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Energy Poverty and Social Inclusion: Exploring the Intersections in Vulnerable Communities

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Abstract
In India, energy poverty is still a major problem that disproportionately affects underprivileged groups including religious minorities, Scheduled Castes (SCs), and Scheduled Tribes (STs). Disparities in energy access continue because of institutional, socioeconomic, and geographic obstacles, even in spite of governmental measures like Saubhagya and Pradhan Mantri Ujjwala Yojana. This paper investigates how social inclusion might help reduce energy poverty by ensuring that everyone has equitable access to modern energy services. The study highlights that energy poverty in India transcends infrastructure challenges, encompassing aspects of affordability, reliability, and socio-cultural exclusion. Systemic discrimination against marginalised populations restricts their access to electricity and clean cooking fuels. Frameworks of energy justice, which include aspects of distributive, procedural, and recognition justice, are crucial for tackling these inequalities. Constitutional provisions and policy interventions have sought to address this gap; however, obstacles such as economic constraints, bureaucratic inefficiencies, and insufficient participatory governance restrict development. It is suggested that caste-sensitive planning, inclusive financing systems, and decentralised renewable energy solutions are important strategies for promoting equitable energy transitions. The results highlight the necessity of socially inclusive energy policies that ensure no community is left behind in the shift to clean energy while also reducing energy poverty and advancing the accomplishment of Sustainable Development Goal 7 (SDG7).

Keywords: *Energy poverty, Social inclusion, Energy justice, Marginalized communities, India, SDG 7*

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I. Introduction

Energy is a fundamental resource and necessity for addressing many of the demands of modern civilisation. Therefore, addressing energy poverty is emphasised as a crucial step towards achieving SDG 7. Energy poverty is defined by the United Nations as "the absence of affordable, reliable, adequate, environmentally friendly, and safe energy services necessary for development" (Sovacool, 2014). In the context of energy vulnerability in developed countries, energy justice and fuel poverty are significant concepts, while accessibility issues are a primary concern often associated with energy poverty (Bouzarovski, 2018). The energy poverty concept, particularly regarding accessibility and affordability, presents numerous challenges in developing valid indicators and indices for its measurement. Developing countries such as India are unlikely to sufficiently address challenges related to energy in the near future by enhancing renewable energy resources (Bagdi et al., 2022). The income poor in rural India are not often regarded as energy poor, according to Khandker et al., (2012) and Wang et al., (2015), Mathen & Sadath, (2022). One of the most significant contributors to the global fuel shortage is the approximately 505 million Indians facing shortage of clean cooking fuel (Manasi & Mukhopadhyay, 2024). The India Energy Outlook study estimates that $2.8 trillion would be needed to build energy infrastructure in order to ensure improved electricity access by 2040 (IEA, 2021). The IEA (2021) estimates that 240 million Indians still lack access to electricity, and 840 million still rely on firewood as their main cooking fuel, which leads to 2.6 million deaths due to harmful air pollution and related health issues (Mani et al., 2020).

The existing literature indicates that there is no universally accepted definition of energy poverty. There are several prominent researcher such as Day et al., (2016) conceptualised energy poverty as a "situation where individuals are unable to achieve essential capabilities due to insufficient access to affordable, reliable, and safe energy services, while also considering alternative means to realise these capabilities". The concept is highly pertinent in light of Amartya Sen's capability approach, which is aimed at reducing energy poverty through the use of specific monetary metrics (Chipango, 2021; Sadath & Acharya, 2017). Energy justice encompasses the provision of reliable, cost effective, and sustainable energy for all (Ikevuje et al., 2023). In India, energy poverty is very widespread, and it often overlaps alongside various types of deprivation, such as income poverty and

social deprivation (Sarkar et al., 2022). Dalits and *Adivasis* are observed to experience significant energy poverty in comparison to their counterparts in India. According to the Central Electricity Authority's (2023) report forecasts, initiatives like the *Saubhagya* program have helped India reach nearly universal household electrification (Wasnik, 2023). Disparities in the quality, reliability, and affordability of energy access are still pronounced, especially among marginalised social groups like SC, ST, and minority communities affecting both cooking fuel and electricity usage.

