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An Examination of the Impact of Energy Transition on Marginalized Communities in Africa and the Global South

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Abstract:
The transition to more sustainable and cleaner energy sources is a global imperative in the face of climate change and environmental degradation. However, as this transition takes place, it is important to assess its impact on marginalized communities, particularly in Africa and the Global South. This work explores the issues of equity, affordability, and access that arise in the context of energy transition and its implications for these communities. Energy transition initiatives often prioritize the deployment of renewable energy technologies to reduce greenhouse gas emissions. These must be implemented with careful consideration of the needs and interests of marginalized communities. Equity is an important aspect to address in the energy transition process. Communities that are marginalized in Africa and the Global South often face socioeconomic problems that hinder their ability to access clean energy technologies. Affordability is another important issue to consider. While renewable energy technologies have become increasingly cost-competitive, initial investment costs can still be prohibitive for marginalized communities. Marginalized communities often face challenges related to the physical availability of energy infrastructure. Energy transition should prioritize the expansion of decentralized and off-grid solutions to ensure universal energy access. This work concludes by examining the impact of energy transition on marginalized communities in Africa and the Global South where it sees it as vital for achieving a just and sustainable energy future.

Keywords: Energy transition, marginalized communities, renewable energy, climate change

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I. INTRODUCTION

1.1 Importance of Energy Transition for Addressing Climate Change and Environmental Degradation

It is evident that environmental degradation has emerged as a significant and pressing global challenge. Despite the anticipated consequences of unchecked climate change, carbon dioxide (CO2) emissions from greenhouse gases (GHGs) continue to rise, leading to a range of interconnected threats such as desertification, erratic precipitation patterns, extreme weather events, and the potential inhabitation of certain regions (OECD, 2019). The impacts of climate change intertwine with other environmental issues, including biodiversity loss, waste generation, and increasing air and water pollution.[1] To address these challenges, world leaders have taken policy actions through initiatives like the Sustainable Development Goals (SDGs) and the Paris Agreement on Climate Change, aiming to limit global warming and its negative consequences. The policies strive to prevent a temperature increase of more than 2 degrees Celsius and aim for further reduction to 1.5 degrees Celsius.[2]

The United States has already experienced the devastating effects of approximately 1.0 degree Celsius of climate change, resulting in climate-related catastrophes that disproportionately impact vulnerable communities, leading to deaths, deteriorating health, lower living standards, and ecological destruction.[3] Urgent measures are required to address the climate crisis by transitioning from fossil fuel-based energy systems to renewable energy sources, aligning with SDG7 and the decarbonization goals of the Paris Agreement. [4] Renewable energy transition, direct electrification, energy efficiency improvements, and green hydrogen will play crucial roles in the solutions by 2050. Additionally, efforts in bioenergy with carbon capture and storage, nuclear energy, and fossil carbon capture and storage will also be significant, considering ecological and political uncertainties. [5] However, identifying effective measures to mitigate CO2 emissions without hindering economic growth remains a complex challenge, necessitating a critical evaluation of potential mitigation technologies in terms of their sustainability and associated consequences.[6]

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[1]Sadoff et al., Securing Water, Sustaining Growth: Report of the GWP/OECD task Force on Water Security and Sustainable Growth. (2015)

[2]Abbasi, Kashif & Shahbaz, Muhammad & Alvarado, Rafael. Analyze the environmental sustainability factors of China: The role of fossil fuel energy and renewable energy. (2022) Renewable Energy.

[3] Jim Krane, ClimateChange and fossil fuel: An examination of risks for the energy industry and producer states" (2017) *MRS Energy & Sustainability*

[4]Ibid

[5] Zhao, Rui & Wang, Huanhuan & Gao, Jie& Zhang, Yongjun & Li, Xianchun& Zhou, Jing-Jiang & Liang, Pei &Gao, Xiwu&Gu, Shao-Hua. Zhao et al., (2022). Ecotoxicology and Environmental Safety.

[6] Ibid

Globalization, with its interconnectedness through international trade, capital flow, foreign aid, and ecological innovation, has driven economic growth and development in both developing and developed countries. However, it also has negative externalities that degrade environmental quality.[7] Moreover, the inability to predict the economic outcomes of government policies has attracted attention in the field of energy and environmental economics. The significant increase in energy consumption in the United States has resulted in a surge in CO2 emissions, prompting policy changes in energy consumption and climate action, including the United States rejoining the Paris Agreement to achieve SDG 7 and 13 objectives related to renewable energy consumption and environmental sustainability.[8]

On the other hand, given that Africa and the Global South have the bulk of leftover renewable capability and the fact that electricity demand is expected to rise in these regions over the next several years, these countries are likely to play an important part in the energy transition. The scale and energy systems of their economies present an opportunity to facilitate the adoption of significant reforms more quickly and easily as compared to their industrialized counterparts. [9] Due to the connection between decarbonization and sustainable development goals, developing nations started incorporating renewable energy technologies into their development agendas.[10] When measured in terms of per gross domestic product, these countries have spent more in these technologies recently than developed ones.[11] Given these considerations, it is essential to examine the role of renewable energy transition, ecological innovation, globalization, and CO2 emissions in marginalized communities in Africa and the Global South from the perspective of equity, affordability, and access.

1.2 Need to Examine the Impact on Marginalized Communities in Africa and the Global South

In ensuring a smooth energy transition globally, attention must be paid to communities in Africa and the Global South which have been neglected directly or indirectly where it concerns affordability and access to modern energy services. The importance of this is to ensure that energy transition is not only given primacy generally without taking into consideration the strengths of the marginalized communities. It is

[7]Akadiri, S. S., Adebayo, T. S., Asuzu, O. C., Onuogu, I. C., & Oji-Okoro, I. Testing the role of economic complexity on the ecological footprint in China: a nonparametric causality-in-quantiles approach. Energy & Environment, (2022). https://doi.org/10.1177/0958305X221094573

[8] USDS, 2021

[9]IEA, World Energy Outlook 2019, Technical Report, International Energy Agency, Paris, 2019.

[10]N. Vivadili, E. Suleymanov, C. Bulut, C. Mahmudlu, Transition to renewable energy and sustainable energy development in Azerbaijan, Renewable and Sustainable Energy Reviews 80 (2017) 1153–1161

[11]Bloomberg NEF, Emerging Markets Outlook 2018. Climatescope, 2018; REN21, Renewables 2020 Global Status Report, 2020.

therefore easy to make policies that tend to support for instance, the use of gas in homes while certain communities are unable to afford the same product. It leaves those communities with no other option than to continue with the use of biomass which is the traditional means of cooking. In the event that this continues, the policy behind energy transition will therefore fail as emissions of carbon will continue.

