-driven energy initiatives are particularly well-suited to addressing energy poverty because they prioritize local needs, maximize local ownership, and ensure that the benefits of energy access are equitably distributed within the community. This involves ensuring that marginalized communities have a say in the development of energy infrastructure projects that will impact their lives [54]. Community-led renewable energy projects, such as solar cooperatives or wind farms, offer a way for local communities to not only gain energy independence but also benefit economically from the production of clean energy. These projects often help reduce energy costs, create local jobs, and contribute to economic resilience [55].

One of the key advantages of community-driven energy solutions is their potential to reduce energy costs. By leveraging locally available renewable energy resources, communities can bypass the need for expensive centralized infrastructure and lower their dependence on fossil fuels. In addition, when communities are actively involved in the planning and management of energy systems, they can ensure that the solutions are tailored to their specific needs and conditions, which increases the likelihood of long-term sustainability [56].

The principles of energy justice can guide the design, implementation, and management of community energy projects by ensuring that: Firstly, there is equitable distribution of benefits. Energy justice ensures that the benefits of community-driven energy solutions are fairly distributed among all members of the community, especially the most vulnerable populations, such as low-income households, marginalized groups, and those living in remote areas. This can be achieved through mechanisms such as community ownership of energy assets, fair pricing structures, and targeted subsidies for energy-poor households [57]. Secondly, by inclusion in decision-making. Procedural justice emphasizes the importance of involving communities in the decision-making processes related to energy solutions. This includes providing platforms for local voices to be heard in the planning, design, and governance of energy systems. For instance, local residents can form energy cooperatives or participate in public consultations to ensure that their needs and preferences are adequately reflected in the energy transition [58]. Thirdly by recognizing the diverse needs in the community. A key aspect of recognition justice is acknowledging the unique energy needs of marginalized communities, such as those in rural or indigenous areas, which are often excluded from mainstream energy policies. Community-driven energy solutions, guided by energy justice principles, can help recognize and address these disparities by designing systems that are culturally appropriate, locally adapted, and responsive to the specific challenges faced by these communities [59]. Fourthly by giving attention to environmental sustainability. Energy justice

aligns with the need for environmental justice, as it promotes renewable energy solutions that reduce the environmental impact of energy generation. By prioritizing clean energy technologies, community-driven energy solutions help mitigate climate change while simultaneously addressing energy poverty [20]. This dual focus on equity and sustainability is central to energy justice.

Several case studies from around the world demonstrate the effectiveness of community-driven energy solutions in addressing energy poverty through the lens of energy justice. For example, in rural India, the Barefoot College has trained women from underserved communities to install and maintain solar systems, empowering them to become "solar engineers" [60]. This initiative has not only provided sustainable energy access to rural households but also fostered gender equality and economic development, aligning with both energy justice and community empowerment goals.

Similarly, in Europe, community energy cooperatives in countries such as Denmark and Germany have allowed local residents to collectively invest in renewable energy projects, ensuring that the benefits of energy production are shared among all members. These cooperatives have helped lower energy costs, increase local energy security, and reduce the carbon footprint of communities [61].

Furthermore, energy justice can be used as a tool for empowering communities by fostering a just energy transition. A just energy transition is about ensuring that the shift from fossil fuel-based to renewable energy systems does not exacerbate existing social inequalities. Energy justice ensures that workers in fossil fuel industries, as well as communities reliant on fossil fuel extraction, are provided with fair opportunities for retraining and economic diversification [47]. For instance, policies that fund retraining programs for workers in coal industries or support the development of new industries in renewable energy-rich areas are essential to facilitating a just transition

Furthermore, energy justice can be used as a tool for empowering communities by enhancing environmental justice and health. Marginalized communities are often the most exposed to the environmental and health impacts of energy systems, including air pollution from coal-fired power plants and environmental degradation from oil and gas extraction. Energy justice recognizes the need to reduce these burdens, not only through cleaner energy technologies but also through efforts to improve the overall health and well-being of these communities. Restorative justice principles advocate for policies that address past harms and ensure that affected communities are compensated or supported in their recovery [62].

Some notable case studies identied with energy justice empowerment are the the Navajo Nation and Solar Energy Initiatives, the South African Renewable Energy Program, and The UK Community Energy Movement.