The aim of social inclusion is to create an inclusive society that upholds democratic governance, cultural diversity, human rights, and the principles of equality and equity. It is a procedure that allows citizens to engage in the making of decisions that affect their lives, particularly those without representation. Consequently, it ensures the elimination of all forms of discrimination and exclusion, the reduction of inequalities, and the establishment of social equality and unity. The concept of social inclusion has grown in popularity as a crucial element in combating inequality and poverty (Dugarova, 2015; Mitchell & Shillington, 2002). Regardless of caste, ethnicity, gender, or socioeconomic background, social inclusion in regards to energy access involves making guarantees that all groups have equal access to modern energy services, take part in decision-making processes, and receive the benefits of energy-driven development outcomes. In order to ensure that interventions do not prolong or worsen already-existing social inequalities and to eradicate energy poverty from societies, socially inclusive energy policies are essential.

Due to structural social exclusion and economic marginalisation, millions of Indians continue to living in energy poverty despite the important advancements made by the country in household electrification and energy infrastructure development. The design and implementation of policies have neglected marginalised populations, which continue to face structural causes of poverty and inequality. The paper's primary goal is to investigate the significance of social inclusion in relation to energy poverty. Even while the current energy policies are effective in focussing on access measures, they frequently fail to addressing concerns pertaining to social justice and equality. The goal of universal and equitable energy access mentioned in SDG 7 could be undermined if social inclusion is not incorporated into energy poverty reduction measures.

II. Energy Poverty and Social Inclusion: A Justice-Centered Perspective

Concept of Energy Poverty

The term of energy poverty is not universally accepted by countries, despite the fact that it is one of the sirius threat for every nation worldwide. Energy poverty is defined as “insufficient availability of modern energy services and goods” by World Economic Forum (2010) (Kumar, 2020). It indicates that there is not enough choice for obtaining sufficient, dependable, reasonably priced, secure, and ecologically friendly energy services (Sher et al., 2014). Petrova et al., (2013) highlights both developed and developing nations struggle to provide their citizens with the socially and substantially necessary level of household energy facilities due to various forms of fuel and energy poverty. The unable of access to clean cooking energy or electricity is only one aspect of energy poverty; other factors include affordability, sustainability, dependability, and the adequate supply of energy services. Recently, research highlighted accessibility, energy cost concerns especially in India. Pachauri et al., (2004) conducted an important research study that revealed that energy poverty has decreased among the extremely impoverished in India. Pachauri & Spreng, (2011) defined energy poverty as “a circumstance in which a household cannot access enough energy services for cooking, heating, and lighting”. The capabilities frameworks of Prof. Amartya Sen and Martha Nussbaum show how closely associated with energy poverty and human well-being (Day et al., 2016). Additionally, this method has been comprehensive to recognise the multidimensional nature of energy poverty. In the study, The Multidimensional Energy Poverty Index (MEPI), a comprehensive metric introduced by Nussbaumer et al., (2012), defines energy poverty as " lack of access to electricity and clean cooking facilities, which are essential to human and economic growth". Sovacool & Dworkin, (2015) defined Energy poverty occurs when people lack the ability to obtain reasonably priced, dependable, superior, secure, and ecologically friendly energy services that support human and economic growth.

Sadath & Acharya (2017), energy poverty is being unable to afford adequate energy levels to meet basic household requirements and the lack of access to modern energy services. In their view, energy poverty in India is about affordability, utilisation, and adequate energy consumption for basic living standards, not merely access to energy infrastructure like electricity. However, Energy poverty disproportionately affects marginalised communities, who face significant obstacles to inexpensive, reliable, and quality energy needed to improve their standard of living. In this context, Bhattacharyya, (2012) characterises energy poverty as “a lack of energy use in households relative to the minimum amount required for socioeconomic development and essential energy services” emphasising the essential function of energy access in tackling socio-economic inequalities.