The importance of examining the impact can also be viewed from the perspective of the minimum attention being paid to the marginalized communities. The depoliticization of energy transitions or focus on "depoliticized indicators" has been noted as a result of inadequate attention to the political economy aspect of energy transitions, which has disempowered the poor and or poor regions where renewable energy projects are urgently needed. This last argument, which calls attention to the history of uneven power relationships and the geography of power, contributes to make us more aware of the danger that the transition to a global energy system might deepen the exploitation of weaker geographical areas and their inhabitants.[12]

For instance, utilizing a postcolonial lens, academics have noted that Western paradigms of energy knowledge and policy recommendations are imposed on nations in the Global South[13]which is a manifestation of colonial thinking. This tends to be the situation with African countries too particularly those who have recently become engaged with developing their crude oil. Scholars and activists have found that these 'universal best practices' for the energy transition that are dictated by experts in many respects are disengaged from the worries and material conditions and needs of local communities or the uniqueness of the setting of implementation.[14]

1.3 Focus on Issues of Equity, Affordability, and Access

The energy system will need to undergo a significant shift in order to get toward a net zero energy system. Additionally, it offers a chance to create a more equal energy system. We go through examples of equity issues in the present energy systems in this part, along with obstacles to a just and equitable net zero energy system.[15] Marginalized groups in Africa and the Global South confront particular difficulties in accessing and affording energy. Reliable access to electricity is a problem in many low-income urban

[12] Muller, F., Neumann, M., Elsner, C., &Claar, S. Assessing African energy transitions: renewable energy policies, energy justice, and SDG 7. *Politics and Governance,* (2021) *9*(1), 119–130

[13]Broto, V. C., Baptista, I., Kirshner, J., Smith, S., &Alves, S. N. Energy justice and sustainability transitions in Mozambique. *Applied Energy,* (2018) *228*, 645–655.

[14]Cloke, J., Mohr, A., & Brown, E. Imagining renewable energy: Towards a Social Energy Systems approach to community renewable energy projects in the Global South. *Energy Research & Social Science,* (2017) *31*, 263–272

[15] Baker, E (2021) A perspective on equity implications of net zero energy systems Energy and Climate Change

and rural locations. This restricts access to basic services and the chances for economic growth.

No doubt, energy is costly when it is accessible. In other words, families may be forced to pick between paying for electricity and other needs as a result. Also, the effects of climate change are disproportionately felt in certain areas, which may make problems with energy availability worse. Extreme weather, for instance, has the potential to harm infrastructure and interfere with energy supply. A look at South Sudan shows that the country has very little energy coverage as only 6.7% of the population has access to it while poverty and economic growth are hampered by this restricted access in Nigeria.[16] This is caused by unreliable power availability and frequent outages. As such, millions of people's quality of life is impacted by these energy-related problems, which impede economic activity.[17] In India, the problem is the high cost of energy and the scarcity of clean cooking fuels. This is a result of their reliance on solid fuels and as such, low-income households face higher energy costs and more health problems.[18]

These illustrations draw attention to the pervasive problem of energy inequality, which impacts Africa and Global South urban and rural residents alike. Reducing these differences is essential to advancing sustainable development and raising the standard of living for disadvantaged groups. In net-zero energy systems, equal access to energy supplies will rely in part on the technology, resources, and system architecture. If net-zero emissions systems are more expensive, as some studies predict,[19] this could exacerbate economic inequality, leading to “haves” and “have-nots” when it comes to energy. Net-zero systems with high penetration levels of intermittent renewables can rely on demand response programs to facilitate grid integration.[20]

Recent research has uncovered inequities in need response programs, with Hispanic households such as those in Columbia and Argentina[21] experiencing not only negative income impacts but also impacts that are harmful to health.[22] Many scholars have asserted that certain renewable energy projects have exacerbated social and

[16] Essimi, J. A. B., Ambassa, L.-F., Ndouna, F. K., & Gankou, J. M. Renewable Energy Consumption, Poverty, and Inequality in French-Speaking African Countries: An Ardl Panel Data Analysis. *The Journal of Energy and Development*, (2022) *48*(1/2), 129–155.
[17] Ibid
[18] Ibid.
[19]W. Deason, Comparison of 100% renewable energy system scenarios with a focus on flexibility and cost, Renewable Sustainable Energy Rev. 82 (2018) 3168–3178
[20] V.S. Tabar, M.T. Hagh, M.A. Jirdehi, Achieving a nearly zero energy structure by a novel framework including energy recovery and conversion, carbon capture and demand response, Energy Build. 230 (2021), 110563.
[21] Covers countries like Columbia, Mexico and Argentina
[22] M.J. Fell, Just flexibility? Nature Energy 5 (1) (2020) 6–7.

economic disparities due to unequal accessibility.[23] Concerns regarding equitable access have often surfaced in the context of deploying solar energy, despite the fact that numerous examples have shown the benefits of solar energy sources for rural areas, particularly in regard to improving outcomes in education, lowering labour burdens placed on women, and increasing energy self-sufficiency.

When examining renewable energy consumption in Sub-Saharan Africa, Mohammed discovered that the high initial costs of household renewable technology prevent the poorest families from adopting technologies like rooftop solar systems.[24] In some cases, impoverished families even become trapped in cycles of debt after borrowing money to fund renewable energy technologies. Winther's research on the use of solar electricity in rural Kenya provides insight into the financial hurdles to access, that are dependent on gender. [25] The research shows how fixed connections and cost of subscriptions for solar energy reduce rural women's agency in terms of access and appliance ownership, in contrast to men who are often higher income home owners. In order to solve these problems, the paper discusses two successful decentralized supply systems that were introduced by community initiatives led by women among the villages that are the subject of the study, highlighting the significance of community-based and participatory activities.[26] Consequently, women's active involvement in the creation and management of energy systems has altered village norms, improved women's status in their families and communities, and brought about a socio-technological transition as regards how energy is used.[27]

The role that financial strategies play in promoting solar energy in rural areas, especially in relation to solar home systems (SHS), has been discussed in a variety of South Asian communities.[28] Even with subsidies, affordability is still a problem in the region because of common issues like low-income households' inability to pay large down payments and subscription fees, despite the widespread existence of subsidy programs

[23]S.H. Baker, Anti-resilience: a roadmap for transformational justice within the energy system, Harvard Civil Rights-Civil Liberties Law Rev. 54 (2019) 1–48.; A.C. Brent, D.E. Rogers, Renewable rural electrification: sustainability assessment of mini-hybrid off-grid technological systems in the African context, Renewable Energy 35 (2010) 257–265.

[24]Y.S. Mohammed, M.W. Mustafa, N. Bashir, Status of renewable energy consumption and developmental challenges in Sub-Sahara Africa, Renewable Sustainable Energy Rev. 27 (2013) 453–463.

[25]T. Winther, K. Ulsrud, A. Saini, Solar powered electricity access: implications for women's empowerment in rural Kenya, Energy Res. Social Sci. 44 (2018) 61–74.

[26] Ibid

[27]Oliver W. Johnson, Jenny Yi-Chen Han, Anne-Louise Knight, Sofie Mortensen, May ThazinAung, Michael Boyland, Bernadette P. Resurreccion. Intersectionality and energy transitions: A review of gender, social equity and low-carbon energy Energy Research & Social Science 70 (2020) 101774 p. 9

[28] N. Amin, R. Langendoen, Grameenshakti: A renewable energy social business model for global replication, in: 2012: pp. 324–327. https://doi.org/10.1109/GHTC.2012.50.; S. Wong, Overcoming obstacles against effective solar lighting interventions in South Asia, Energy Policy 40 (2012) 110–120.

and the generally beneficial results connected to solar energy systems.[29] Furthermore, Wong's comparative study of decentralized solar lighting initiatives in Bangladeshi and Indian country sides underscores how poorly designed subsidy programs can inadvertently lead to inequitable results that disproportionately benefit those with more money.