In the United States, the Navajo Nation has faced significant challenges related to energy access, with many households still lacking reliable electricity. Energy justice initiatives, including solar energy programs designed specifically for remote Indigenous communities, have helped to address energy poverty in these areas. Solar cooperatives and community-driven energy solutions have provided both electricity and new economic opportunities, empowering the community to take ownership of their energy future [20].

South Africa’s transition to renewable energy has been framed by principles of energy justice, with a strong focus on providing affordable and reliable energy to underserved communities. The country’s Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) includes provisions to ensure that local communities benefit from job creation, skills development, and local ownership in renewable energy projects [61].

In the UK, the community energy movement has gained momentum in recent years, as communities organize to develop their own renewable energy projects. These initiatives are designed to provide affordable energy and generate local economic benefits. For example, the Westmill Solar Cooperative is a community-led solar project that provides energy to its members while also contributing to the local economy through revenue from the sale of energy [63].

In summation, energy justice offers a powerful framework for empowering communities by promoting fairness, equity, and inclusion in energy systems. By addressing energy poverty, promoting community-driven energy solutions, and ensuring that vulnerable populations are not left behind in the energy transition, energy justice can foster a more just and sustainable energy future. As communities worldwide seek to balance environmental sustainability with social equity, energy justice will play a pivotal role in shaping the energy systems of the future.

7. Case Studies of Community-Led Energy Transitions

The concept of community-led energy transitions has gained increasing prominence in the global discourse surrounding sustainability, climate change mitigation, and energy justice. Such transitions are particularly important as they emphasize local empowerment, democratic energy governance, and resilience. Community-led initiatives can involve a wide array of actions, from local renewable energy projects to energy cooperatives and grassroots advocacy for cleaner energy policies. The following case study gives insights and challenges on community led energy transition in various part of the world.

Firstly is the transition town movement. One of the most prominent examples of community-led energy transitions is the Transition Town Movement, which began in the United Kingdom in 2006 with the establishment of the town of Totnes. This grassroots movement emphasizes local solutions to global challenges, particularly in energy production,

food security, and resilience to climate change. Transition initiatives typically involve a variety of activities, including the development of local renewable energy infrastructure, community-owned energy projects, and educational campaigns about energy efficiency and sustainability. A key aspect of the Transition Town model is the notion of "resilience," which reflects the ability of communities to withstand and adapt to external economic and environmental shocks. In this context, energy resilience is paramount, as communities seek to reduce dependency on fossil fuels and external energy markets [63]. Research has shown that the Transition Towns movement has led to significant local renewable energy projects, such as solar installations and community wind turbines, as well as the development of cooperative energy schemes [64]. However, the movement faces challenges, including securing financial support for large-scale energy projects, overcoming political resistance, and achieving broad public engagement. Despite these barriers, the Transition Towns movement offers a compelling model for community-driven energy transitions, demonstrating how local engagement can foster meaningful change [65].

Secondly is the Garlinge Renewable Energy Cooperative in Germany. Germany has been a leader in the promotion of community-led renewable energy projects, particularly through the concept of energy cooperatives. One notable case is the Garlinge Renewable Energy Cooperative, located in the small town of Garlinge in the federal state of Branden-burg. The cooperative was founded in 2009 and has since become a model for other rural communities seeking to invest in renewable energy. The Garlinge cooperative primarily focuses on the installation of photovoltaic (solar) systems and wind turbines. Through the cooperative structure, local residents are able to invest in renewable energy infrastructure and benefit from the financial returns generated by these installations. The cooperative model ensures that the profits from energy generation are retained within the community, thus supporting local economic development and increasing energy sovereignty [65]. One of the key successes of the Garlinge project is the high level of local participation and the ability of the cooperative to maintain a sense of ownership and control over the energy transition. This structure has enabled Garlinge to generate sufficient revenue to reinvest in additional renewable energy projects and support other community development initiatives. However, the cooperative has also faced challenges in navigating complex regulatory environments and securing initial funding for large-scale projects [66]. Despite these hurdles, Garlinge represents a successful example of how energy cooperatives can foster local engagement in the transition to renewable energy. Thirdly is the the Community Energy Scotland Initiative. Community Energy Scotland (CES) is a non-profit organization that supports community groups in Scotland to develop renewable energy projects. Since its founding in 2007, CES has played a pivotal role in facilitating the establishment of community-owned renewable energy projects, including wind, hydro, and solar installations. These projects are particularly significant in rural and remote areas, where traditional energy infrastructure is often lacking or unreliable. One notable project facilitated by CES is the Gigha Island Wind Farm, which was completed in 2009. This wind farm, owned by the residents of Gigha Island, provides electricity to the local community and generates substantial revenue, part of which is reinvested into local projects and services. The Gigha project is a prime example of how community ownership of renewable energy infrastructure can support local economic development and energy autonomy [67]. A key factor contributing to the success of CES projects is the strong sense of community involvement and the emphasis on local decision-making. However, these projects often face financial and technical challenges, particularly in terms of securing capital for the initial investment and managing the technical aspects of energy generation. Despite these obstacles, CES has been instrumental in promoting the idea that community-led energy transitions are not only feasible but also beneficial for local economies and social cohesion [67].