Concept of Social Inclusion

Social inclusion involves an equitable integration of various social groups into economic, political, and social frameworks, guaranteeing equal access to resources, opportunities, and decision-making processes. Social

inclusion, often known as social integration or cohesiveness, aims to create "a society for all" in which each person actively participates and has rights and responsibilities (DESA, 2009). It is a process enabling those at threat of poverty and exclusion to access prospects and properties for full societal involvement (Dugarova, 2015). Numerous people believe that social inclusion results from combating social exclusion, which is the unconscious exclusion of people and groups from social, political, and economic processes that prevents them from fully participating in society (Hassan et al., 2022). In this context, exclusion was treated as a result of poverty because economic activity was valued more highly than political, social, environmental, and cultural factors (Khan et al., 2015). Since gaining prominence after the World Summit for Social Development (1995) in Copenhagen, social inclusion has often been framed as an extension of economic inclusion, linked to the exclusion of people or groups because of their gender, race, ethnicity, and assessed through the lens of individual well-being (Dugarova, 2015). Thus, evaluations of social inclusion focused on indicators of access to services or resources, providing limited insight into social interactions or institutions. Consequently, initiatives that incorporate targeting and means testing frequently undermined connections to society rather than promoting social inclusion. Therefore, inclusion policies prioritised economic efficiency, individual well-being, and poverty reduction while disregarding relationships and rights to security, social protection, and participation.

Energy Justice Framework: A Social Inclusion Approach

Energy justice investigates inequities in energy access and supply, identifies communities that are disadvantaged, and explores strategies for eliminating these disparities. Energy justice is connected to environmental integrity, which arose in the 1970s to emphasise the difficulties encountered by socially disadvantaged and ethnic minority communities (Jenkins et al., 2016). The energy justice framework, based on three fundamental principles (Figure 1)—distributional justice, recognition justice, and procedural justice—offers a significant methodology for empirical research into energy disparities (Sovacool & Dworkin, 2015). Energy justice was initially developed to address distributional injustices in energy access and use, and it emphasises equitable access to basic energy needs. Distributional justice investigates the sources of energy injustices within this framework, particularly emphasis on the unfair placement of energy facilities and the disproportionate burden of increasing energy costs on energy-poor communities (Haldar et al., 2023). Distributional justice also ensures equitable distribution of energy costs and benefits, emphasising affordability and accessibility (Haldar et al., 2023). The equitable distribution of advantages and disadvantages, including pollution control and environmental hazards, has emerged as major area of concern in justice analysis as energy transitions gain gaining momentum. It subsequently developed to highlight equitable involvement in energy policy-making (procedural justice) and the acknowledgement of the rights of marginalised groups to gain from inclusive energy policies (recognition justice) (Ikevuje et al., 2023). Procedural justice guarantees that all stakeholders can participate without discrimination, highlighting the importance of transparency from governments and industries, while stressing the need for equitable legal processes and equal inclusion within communities (Yadav, 2024). Warren and McFadyen show, encouraging community ownership in wind farm projects can increase acceptance and encourage inclusive decision-making rather than just pointing out inequalities (Warren & McFadyen, 2010). Recognition justice highlights the equitable treatment of energy-impoverished households, recognising the different cultures and rights of local communities (Aryal et al., 2024). It is compromised when vulnerable groups are excluded from policy-making or when targeted policies are not implemented. Although it is regarded as less tangible than other tenets of energy justice, it emphasises the aspects of marginalised populations that are often disregarded. Researchers like Heffron & McCauley, (2017) emphasise the importance of acknowledging these communities as a crucial measure for attaining equitable distribution. In addition, research emphasise the unequal placement of energy plants in proximity to ethnic minorities and indigenous communities, along with the energy difficulties encountered by older adults and disabilities people. In addition, the eight guiding concepts of (Sovacool & Dworkin, 2015) suggested decision-making framework of energy justice are accessibility, affordability, accountability and transparency, sustainability, intergenerational and intergenerational equity, and obligation. Research identifies examples of energy disparity and acknowledges its significance in energy justice, despite ongoing ethical discussions on how to solve energy poverty.