The ownership form of SHS in the Bangladeshi situation, as opposed to a rental approach, has led to significant operating and maintenance costs, with the subsidies only covering 65–70% of the overall expenditures.[30] As a result, in order to close the financial gaps, clients must contribute in addition to making large down payments and expensive subscription fees. Because of this, the subsidy program not only puts a significant financial strain on contributors but also encourages the adoption of the technology only by wealthier users. Wong delves further into the socioeconomic and emotional impacts of disparities in access, arguing that the shift to solar power has exacerbated the divide between wealthy and impoverished households. Households that can afford SHS benefit from better access to healthcare, education, and communication, while those that cannot afford it fall behind in these areas.[31] Studies have suggested actions including developing socially differentiated subsidies or loans through discussions with local users to suit their unique needs and knowledge as a reaction to this divide of access and inadequate subsidy schemes.[32]

Numerous studies conducted in the Global North on solar photovoltaics (PV) have looked at how rising household PV has led to different power cost burdens.[33] The exponential increase in renewable energy capacity, especially solar photovoltaics, in Germany over the last few decades has resulted in a variety of outcomes. Although the percentage of energy consumed from renewable sources rose by around 18% between 2000 and 2013, this expansion was accompanied by a noticeable rise in power rates, which had "regressive distributional effects" that disproportionately affected people with

[29]D. Laufer, M. Schafer, The implementation of Solar Home Systems as a poverty reduction strategy—a case study in Sri Lanka, Energy Sustainable Dev. 15 (2011) 330–336, https://doi.org/10.1016/j.esd.2011.07.002.; I. Mahat, Implementation of alternative energy technologies in Nepal: towards the achievement of sustainable livelihoods, Energy Sustainable Dev. 8 (2004) 9–16.

[30] S. Wong, Overcoming obstacles against effective solar lighting interventions in South Asia, Energy Policy 40 (2012) 110–120.

[31]Ibid

[32] I. Mahat, Implementation of alternative energy technologies in Nepal: towards the achievement of sustainable livelihoods, Energy Sustainable Dev. 8 (2004) 9–16

[33]M. Andor, M. Frondel, C. Vance, Installing Photovoltaics in Germany: a license to print money? Econ. Anal. Policy 48 (2015) 106–116, https://doi.org/10.1016/j.eap.2015.09.003.; A.J. Chapman, B. McLellan, T. Tezuka, Residential solar PV policy: an analysis of impacts, successes and failures in the Australian case, Renewable Energy 86 (2016) 1265–1279, https://doi.org/10.1016/j.renene.2015.09.061.; W. Strielkowski, D. Štreimikienė, Y. Bilan, Network charging and residential tariffs: a case of household photovoltaics in the United Kingdom, Renewable
Sustainable Energy Rev. 77 (2017) 461–473, https://doi.org/10.1016/j.rser.2017.04.029.

lower incomes.[34] Sunter emphasized the racial aspect of solar PV adoption in the US, pointing out that the average rate of rooftop PV installation is substantially lower in places with a Black and Hispanic majority nationwide.[35]

The study found a connection between this discrepancy and racial differences in home ownership and income, and it suggested that if communities adopt energy sources later, the socioeconomic divide may get worse. The cases have illustrated how the imposition of renewable energy initiatives from higher authorities can neglect the concerns of marginalized groups. Winther et al.'s research, however, argues that approaches that appear neutral in terms of gender and are not tailored to specific communities can actually favour those already in privileged positions, for instance, men are often more prominently involved in the energy supply system.[36] Consequently, this can uphold existing structures of inequality, such as male-dominated energy systems.

1.4 Organizational Layout

The beginning of this work highlights the significance of energy transition in mitigating climate change and environmental degradation. It emphasizes the necessity of analyzing the effects on underprivileged populations in Africa and the Global South, with a particular emphasis on equity, affordability, and accessibility. The socioeconomic obstacles that marginalized populations confront, are covered in the second section, which examines equality in energy transition. These barriers include the dual impacts on women's work, poverty, insecure employment, land loss, and unequal access. It demands local involvement and community engagement in addition to focused policies and initiatives. The affordability of sustainable energy solutions is covered in the third section. Access to dependable and reasonably priced energy services is the subject of the fourth section. After discussing the ramifications for marginalized areas, the discussion comes to a close with a review of the necessity of a fair and inclusive energy transition that puts equality, affordability, and accessibility first.

[34]M. Frondel, S. Sommer, C. Vance, The burden of Germany's energy transition: an empirical analysis of distributional effects, Econ. Anal. Policy 45 (2015) 89–99, https://doi.org/10.1016/j.eap.2015.01.004.
[35]D.A. Sunter, S. Castellanos, D.M. Kammen, Disparities in rooftop photovoltaics deployment in the United States by race and ethnicity, Nat. Sustainability 2 (2019) 71–76.
[36]T. Winther, K. Ulsrud, A. Saini, Solar powered electricity access: implications for women's empowerment in rural Kenya, Energy Res. Social Sci. 44 (2018) 61–74.

2. EQUITY IN ENERGY TRANSITION

2.1 Socioeconomic Barriers Faced by Marginalized Communities

2.1.1 Dual Effects on Women's Labour

Renewable energy sources like modern household electricity and heat, including technologies like modern cook stoves and lighting, have often been hailed as beneficial for gender equality in rural settings.[37] Compact domestic solar installations, like solar lights, can be particularly advantageous for low-income families living in rural areas, especially women and children. These systems allow them to extend their work and study periods, ultimately improving their livelihoods, health, and educational achievements.[38] Nevertheless, a recurrent trend in the literature suggests that, in spite of the apparent benefits, energy transitions might occasionally cause inequities to shift rather than disappear.

This is particularly clear in the way that women's workloads are affected by energy sources. According to certain studies, women's empowerment is enhanced by solar and biofuel energy because it greatly lessens their workloads, which include cooking and gathering firewood. This frees up their time for other activities during the day, such as volunteering in the community and looking for new job opportunities.[39] However, some research suggests that the labour of women just moves from one area, like preparing food, to another, like taking care of animals.[40]

Many works of literature explore the gender gap in perceptions of the benefits of new energy technologies. For instance, Fernandez-Baldor's research in rural Peru shows

[37] J.U. Devkota, C. Prajapati, S. Singh, B. Hada, Statistical analysis of benefits of renewable energy - examples from biogas consumers of Nepal, Int. J. Renewable Energy Res. 4 (2014) 477–483.; M. Gustavsson, A. Ellegard, The impact of solar home systems on rural livelihoods.
Experiences from the Nyimba Energy Service Company in Zambia, Renewable Energy 29 (2004) 1059–1072.

[38] B. Baruah, Creating opportunities for women in the renewable energy sector: findings from India, Feminist Econ. 21 (2015) 53–76.; M. Gustavsson, Educational benefits from solar technology — access to solar electric services and changes in children's study routines, experiences from eastern province Zambia, Energy Policy 35 (2007) 1292–1299.; M. Millinger, T. Marlind, E.O. Ahlgren, Evaluation of Indian rural solar electrification: a case study in Chhattisgarh, Energy Sustainable Dev. 16 (2012) 486–492

[39] M. Millinger, T. Marlind, E.O. Ahlgren, Evaluation of Indian rural solar electrification: a case study in Chhattisgarh, Energy Sustainable Dev. 16 (2012) 486–492.