Fourthly the Brooklyn Microgrid of United States of America. In the United States, the Brooklyn Microgrid project stands as an innovative example of community-led energy transition through the use of blockchain technology. Launched in 2016, the Brooklyn Microgrid enables local residents to generate, share, and trade solar energy within their community, bypassing traditional utility companies. This model creates a decentralized energy system in which participants can both consume and sell energy, allowing for greater energy autonomy and efficiency [68]. The project is particularly notable for its use of blockchain, which facilitates secure and transparent transactions between participants. This technology enables individuals to monitor their energy consumption and production in real-time, while also allowing for peer-to-peer energy trading [69]. By empowering individuals to take control over their energy use and engage in direct transactions with their neighbors, the Brooklyn Microgrid represents a shift towards a more decentralized and democratized energy system. However, the project has also encountered challenges, such as regulatory hurdles and the complexities of integrating new technologies into existing infrastructure. Additionally, the scale of the project has been limited, and questions remain regarding the broader applicability of the microgrid model to other urban settings [68]. Despite these challenges, the Brooklyn Microgrid exemplifies the potential of innovative technologies in enabling community- led energy transitions.

In summation, the case studies of community-led energy transitions demonstrate the diverse ways in which local communities can drive the shift towards renewable energy. From the Transition Towns movement in the UK to the Brooklyn Microgrid in the US, these examples showcase the potential for communities to reduce their dependence on fossil fuels, create local economic opportunities, and enhance energy resilience. However, the challenges faced by these initiatives-ranging from financial constraints to regulatory obstacles-underscore the need for supportive policy frameworks, technical expertise, and access to capital.

Ultimately, community-led energy transitions offer a promising pathway for achieving a sustainable energy future, but their success depends on fostering collaboration, local ownership, and the integration of innovative solutions that

empower communities to take charge of their energy needs.

8. Ghana's Energy Transition and Lessons for Ewoyaa

The global shift towards sustainable energy systems has brought increased focus on renewable energy transitions, particularly in developing countries. Ghana, a West African nation rich in natural resources, has been undergoing an energy transition from fossil fuels to cleaner energy sources, aligning with global climate change commitments. Ghana's energy transition offers valuable lessons for other emerging economies, including Ewoyaa, a region in Ghana known for its critical mineral resources. Ghana's energy sector has historically been dominated by fossil fuels, with oil, natural gas, and hydroelectricity being the primary sources of energy. However, with the growing demand for energy, limited fossil fuel reserves, and increasing environmental concerns, Ghana has made strides toward diversifying its energy portfolio by incorporating renewable energy sources like solar, wind, and biomass.

Ghana has implemented a renewable energy policy framework through act of parliament. These policies are aimed at increasing the share of renewables in its energy mix. The Renewable Energy Act of 2011 established a legal framework for renewable energy development, and the National Energy Policy (2010) set ambitious goals for renewable energy deployment, aiming to achieve a 10% renewable energy share in total energy generation by 2030 [70]. Although this target has not been fully met, there has been a noticeable increase in solar power investments, supported by both government incentives and private sector participation.

Furthermore, Ghana has significant solar potential due to its favorable geographical location near the equator. The country has seen substantial growth in solar energy projects, such as the 20 MW Nzema Solar Project, one of West Africa's largest, Bui Power Solar project and numerous off-grid solar initiatives [71]. These projects have contributed to increasing energy access in rural areas, thus addressing energy poverty.