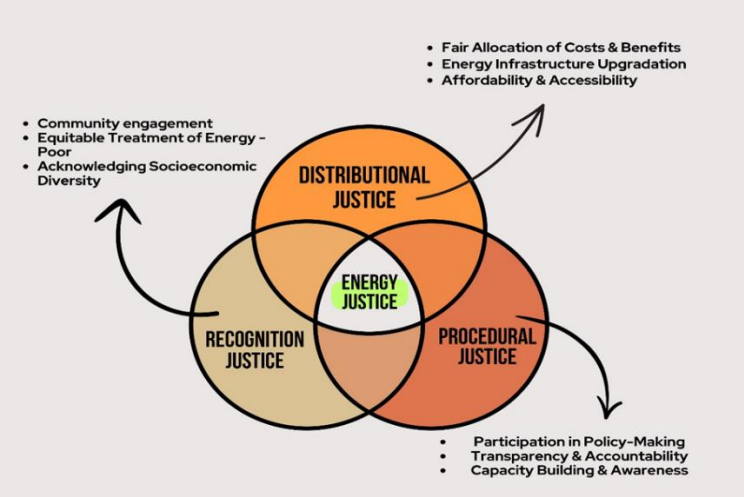

Figure 1: Social inclusion dimensions in energy justice

Intersectionality in Energy Poverty and Social Inclusion

In India, social, economic, geographic, and institutional issues all contribute to energy poverty by causing inequalities in access to reliable, cost-effective, and clean energy. The intersectionality framework (Figure 2) draws attention to the ways that regional disparities, caste, ethnicity, and religion interact to exacerbate existing inequities. Energy access has been increased by programs like *Saubhagya* (universal electrification) and *Ujjwala Yojana* (LPG distribution), but they frequently ignore the systemic obstacles that keep underprivileged communities from fully benefiting, resulting in differences in actual usage, affordability, and sustainability (Patnaik & Jha, 2020). Therefore, energy poverty must be addressed with a socially inclusive strategy that ensures all communities can equally engage in and benefit from modern energy transitions, irrespective of caste, religion, or region. However, historical marginalisation, structural exploitation, and socioeconomic constraints have resulted in systemic exclusions for SC, ST, and religious minorities, which have strengthened their reliance on conventional and inferior energy sources (Saxena & Bhattacharya, 2018). Combating this gap requires strategies that extend beyond infrastructure development to confront issues of affordability, accessibility, and institutional biases, thereby promoting an inclusive and equitable energy transition is prioritised. Ensuring equitable energy access requires an integrative approach because it identifies communities that continue to be marginalised in spite of progress made at the national level. However, policymakers should explore how caste, race, religion, and geography connect to identify structural hurdles that hinder marginalised groups from using modern energy services. This disparity can be targeted to create more inclusive policies that make energy transitions widespread, equitable, and sustainable for all. India will progress towards more equitable, sustainable, and inclusive energy transitions that advantage every section of community by incorporating intersectionality into energy planning and policy design.