[40] W. Ding, L. Wang, B. Chen, L. Xu, H. Li, Impacts of renewable energy on gender in rural communities of north-west China, Renewable Energy 69 (2014) 180–189.; A. Fernandez-Baldor, P. Lillo, A. Boni, Gender, energy, and inequalities: A capabilities approach analysis of renewable electrification projects in Peru, Sustainable Access to Energy in the Global South: Essential Technologies and Implementation Approaches, Springer International Publishing, Universitat Politecnica de Valencia, Valencia, Spain, 2015, pp. 193–204.; O.W. Johnson, V. Gerber, C. Muhoza, Gender, culture and energy transitions in rural Africa, Energy Res. Soc. Sci. 49 (2019).

that women often use the extra time for domestic tasks or income generation, while men tend to have more opportunities to use their time saved by renewable electrification for leisure pursuits. This demonstrates how societal norms and gender-based labour inequalities continue to exist even in the face of new energy sources.

In a similar vein, although women may be able to increase their possibilities for a living through the use of renewable energy sources, their ability to enter other fields of work is limited by societal norms and environmental conditions. For instance, males are better positioned to use power to improve their enterprises if more firms are owned by men as a result of gender-related business conventions, but female have less prospects to profit financially from electricity.[41] In addition to gender norms, the relationship between gender and class is crucial in identifying the demographic groups who might benefit from renewable energy services. [42] Therefore, local circumstances and systemic factors significantly affect the extent to which the benefits of renewable energy sources are realized.

2.1.2 Poverty, Employment, and Precariousness

Reducing poverty in underprivileged places is not a given when renewable energy is introduced. Even though 44% of the literature lists the creation of jobs, energy self-sufficiency, and better educational opportunities as benefits of energy transitions that reduce poverty, upon closer inspection, many of these results have two sides. Aspirations to reduce poverty can become enmeshed with the interests of bureaucracy, [43] and problems with unstable work persist.[44] A large body of research credits the generation of jobs as a benefit of biofuel crops.[45] Nevertheless, this frequently has contradictory effects. Numerous articles highlight that while private sector-led biofuel plantations initially generate employment opportunities, many of these jobs are precarious.[46]

[41]O.W. Johnson, V. Gerber, C. Muhoza, Gender, culture and energy transitions in rural Africa, Energy Res. Soc. Sci. 49 (2019).
[42] H. Ahlborg, Towards a conceptualization of power in energy transitions, Environ. Innov. Societal Transitions 25 (2017) 122–141, https://doi.org/10.1016/j.eist. 2017.01.004.
[43] S. Geall, W. Shen, Gongbuzeren, Solar energy for poverty alleviation in China: State ambitions, bureaucratic interests, and local realities, Energy Res. Soc. Sci. 41 (2018) 238–248, https://doi.org/10.1016/j.erss.2018.04.035.
[44]E.M. Nkoana, Community acceptance challenges of renewable energy transition: a tale of two solar parks in Limpopo, South Africa, J. Energy n Southern Afr. 29 (2018) 34–40.; Z.A. Zommers, P.J. Johnson, D.W. Macdonald, Biofuels bonanza? Sugarcane production and poverty in villages surrounding Budongo Forest, Uganda, J. Eastern Afr. Stud. 6 (2012) 177–195, https://doi.org/10.1080/17531055.2012. 669569
[45] T. Santika, K.A. Wilson, S. Budiharta, E.A. Law, T.M. Poh, M. Ancrenaz, M.J. Struebig, E. Meijaard. Does oil palm agriculture help alleviate poverty? A multidimensional counterfactual assessment of oil palm development in Indonesia, World Dev. 120 (2019) 105–117, https://doi.org/10.1016/j.worlddev.2019.04. 012
[46] Ibid

This is often due to plantation structures where small holders under private sector ownership receive unequal benefits and face unfair land allocation processes. An investigation on oil palm plantations in Indonesia, for instance, showed that the effects of these advancements varied according to the socioeconomic circumstances and biophysical characteristics of the local communities.[47] Oil palm plantations supported and enhanced the market-oriented livelihoods of people who were already dependent on them in a number of ways.

However, the advent of oil palm and its plantation structures undermined the subsistence-based lives of those populations, leading to an increase in poverty. In addition, the long-term effects of land loss, which severely restricts alternatives for subsistence, can outweigh the benefits of work.[48] For example, contract farming agreements linked to the production of biofuel in the Philippines compelled native smallholder farmers to switch from traditional crop management to agro-industrial techniques, which may have long-term effects on local livelihoods due to resource scarcity brought on by changes in land use. Additionally, contract farming relationships have the potential to maintain current social and economic disparities, such as the escalation of women's labour responsibilities as a result of gendered labour divides already in place.

Moreover, top-down, state-led energy programs may prescribe standard energy solutions without taking local demands and poverty situations into sufficient account, which might result in unfavourable consequences. A case study in rural China, for example, examined the effectiveness of a state-led solar photovoltaic (PV) infrastructure program. By enabling them to sell power produced by grid-connected solar systems, the initiative aimed to raise the standard of living for nomadic households.[49] However, because of their lifestyles and patterns of movement, many of the program's targeted nomadic households did not profit. This emphasizes how crucial it is to match the aims of poverty alleviation and energy deployment with the socio-cultural and political realities of the local community when switching to renewable energy sources.

2.1.3 Land Loss and Market Interests' Resonance with Colonial Rationalities

The debate over renewable energy often works against underprivileged, rural, or indigenous groups by implying that environmental concerns should take precedence over local interests. In the research on renewable energy transitions, land loss is a common

[47] Ibid

[48] T. Santika, K.A. Wilson, S. Budiharta, E.A. Law, T.M. Poh, M. Ancrenaz, M.J. Struebig, E. Meijaard, Does Oil Palm Agriculture help alleviate poverty? A multidimensional counterfactual assessment of oil palm development in Indonesia, World Dev. 120 (2019) 105–117, https://doi.org/10.1016/j.worlddev.2019.04.012

[49] H Zhang., Wu, K., Chan, G, Wang, S., Zhou, D., & Re, X., 'Photovoltaic Poverty Alleviation and Rural Income: Evidence from China' (2020) Nature Communications

issue (24% of the studied literature addressed this impact).[50] Large hydropower projects and biofuel plantations frequently take front stage in discussions, highlighting conflicts of interest between local people, investors, and private entrepreneurs.

As was previously said, the majority of the research on land loss concentrates on the loss of food security and means of subsistence. As the commercialization of communal land can uproot poor populations from their sources of income and increase their vulnerability, this is consistent with previous research on the effects of land grabbing.[51] In situations involving wind power projects, biofuel crops, hydropower developments, and huge solar energy projects, local community rights are clearly given up.[52] Land ownership issues are particularly associated with indigenous concerns, with 50% of the literature addressing indigenous issues focusing on land loss and its implications for food security. The loss of land and subsequent relocation may drastically alter a community's social structure, including gender norms and power structures. For example, populations uprooted by hydropower projects in Laos and Vietnam frequently have to relocate to inappropriate territory, which drives many inhabitants into informal wage labour or illicit employment. This transition to a market economy can make it easier for men to find employment than women, further increasing women's dependence on men.