There is notwithstanding challenges in the Ghanaian Energy Transition drive. Despite progress, Ghana faces several challenges in its energy transition. These include infrastructure limitations, regulatory hurdles, and the need for a skilled workforce to support the renewable energy industry [72]. Furthermore, the country's dependence on hydroelectric power leaves it vulnerable to climate variability, which can affect the water availability for the Akosombo dam [73].

Lessons for Ewoyaa is embedded in opportunities and challenges. Ewoyaa, situated in the Central Region of Ghana, has attracted attention due to its critical mineral resources, particularly lithium. As Ghana embarks on its energy transition, Ewoyaa stands at the crossroads of economic development and environmental sustainability. The lessons learned from Ghana's energy transition can offer valuable insights for Ewoyaa's energy future.

Firstly, one of the key lessons from Ghana's energy transition is the importance of diversifying the energy mix. While fossil fuels remain integral to the economy, increasing reliance on renewables, particularly solar and wind, has the potential to reduce energy insecurity and ensure a more sustainable energy future. Ewoyaa can build on this by exploring solar energy options, which are abundant in the region due to its proximity to the equator. In addition, Ewoyaa's relatively small population and infrastructure could benefit from decentralized solar power systems, reducing dependence on large grid infrastructure.

Secondly, Ghana's experience highlights the importance of a supportive regulatory environment. Ewoyaa's energy development should include the establishment of clear policies and frameworks that encourage investment in renewable energy technologies. Learning from Ghana's Renewable Energy Act of 2011, Ewoyaa can implement policies that provide incentives for clean energy investments and ensure that energy development is inclusive, equitable, and sustainable. Furthermore, aligning local policies with national goals would create synergies and help attract both domestic and international investors.

Thirdly Ewoyaa can take steps towards integration of energy storage and grid stability. A major challenge in transitioning to renewable energy is ensuring grid stability, particularly with intermittent sources like solar and wind. Ghana's energy transition has underscored the importance of investing in energy storage technologies, such as batteries and pumped hydro storage, to balance supply and demand. Ewoyaa could explore these technologies in conjunction with renewable energy generation to ensure a reliable and stable energy supply for both industrial and residential needs.

Furthermore, Ewoyaa can leverage the mining sector for renewable energy. Ewoyaa's growing importance as a mining hub, especially for lithium production, provides an opportunity to integrate renewable energy technologies into the mining sector. Lithium, essential for battery storage technologies, could be used as a foundation for the development of local manufacturing capacity for batteries and electric vehicles (EVs). Integrating clean energy solutions into the mining operations could reduce the sector's carbon footprint and create a sustainable model for energy development that aligns with global trends towards decarbonization (Nartey & Kumi, 2023).

Moreover, Ewoyaa can use such avenue to champion energy access and rural development. One of the key successes of Ghana's energy transition has been its focus on improving energy access in rural areas, particularly through off-grid solar systems. Ewoyaa, with its relatively low population density, could adopt similar off-grid solutions to power communities and small businesses, thereby promoting local economic development. By providing affordable, clean, and reliable energy, Ewoyaa can improve living standards while reducing carbon emissions.

Furthermore, Ewoyaa can use such avenue to augment capacity building and workforce development. As Ghana's

energy transition has demonstrated, a skilled workforce is crucial for the growth of the renewable energy sector. Ewoyaa can learn from Ghana's emphasis on education and training programs to build a local workforce skilled in renewable energy technologies, project management, and maintenance. This would not only support the region's energy transition but also create employment opportunities and foster local innovation.

In summation, Ghana's energy transition offers valuable lessons for Ewoyaa as it looks to navigate its own path towards a sustainable energy future. By diversifying its energy sources, establishing strong regulatory frameworks, integrating energy storage solutions, leveraging its mineral resources, and focusing on rural energy access and work-force development, Ewoyaa can set the stage for a resilient, low-carbon economy. As Ghana continues its transition to a green energy future, Ewoyaa can position itself as a model for sustainable development that balances economic growth, environmental sustainability, and social inclusion.

9. Conclusion

The discourse on energy justice and community-led transitions is pivotal in addressing the socio-economic and environmental disparities that often accompany resource extraction in marginalized regions. The case of the Ewoyaa lithium extractive community in Ghana exemplifies the complex intersection of global energy transitions, local livelihoods, and justice imperatives. While lithium extraction is vital for the shift towards renewable energy technologies, its extraction must not replicate historical patterns of resource exploitation that have disproportionately disadvantaged host communities.