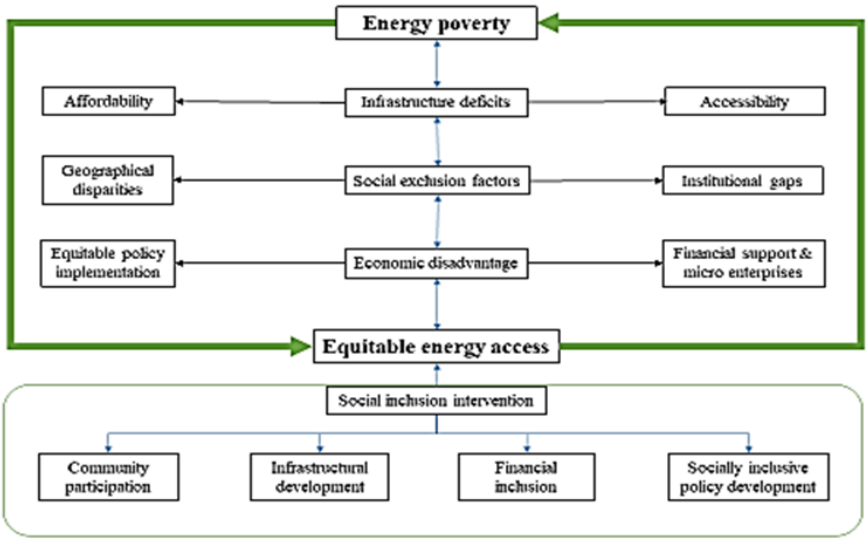

Figure 2: Energy poverty and equitable access pathways

III. Status Of Energy Poverty and Social Exclusion in Energy Access, India

Energy Poverty scenario in India

Lack of access to modern energy services required for fundamental human requirements is known as energy poverty. It depends on energy sources that are physically accessible and household choices for efficient, convenient, and less polluting energy. There is still a gap between residential energy use and grid access, even after universal electrification was achieved in 2018 (Panda & Pradhan, 2024). Gupta et al., (2020) discovered that over 12 hours/day of load shedding are experienced by 50% of electrified households in a 2018 survey conducted by the Government of India. Energy poverty measurement has evolved through various frameworks such as Foster et al., 2000 used binary classification, while Pachauri & Spreng, (2004) introduced the use-access matrix. Mirza & Szirmai, (2010) developed the Energy Inconvenience Index, requiring extensive data. Nussbaumer et al., (2012, 2013) proposed the Multidimensional Energy Poverty Index, based on Amartya Sen's capabilities framework, assessing deprivation beyond access (Sen, 1990). Gupta et al., (2020) introduced the Household Energy Poverty Index, incorporating accessibility and affordability. Khandker et al., (2012) highlight various approaches to defining energy poverty, including physical supply, adequacy, and affordability. Khandker et al. (2012) found that poverty in terms of both money and energy are correlated in urban regions but not in rural India. Energy access is limited even among non-poor household in India, as evidenced by the fact that just 22% of households are income poor, compared to 57% of energy poor households in rural India (Khandker et al., 2012). Pachauri et al. (2004) propose three key elements: essential energy services, quantitative and qualitative thresholds, and cost comparisons across economic groups. The Government uses an engineering approach to set a fuel poverty line, estimating 30W per capita for cooking, 1.5W for space heating, and 1.5W for lighting (Pachauri, 2011). Another approaches define energy poverty based on household energy expenditure relative to income, with thresholds ranging from 5% to 20% of cash income (Thema & Vondung, 2020). Energy poverty line measured by demand-based approach which sets the at the point where energy usage rises with income, identifying households consuming only the bare minimum as energy-poor (Panda & Pradhan, 2024). Energy poverty in rural India exacerbates economic instability among poor and vulnerable groups (Bouzarovski, 2018; Khandker et al., 2012). In addition, some of the most economically disadvantaged communities in the country, approximately 1.73 Lakh forest fringe villages continue to rely significantly on kerosene for lighting and fuelwood for cooking signifies the energy poverty which measured by Energy Access Index (Sinha & Yadava, 2019). Households with limited energy access spend a larger percentage of their income going towards energy than those with better access. It also affects education, lower average school years for households with low energy use (Oum, 2019). Educational attainment is inversely related to socio-economic constraints and energy poverty (Abbas et al., 2020), promoting a shift to sustainable energy sources (Aryal et al., 2024). Empirical studies in India show that a 10% increase in education leads to a 3% decline in energy poverty (Tewathia, 2014), especially among lower economic groups (Sharma & Rajpurohit, 2022). Sadath & Acharya (2017) identified districts where energy poverty remarks (over 40%) affect over 90% of houses. The highest numbers are in Uttar Pradesh (19 districts), Madhya Pradesh (17 districts), Odisha (13 districts), Chhattisgarh (11 districts), Bihar (8 districts), Rajasthan (6 districts), West Bengal (5 districts), and Maharashtra (3 districts) (Sadath & Acharya, 2017). Sadath & Acharya (2017) found Adivasis and Dalits face the greater energy poverty, OBCs and Muslims align with the national average, while forward castes, Christians, Sikhs, and Jains have significantly lower levels.

Energy Access by Marginalised Groups

Access to energy is still a significant equality and justice concern, especially for underserved populations. The sustainable growth of liberties and capacities among impoverished and disadvantaged communities is severely hampered by the unequal distribution of modern energy services, which skews the benefits of development programs. In India, caste-based social structures and hierarchies have imperative influence on the results of rural development, particularly the differences in energy availability between ST and SC. Due to their poor representation in developmental programs, financial instability, and locational remoteness, these groups frequently face insufficient access. Pelz et al., (2021) found that between 2004 and 2012, SC and ST groups' access to electrical supply and LPG remained significantly lower than that of other social groups, showing persistent disparities. Disparities still exist even though national electrification programs like *Saubhagya* (2017), *DDUGJY* (2014), and *RGGVY* (2005) have been successful in almost achieving universal household electrification (Palit & Kumar, 2022). Despite SC households' grid connections are improving when compared to ST families, both groups still receive insufficient electricity. According to Sedai et al., (2021), marginalised families have one more outage day per month and a daily electricity deficit of 1.42 hours when compared to other categories. According to Dugoua et al., (2017), SC/ST households have a 15% lower likelihood of being connected to the grid. Additionally, there is an adverse relationship between the percentages of marginalised (SC/ST) families in a hamlet with the pobability of electrification. Caste-based differences in electricity consumption were also noted by Saxena & Bhattacharya, (2018), who found that ST households reduced their usage by 10% and SC households by 5.6%, primarily as a result of geographic remoteness that makes it more