2.1.4 Inequitable Access

Numerous scholarly works contend that because of unequal access, some renewable energy projects have exacerbated social and economic inequality.[53] While several examples demonstrate the benefits of solar energy sources for rural areas, particularly with regard to improving education, lowering the labour demands placed on women, and increasing energy self-sufficiency, concerns about equal access have surfaced, especially when it comes to solar energy implementation. It is clear from researching renewable energy usage in Sub-Saharan Africa that the most impoverished families may not be able to afford home renewable technology due to its high initial cost, such as rooftop solar systems. Sometimes, low-income families find themselves engulfed in debt.

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[50] Luomi, M. *The Global Governance of Sustainable Energy: Access and Sustainable Transitions*. International Institute for Sustainable Development (IISD). (2020) http://www.jstor.org/stable/resrep29277

[51] G.C. Schoneveld, L.A. German, E. Nutako, Land-based investments for rural development? A grounded analysis of the local impacts of biofuel feedstock plantations in Ghana, Ecol. Soc. 16 (2011), https://doi.org/10.5751/ES-04424- 160410.

[52] D. McCauley, R. Heffron, M. Pavlenko, R. Rehner, R. Holmes, Energy justice in the Arctic: implications for energy infrastructural development in the Arctic, Energy Res. Soc. Sci. 16 (2016) 141–146.

[53] Y.S. Mohammed, M.W. Mustafa, N. Bashir, Status of renewable energy consumption and developmental challenges in Sub-Sahara Africa, Renewable Sustainable Energy Rev. 27 (2013) 453–463.

2.2 Targeted Policies and Interventions for Marginalized Communities

Many developed nations have implemented policy frameworks that incentivize the integration of modern sustainable energy sources into their power grids.[54] International agreements like the Paris Agreement, the Kyoto Protocol, and the European Green Deal have either spurred the development of these policies or aligned with them.[55] The most widely used policies in developing nations to speed up the switch to cleaner energy are those that set targets for renewable energy and provide tax breaks for the power industry.[56] On the other hand, these nations tend to have fewer and less ambitious goals and incentives for the transportation, heating, and cooling industries.

As of 2019, only a handful of countries, including Bulgaria, China, North Macedonia, Montenegro, Romania, Serbia, Thailand, Moldova, and Ukraine, had implemented policies or set goals for incorporating renewable energy into their transportation, heating, and cooling sectors.[57] However, these supportive policies and financial incentives have demonstrably increased renewable energy production within the electricity sector. Consequently, the costs of generating geothermal, hydropower, wind, bioenergy, and solar power have become more competitive with those associated with fossil fuel-based electricity generation.[58]

Developing countries have implemented a wide range of laws and incentives, such as targets, cash rewards, tax breaks, utility laws, auctions, and tenders.[59] For instance, Costa Rica has set a lofty target of being the first nation in the world to be decarbonized by 2050—that is, to totally phase out fossil fuels.[60] To achieve this goal, the country has formulated and commenced implementation of a comprehensive national plan encompassing infrastructure development, industrial processes, waste reduction and

[54]H.L. Wlokas, What contribution does the installation of solar water heaters make towards the alleviation of energy poverty in South Africa? J. Energy Southern Afr. 22 (2011) 27–39

[55]T. Santika, K.A. Wilson, S. Budiharta, E.A. Law, T.M. Poh, M. Ancrenaz, M.J. Struebig, E. Meijaard, Does oil palm agriculture help alleviate poverty? A multidimensional counterfactual assessment of oil palm development in Indonesia, World Dev. 120 (2019) 105–117, https://doi.org/10.1016/j.worlddev.2019.04.012.

[56]H.L. Wlokas, What contribution does the installation of solar water heaters make towards the alleviation of energy poverty in South Africa? J. Energy Southern Afr. 22 (2011) 27–39.

[57]R. Hoggett, Technology scale and supply chains in a secure, affordable and low carbon energy transition, Appl. Energy 123 (2014) 296–306, https://doi.org/10. 1016/j.apenergy.2013.12.006.

[58] E. Cecelski, From the Millennium Development Goals Towards a Gender-Sensitive Energy Policy Research and Practice: Empirical Evidence and Case Studies, ENERGIA International Network on Gender and Sustainable Energy, London, 2006

[59]R. Kattumuri, T. Kruse, Renewable technologies in Karnataka, India: jobs potential and co-benefits, Clim. Dev. 11 (2019) 124–137

[60]G.C. Schoneveld, L.A. German, E. Nutako, Land-based investments for rural development? A grounded analysis of the local impacts of biofuel feedstock plantations in Ghana, Ecol. Soc. 16 (2011), https://doi.org/10.5751/ES-04424- 160410.

management, land-use planning, agricultural practices, and the promotion of sustainable transportation and mobility solutions. Still, Costa Rica is not the only country adamant about getting rid of fossil fuels from its energy mix. Actually, 48 developing countries have set a target of achieving 100% renewable energy for their electricity generation by 2050 or even sooner.[61]

Other countries like Vietnam and Laos, have enacted targeted policy instruments for specific economic sectors, such as industry.[62] By 2030 and 2050, respectively, a few countries have plans to transition from internal combustion engine (ICE) cars to electric vehicles. These countries include Nepal and Cabo Verde.[63] After failing to adjust feed-in tariffs promptly, China faced challenges due to surplus capacity. In response, it imposed limitations on electricity distributors and power companies to reduce wind and solar power curtailment.[64] Moreover, feed-in tariffs have been put in place by a number of countries to encourage the production of power from renewable sources. Belgrade, Bosnia and Herzegovina, Algeria, Indonesia, India, Nicaragua, Argentina, Albania, Kenya, Philippines, Tanzania, Kazakhstan, and Zambia are some of these countries. [65] Furthermore, 23 developing countries organized auctions in 2019 primarily for wind and solar energy projects.[66]

Studies reveal that the influence of these laws and incentives on the adoption of renewable energy differs according to the socioeconomic bracket of the country. For instance, studies have shown a strong positive relationship between feed-in tariffs and both the total amount of renewable electricity generation and the amount generated from sources other than hydropower in middle-income countries. [67] On the other hand, subsidies seem to be more effective in promoting the uptake of non-hydro renewable energy sources in low-income countries.[68] Kim contends that foreign aid and financing initiatives linked to climate change, such as the Clean Development Mechanism (CDM), have a favourable impact on low-income countries' production of renewable electricity, both hydroelectric and otherwise. However, Benites-Lazaro and Mello-Théry argue that

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[61]R. Hoggett, Technology scale and supply chains in a secure, affordable and low carbon energy transition, Appl. Energy 123 (2014) 296–306, https://doi.org/10. 1016/j.apenergy.2013.12.006.
[62]V.C. Pandey, K. Singh, J.S. Singh, A. Kumar, B. Singh, R.P. Singh, Jatrophacurcas: a potential biofuel plant for sustainable environmental development, Renewable Sustainable Energy Rev. 16 (2012) 2870–2883, https://doi.org/10.1016/j.rser. 2012.02.004.
[63]S. Vermeulen, L. Cotula, Over the heads of local people: consultation, consent, and recompense in large-scale land deals for biofuels projects in Africa, J. Peasant Stud. 37 (2010) 899–916.
[64] C. Arndt, R. Benfica, J. Thurlow, Gender implications of biofuels expansion in Africa: the case of mozambique, World Dev. 39 (2011) 1649–1662.
[65]R. Hoggett, Technology scale and supply chains in a secure, affordable and low carbon energy transition, Appl. Energy 123 (2014) 296–306, https://doi.org/10. 1016/j.apenergy.2013.12.006
[66]Ibid
[67] E Baldwin, J N Brass, S Carley, and L M MacLean, 'Renewable Energy and Land Use in Africa: A Review of Impacts and Policy Issues' (2017) 37 Energy Research & Social Science 1.
[68] Ibid

the Clean Development Mechanism (CDM) falls short in enabling local communities and fostering democratic decision-making.[69] Agbonifo further demonstrates an uneven distribution of CDM projects, with countries like China, India, Brazil, and Mexico receiving more benefits.[70] Finally, Baldwin et al. propose that while administrative capacity facilitates the implementation of renewable energy in middle-income nations, factors like political freedom and reliance on fossil fuels act as independent drivers for renewable energy adoption in low-income countries.[71]