This study underscores the necessity of integrating energy justice principles-distributive, procedural, and recognitional justice-into the governance of lithium mining in Ewoyaa. Distributive justice necessitates equitable benefit-sharing mechanisms that ensure economic and infrastructural development within the community. Procedural justice calls for inclusive decision-making processes where local voices are not merely heard but actively shape policies and project implementations. Recognitional justice demands acknowledgment of the community's social cultural and historical contexts, ensuring that their rights and identities are preserved in the face of large-scale extractive activities.

A community-led transition approach presents a trans-formative pathway for addressing these justice dimensions. By fostering participatory governance, strengthening local agency, and implementing policies that prioritize community well-being over corporate profits, sustainable resource governance can be achieved. This necessitates a collaborative effort among governments, mining corporations, and civil society to create frameworks that balance economic interests with social and environmental sustainability. Additionally, transparency, accountability, and long-term capacity-building initiatives must be embedded within lithium extraction projects to prevent exploitative practices and ecological degradation.

In conclusion, the Ewoyaa lithium mining case serves as a microcosm of the broader energy justice debate in the Global South. If not managed equitably, the energy transition risks reinforcing systemic injustices rather than rectifying them. Therefore, a justice-centered approach-one that integrates community-led strategies, inclusive governance, and sustainable development principles-is essential to ensuring that energy transitions are not only green but also just. Future research should explore best practices for operationalizing energy justice in extractive economies and the role of policy frameworks in safeguarding marginalized communities within the global clean energy agenda.

10. Recommendation and Further Research

The following recommendations will be suggested. Communities must be involved in decision-making processes related to the extraction of energy resources. This includes ensuring that local and indigenous communities have control over how energy resources are managed and how the profits are distributed. Additionally, land tenure rights should be clearly established and respected.

Also, adopting more sustainable extraction practices, such as reduced emissions, waste minimization, and efforts to restore the environment post-extraction, can mitigate some of the negative impacts on local communities and ecosystems. Corporate social responsibility (CSR) initiatives should also be more than token gestures; they need to genuinely benefit the communities they affect.

Furthermore, energy transition and diversification is a way to go. Moving away from fossil fuel extraction to renewable energy sources presents an opportunity for justice. Renewable energy projects, if managed equitably, could offer more sustainable alternatives that benefit local populations without the same harmful environmental and social consequences as fossil fuel extraction. This transition requires careful planning and investments to ensure that marginalized communities are not left behind in terms of economic opportunities or energy access.

The Ewoyaa Lithium Project in Ghana represents a significant development in the global pursuit of critical minerals essential for the energy transition. However, ensuring that such projects promote energy justice and empower marginalized communities requires careful consideration and further research. Key areas for additional study include:

Assessing the impact on Local Communities by investigating how the Ewoyaa project affects the livelihoods, rights, and ancestral knowledge of indigenous populations. The acquisition of land for mining operations can profoundly impact these aspects, necessitating a comprehensive understanding of the socio-economic consequences.

Investigating on Community-Led Transition Models by exploring frameworks where local communities actively participate in decision-making processes related to energy projects. A just transition should be inclusive, centering the priorities of communities working towards protecting their land and proposing sustainable solutions.

Exploring community-led transition models by exploring frameworks where local communities actively participate in decision-making processes related to energy projects. A just transition should be inclusive, centering the priorities of communities working towards protecting their land and proposing sustainable solutions.

Examination of policy and regulatory frameworks by examining existing policies to ensure they promote equity and justice throughout the renewable energy transition. Without actions that promote these values, the transition may fail to earn the trust of frontline communities.

Exploring Lessons from Similar Initiatives by analyzing case studies from other regions where energy projects have been implemented in indigenous territories. For instance, the Wayuu community in Colombia has expressed concerns over renewable energy projects impacting their sacred lands, highlighting the need for prior consultation and respect for indigenous rights.

Exploring the economic implications of lithium price fluctuation by assessing how fluctuations in global lithium prices might affect the project's viability and, consequently, the local communities' economic prospects. Ghana has expressed concerns that declining lithium prices could jeopardize its first lithium mining project, underscoring the need for economic resilience strategies.

By focusing on these areas, future research can contribute to a more equitable and just energy transition for the Ewoyaa community and similar marginalized groups worldwide.

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