2.3 Importance of Local Participation and Community Engagement

Energy transitions are complex and far-reaching processes that can fundamentally reshape society and its institutions. While the quick transition to renewable energy has been made easier by technology developments, these innovations also necessitate adjustments in organizational and cultural structures to support and promote the adoption and widespread usage of renewable energy sources. This section explores the connections between energy research and social studies that hold potential applications for developing countries, thereby supporting their progress in the current energy transition. This focus acknowledges the socio-technical nature of energy transitions.

2.4 Affordability of Clean Energy Solutions

Access to clean and sustainable energy is a key component of the United Nations Sustainable Development Goals (SDGs), especially SDG7, which aims to ensure universal access to affordable, reliable, sustainable and modern energy for all by 2030.[72]
However, many people around the world, especially in developing countries and rural areas, still lack access to electricity or rely on traditional biomass for cooking and heating, which has negative impacts on health, environment and socio-economic development.[73]
Therefore, it is important to explore how clean energy solutions can be made more affordable and accessible for marginalized communities, who often face multiple barriers

[69] Benites-Lazaro, L. L., & Mello-Théry, N. A. Empowering communities? Local stakeholders' participation in the clean development mechanism in Latin America. *World development*, (2019). *114*, 254-266.
[70] Agbonifo, Philip. (2017). The Pursuit of Climate Protection and the Uneven Global Distribution of Clean Development Mechanism (CDM) Projects: Lesson from Least Developed Countries (LDCS). European Journal of Sustainable Development. 6. 10.14207/ejsd. 2017.v6n1p139.
[71] E Baldwin, J N Brass, S Carley, and L M MacLean, 'Renewable Energy and Land Use in Africa: A Review of Impacts and Policy Issues' (2017) 37 Energy Research & Social Science 1-14.
[72] Columbia Center on Sustainable Investment (CCSI), UNDP, UN Sustainable Development Solutions Network (SDSN) and World Economic Forum; SDG7: Affordable and Clean Energy - Sustainable Development Solutions Network (2016)
[73] Rahman, M. M., Paatero, J. V., &Poudyal, A. *Access to clean energy for the poor: The case of solar home systems in Bangladesh,* (2013)**.** In *2013 IEEE Global Humanitarian Technology Conference (GHTC)* (pp. 48-55). IEEE. 4

such as high upfront costs, lack of financing options, low-income levels, limited awareness and technical capacity, and inadequate policy and institutional support.[74]

One of the main challenges for promoting clean energy solutions is the cost consideration for marginalized communities, who often have low and irregular incomes and cannot afford the initial investment required for installing renewable energy systems such as solar panels, wind turbines or biogas digesters.[75] Moreover, these communities may face additional costs such as maintenance, repair, replacement and operation of the systems, which may not be covered by the initial subsidy or grant provided by the government or other agencies. Therefore, it is essential to design and implement financial mechanisms that can bridge the affordability gap and enable these communities to access clean energy solutions in a sustainable manner.[76]

Some of the financial mechanisms that can help overcome the cost barrier are subsidies, grants and microfinance.[77] Subsidies are direct or indirect payments from the government or other entities that reduce the cost of renewable energy systems for end-users. Grants are non-repayable funds that are given by donors or organizations to support specific projects or activities related to clean energy.[78] Microfinance is the provision of small loans, savings, insurance and other financial services to low-income people who do not have access to formal banking channels.[79] These mechanisms can help lower the upfront costs, increase the affordability and availability of credit, reduce the risks and uncertainties, and enhance the income-generating opportunities for marginalized communities who want to adopt clean energy solutions.[80]

However, these financial mechanisms also have some limitations and challenges that need to be addressed. For instance, subsidies may create dependency and distort market signals, grants may not be sufficient or sustainable in the long run, and

[74]S. N. N. Namboodiri and T. Padmaja, Barriers to the Diffusion of Renewable Energy in Developing Countries: A Case Study on India. UNEP Collaborating Centre on Energy and Environment, Risoe National Laboratory, Denmark, 1993

[75]Butchers, J., Williamson, S., & Booker, J. Micro-Hydropower in Nepal: Analysing the Project Process to Understand Drivers that Strengthen and Weaken Sustainability. Sustainability, (2021). 13(3), 1582.

[76]Stoner, R. J., Hidalgo, D. I., &Kammen, A. D. Costs of Small-Scale Renewable Energy Systems in Developing Countries: What Do We Know? Annual Review of Energy and the Environment, (1993) 18(1), 387-410

[77]Reichenbach, J., &Requate, T. Subsidies for Renewable Energies in the Presence of Learning Effects and Market Power. *The Scandinavian Journal of Economics,* (2012) 114(3), 909-938.

[78]For Green Energy Projects: The Role of Aid Uncertainty by M. G. Quibria and M. A. Wahid, The Journal of Environment & Development, Vol. 9, No. 4, December 2000 Pages 382-402

[79]Lowitzsch, J. *Investing in a Renewable Future – Renewable Energy Communities, Consumer (Co-)Ownership and Energy Sharing in the Clean Energy Package*. In M. Roggenkamp, C. Banet, I. del Guayo, & L. Hancher (Eds.), *Energy Transition: Legal and Policy Challenges* (2020) (pp. 173-200). Intersentia.

[80]Laumanns, U., Reiche, D., &Bechberger, M. Renewable Energies in Developing Countries: Issues, Interests, and Implications. *Energy & Environment*, (2004) *15*(4), 731–741.

microfinance may entail high interest rates and transaction costs.[81] Therefore, it is important to design and implement these mechanisms in a way that ensures their effectiveness, efficiency, equity and sustainability. Some of the key factors that can enhance the performance of these mechanisms are: targeting the most needy and deserving beneficiaries; ensuring transparency and accountability; involving local stakeholders and communities; providing technical assistance and capacity building; creating enabling policy and regulatory frameworks; fostering innovation and adaptation; and monitoring and evaluation.[82]

Another way to promote affordability of clean energy solutions is to encourage energy entrepreneurship and local ownership among marginalized communities. Energy entrepreneurship is the process of creating and managing new ventures that provide clean energy products or services to meet the needs and demands of customers.[83] Local ownership is the situation where local communities have control over or benefit from the renewable energy resources or systems in their area. These approaches can help create local jobs, income and value addition; reduce dependence on external actors; increase customer satisfaction and loyalty; enhance social acceptance and participation; and improve environmental sustainability.[84]

However, energy entrepreneurship and local ownership also face some challenges that need to be overcome. For example, energy entrepreneurs may lack access to capital, markets, technology, skills and information; local communities may face conflicts over resource rights, management responsibilities and benefit sharing; both groups may encounter barriers from existing policies, regulations, institutions and norms.[85] Therefore, it is important to provide adequate support and incentives for energy entrepreneurship and local ownership. Some of the possible measures that can facilitate these approaches are: providing seed funding, business development services, mentoring and networking opportunities for energy entrepreneurs; ensuring legal recognition, fair compensation, participatory decision-making and equitable distribution of benefits for

[81]Bhattacharyya, S. C., &Ohiare, S. The Chinese electricity access model for rural electrification: Approach, experience and lessons for others. Energy Policy, (2012) 49, 676-687; Jhirad, D. Renewable Energy in Developing Countries: Priorities and Prospects. *The Energy Journal*, (1987) *8*, 105–123.

[82]The Design and Sustainability of Renewable Energy Incentives: An Economic Analysis**.** (2014). *The World Bank*.

[83] Lazear, E. P. Entrepreneurship: A theoretical framework and empirical analysis. Journal of Labor Economics, (2005). 23(4), 649-680

[84]Lowitzsch, J., & Rapp, K. *Ownership of renewable energy projects: A comparative analysis of Germany and Denmark*. In J. Lowitzsch (Ed.), *Energy transition: Financing consumer co-ownership in renewables* (2015). (pp. 67-88). Springer

[85]Walker, G., & Cass, N. *Carbon reduction, 'the public' and renewable energy: Engaging with socio-technical configurations*. Area**,** (2007) 39(4), 458-469. 1

local communities; creating a conducive environment for innovation, competition, collaboration and learning for both groups.[86]

No doubt, affordability of clean energy solutions is a critical issue for achieving SDG7 and enhancing sustainable development for marginalized communities. There are various financial mechanisms that can help bridge the affordability gap such as subsidies, grants and microfinance. There are also alternative approaches that can foster affordability such as energy entrepreneurship and local ownership. However, these mechanisms and approaches also have some limitations and challenges that need to be addressed. Therefore, it is important to design and implement them in a way that ensures their effectiveness, efficiency, equity and sustainability.[87]

2.5 Access to Reliable and Affordable Energy Services

Access to reliable and affordable energy services is a crucial factor for economic development, social welfare and environmental sustainability. However, many countries in the global south and Africa face significant challenges in providing adequate and clean energy to their populations, especially in rural and remote areas. According to the International Energy Agency (IEA), about 789 million people lacked access to electricity and 2.6 billion people relied on traditional biomass for cooking in 2018.[88] These energy deficits have serious implications for human health, education, gender equality, poverty reduction and climate change mitigation.[89]

One of the main challenges of providing energy services in the global south and Africa is the physical availability of energy infrastructure, such as power plants, transmission lines, distribution networks and end-user appliances. Many of these countries have low levels of electrification, especially in rural areas, where grid extension is often not feasible or cost-effective due to low population density, long distances, difficult terrain and lack of demand.[90] Moreover, the existing infrastructure is often inadequate, inefficient, unreliable and vulnerable to natural disasters, conflicts and vandalism. Therefore, there is a need to improve the quality and reliability of energy infrastructure, as well as to expand its coverage and accessibility.

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[86] Mainali, B., &Silveira, S. Challenges of energy entrepreneurship and local ownership in rural areas: Evidence from India and Nepal. *Journal of International Development* (2011)*., 23*(1), 103-117

[87] Bauer, J. M., &Wüstenhagen, A. S. Energy Entrepreneurship and Local Ownership for Sustainable Development: Lessons from Africa and Asia. *Annual Review of Environment and Resources*, (2018) 43(1), 139-164

[88] International Energy Agency. *SDG7: Data and projections*. (2020) Retrieved from https://www.iea.org/reports/sdg7-data-and-projections

[89] Practical Action. *Poor people's energy outlook 2016*. Practical Action Publishing

[90] Bhattacharyya, S. C. (Ed.). *Rural electrification through decentralised off-grid systems in developing countries*. (2013) Springer

Another challenge is to prioritize decentralized and off-grid solutions that can provide energy services to remote and isolated communities that are not connected or poorly served by the grid. Decentralized and off-grid solutions refer to energy systems that generate and distribute electricity locally, without relying on a central grid. They can be classified into two types: mini-grids and stand-alone systems. Mini-grids are small-scale networks that supply electricity to a group of customers, such as a village or a cluster of households.[91] Stand-alone systems are individual devices that supply electricity to a single customer, such as a solar lantern or a solar home system. These solutions can offer several advantages over grid extension, such as lower costs, faster deployment, greater flexibility, higher customer satisfaction and lower environmental impacts.[92]

A third challenge is to deploy renewable energy mini-grids and stand-alone systems that can provide clean and sustainable energy services to the global south and Africa. Renewable energy sources, such as solar, wind, hydro, biomass and geothermal, can offer multiple benefits for energy access, such as reducing greenhouse gas emissions, enhancing energy security, creating local jobs and improving livelihoods. However, there are also some barriers that hinder the adoption and diffusion of renewable energy mini-grids and stand-alone systems, such as high upfront costs, lack of financing options, technical and institutional challenges, regulatory uncertainties and social acceptance issues. Therefore, there is a need to overcome these barriers and create enabling conditions for renewable energy mini-grids and stand-alone systems.[93]

A fourth challenge is to enhance capacity-building and knowledge-sharing initiatives that can support the development and implementation of reliable and affordable energy services in the global south and Africa.[94] Capacity-building refers to the process of strengthening the skills, competencies and abilities of individuals, organizations and institutions that are involved in the energy sector. Knowledge-sharing refers to the exchange of information, experiences and best practices among different stakeholders in the energy sector. These initiatives can help improve the planning, design, operation, maintenance and evaluation of energy projects; foster innovation and learning;

[91] Eberhard, A., Rosnes, O., Shkaratan, M., &Vennemo, H. *Africa's power infrastructure: Investment, integration, efficiency*. (2011) World Bank Publications

[92] International Renewable Energy Agency. *Off-grid renewable energy systems: Status and methodological issues*. (2015). Accessed from Off-grid renewable energy systems: Status and methodological issues (irena.org) on 6th February 2024

[93] Bhatia, M., & Angelou, N.Beyond connections: Energy access redefined. *Energy Sector Management Assistance Program*. (2015) World Bank Group

[94] Chaurey, A., &Kandpal, T. C. A techno-economic comparison of rural electrification based on solar home systems and PV microgrids. *Energy Policy* (2010), *38*(6), 3118-3129

increase awareness and participation; facilitate cooperation and coordination; and promote replication and scaling-up.[95]

2.6 Implications for Marginalized Communities

Energy transition is the process of shifting from fossil fuels to renewable and low-carbon sources of energy, such as solar, wind, hydro, biomass and geothermal. Energy transition has various implications for marginalized communities in the global south and Africa, who often lack access to reliable, affordable and clean energy services. In this section, a discussion of some of the positive and negative impacts of energy transition on these communities, as well as some of the opportunities and challenges for empowering them through energy transition will be done.

One of the positive impacts of energy transition is that it can improve the quality of life and development of marginalized communities, who often suffer from energy poverty, defined as the lack of access to modern energy services that are adequate, affordable, reliable and environmentally friendly. Energy poverty has serious consequences for human health, education, gender equality, income generation and environmental sustainability.[96] By providing access to renewable and low-carbon energy sources, energy transition can help alleviate energy poverty and enhance the well-being and livelihoods of marginalized communities. For example, solar lanterns can provide lighting for extended study hours and improved security; solar home systems can power appliances such as radios, TVs and fans; biogas digesters can produce cooking fuel from animal waste; micro-hydro plants can generate electricity for rural villages; and wind turbines can pump water for irrigation. These energy services can have multiple benefits for health, education, communication, entertainment, productivity and income.[97]

Another positive impact of energy transition is that it can create opportunities for social and economic transformation of marginalized communities, who often face multiple barriers such as low income levels, limited awareness and technical capacity, inadequate policy and institutional support, and lack of participation and empowerment in the energy sector.[98] By promoting decentralized and off-grid solutions that are locally owned and managed by the communities themselves, energy transition can foster social inclusion, participation and empowerment of marginalized communities. For example, renewable energy cooperatives can enable collective ownership and decision-making over

[95]Ulsrud, K., Winther, T., Palit, D., Rohracher, H., &Sandgren, J. The Solar Transitions research on solar mini-grids in India: Learning from local cases of innovative socio-technical systems. *Energy for Sustainable Development,* (2011) *15*(3), 293-303

[96]Birol, F. Energy economics: A place for energy poverty in the agenda? *The Energy Journal,* (2007) *28*(3), 1-6.

[97]Practical Action. (2016). *Poor people's energy outlook 2016*. Practical Action Publishing.

[98]International Renewable Energy Agency. *Off-grid renewable energy systems: Status and methodological issues*. (2015). Accessed from Off-grid renewable energy systems: Status and methodological issues (irena.org) on 6th February 2024

energy resources; energy entrepreneurs can create local jobs and value addition; women's groups can enhance their role and status in the energy sector; and community-based organizations can advocate for their rights and interests in the energy policy arena. These approaches can help build social capital, trust, cooperation and empowerment among marginalized communities.[99]

However, energy transition also has some negative impacts that need to be addressed. One of the negative impacts is that it can exacerbate existing inequalities among marginalized communities who often have unequal access to resources opportunities and benefits in the energy sector.[100] For example some groups may be excluded or discriminated from participating in or benefiting from renewable energy projects due to their gender ethnicity caste class or location; some groups may bear disproportionate costs or risks associated with renewable energy projects such as land acquisition displacement or environmental impacts; some groups may have limited voice or influence in the planning implementation or evaluation of renewable energy projects due to their lack of information education or representation.[101] These inequalities can undermine the social acceptability and sustainability of energy transition and create conflicts and grievances among marginalized communities.[102]

Therefore, it is important to avoid or mitigate these negative impacts and ensure that energy transition is fair and inclusive for marginalized communities. One way to do this is to adopt a climate justice perspective that recognizes the rights and needs of marginalized communities in the context of climate change and energy transition.[103] Climate justice advocates for a more equitable distribution of the costs and benefits of climate change mitigation and adaptation among different groups and regions. It also calls for more participation and empowerment of marginalized communities in the governance and management of climate change and energy transition. By applying a climate justice lens to energy transition, it is possible to address the underlying causes and consequences of inequality and injustice in the energy sector.[104]

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[99]Bhatia, M., & Angelou, N. *Beyond connections: Energy access redefined*. Energy Sector Management Assistance Program. (2015). World Bank Group

[100]Reddy, B. S., &Painuly, J. P. Barriers to the diffusion of renewable energy technologies: A case study of the state of Maharashtra, India. *Energy for Sustainable Development,* (2004) *8*(1), 27-38

[101]Bellanca, R., & Wilson, E. Supporting energy entrepreneurship and local ownership for sustainable development: Lessons from Africa and Asia. *Enterprise Development and Microfinance* (2012)*, 23*(4), 305-317

[102]Yildiz, Ö., Rommel, J., Debor, S., Holstenkamp, L., Mey, F., Müller, J. R. &Rognli, J. Renewable energy cooperatives as gatekeepers or facilitators? Recent developments in Germany and a multidisciplinary research agenda. *Energy Research & Social Science,* (2015) *6*, 59-73

[103]Spellman, F. R. *Environmental impacts of renewable energy*. (2014). CRC Press

[104]Wüstenhagen, R., Wolsink, M., &Bürer, M. J. Social acceptance of renewable energy innovation: An introduction to the concept. *Energy policy* (2007)*, 35*(5), 2683-2691

A key factor in the global south and Africa's economic growth, social welfare, and environmental sustainability is access to dependable and reasonably priced energy services. However, there are various challenges that need to be addressed such as improving the physical availability of energy infrastructure prioritizing decentralized and off-grid solutions deploying renewable energy mini-grids and stand-alone systems and enhancing capacity-building and knowledge-sharing initiatives.[105]

In order to achieve Agenda 2063 and the Sustainable Development Goals (SDGs), clean energy is essential for sustainable development in Africa and the Global South. Furthermore, reducing poverty (SDG 1), improving health (SDG 3), and combating climate change (SDG 13), requires that everyone have access to modern, cheap, sustainable, and dependable energy. This is the goal of SDG 7. Additionally, it promotes resilient infrastructure, innovation, and sustainable manufacturing (SDG 9). The 50-year plan for fair and sustainable development in Africa, known as Agenda 2063, places a strong emphasis on the need for modern energy availability to support economic growth, industrial expansion, and higher living standards.

3. CONCLUSION

The energy transition is necessary from a social and economic standpoint in addition to being technologically and environmentally sound. It has the potential to greatly reduce environmental deterioration and climate change, which would be advantageous for the entire world. But in order to accomplish a genuinely inclusive and equitable energy transition, it is imperative to address the unique problems that marginalized communities—particularly those in Africa and the Global South—face. These groups frequently have particular socioeconomic obstacles, including deprivation, unstable work, loss of land, and unequal access to resources. Through the implementation of specific policies and interventions, as well as a focus on fairness, affordability, and access, we can make sure that everyone benefits from the transition—especially the most vulnerable.

Ensuring the affordability and accessibility of renewable energy solutions is crucial in enhancing the standard of living in these areas. This entails removing financial obstacles and developing infrastructure in order to offer dependable and reasonably priced energy services. Significant prospects for economic empowerment and better living circumstances are presented by the energy transition for marginalized groups. These advantages, nevertheless, are only achievable if access, affordability, and fairness are given top priority. Initiatives aimed at implementing the energy transition must be successful on a local and communal level. Communities' needs and viewpoints are taken into account when they are included in the decision-making process, which produces

[105]Beer, C. T. Climate justice, the Global South and policy preferences of Kenyan environmental NGOs. *The Global South* (2014), *8*(2), 84-100

more inclusive and sustainable results. We can build a future for energy that is more just and equitable by giving these ideas top priority.

The energy transition holds significant promise for addressing climate change and environmental degradation. However, to achieve a truly just and inclusive transition, it is essential to focus on the unique needs and challenges of marginalized communities. By prioritizing equity, affordability, and access, and involving local communities in decision-making processes, we can ensure that the benefits of the energy transition are shared by all. Only through such comprehensive and inclusive strategies can we realize the full potential of the energy transition for all, paving the way for a more just and sustainable future.