difficult to provide energy services. Similarly, compared to Dalit and Adivasi households, upper caste households in Uttar Pradesh were more likely to adopt stable electricity, according to Aklin et al., (2016). Even while rural electricity has made progress, there are still several obstacles in getting clean cooking fuels, especially LPG. Issues such as pricing, cultural acceptability, and infrastructure continue to constrain adoption in rural areas. Despite efforts to solve these problems through programs like *Unnat Chulha Abhiyan* (2014), *Direct Benefit Transfer –LPG* (2013), and *PMUY* (2016), inequalities still exist, such as the fact that SC/ST families are 9 percentage points less likely than other social categories to adopt LPG (Saxena & Bhattacharya, 2018). Concerns regarding ongoing accessibility have been raised by the decrease in the number of SC/ST recipients receiving LPG connections under PMUY since 2019. However, Dash & Sahoo, (2024) demonstrate that 35.1% of PMUY beneficiaries were SC/ST as of December 1, 2021. However, a report by the Council on Energy, Environment and Water in 2020 indicated that compared to 49% of general category families, just 32% of SC households and 21% of ST households stated that LPG was their main cooking fuel (Patnaik & Jha, 2020). The affordability of LPG connections continues to be a significant obstacle, as more than three-fourths of households that lack LPG connections reside in kuccha houses and earn less than INR 10,000 per month (Kar et al., 2024), which leads to these households to revert to biomass or mixed fuels. Therefore, a socially inclusive approach to policy design and implementation is necessary to resolve this issue, with a greater emphasis on community-specific needs and structural barriers.

IV. Reduction of Energy Poverty through Social Inclusion

Social Inclusion: A Key Driver

Social inclusion improves the ability, opportunity, and dignity of people and groups to participate in society, especially those who are disadvantaged because of their identity. Social inclusion permits full participation in society by securing equitable access to opportunities, resources, and decision-making. It is essential for sustainable development as well as human rights in a world that is changing quickly. Discrimination on the basis of socioeconomic status, gender, or disability impedes progress and exacerbates inequality. Social inclusion improves the ability, opportunity, and dignity of people and groups to participate in society, especially those who are disadvantaged because of their identity (Mitchell & Shillington, 2002). It ensures equal access to opportunities, resources, and decision-making, enabling full participation in society. In a rapidly changing world, it is vital not only for human rights but also for sustainable development. Exclusion based on factors like socio-economic status, gender, or disability hinders progress and deepens inequality (Bagdi et al., 2023). The SDG 10 highlight the importance of social and economic inclusion by advocating for equitable access to education, employment, healthcare, and opportunities for all (Bhandari, 2024; Castellino & Bradshaw, 2015). Equality and inclusion must be incorporated into clean energy policy in order to protect human rights, avoid exacerbating already-existing disparities, and prevent disproportionate impacts. Inclusive decision-making is necessary to guarantee that no one is excluded from the renewable energy transition, allowing all individuals to participate. Due to structural obstacles that restrict their access to contemporary energy, social inclusion is essential in alleviating energy poverty among marginalised groups (SC & ST). These communities frequently inhabit isolated villages without legal land ownership, which hinders their ability to obtain government subsidies for LPG or electricity connections (Patnaik & Jha, 2020). These communities are also struggle to switch to sustainable energy sources, remaining reliant on kerosene, firewood and cow dung due to financial limitations and discriminatory service delivery policies. Most of the disadvantage families depend on small-scale farming, daily wage labour, or raising livestock, but inconsistent energy supply reduces their income. Additionally, disadvantage and marginalised populations, rely largely on forests for their fuel needs, have a direct relationship with climate resilience and energy poverty, which exacerbates environmental degradation and increases vulnerability to climate change (Yadava & Sinha, 2022). In conclusion, since equitable energy access is crucial for social justice and sustainable development, alleviating energy poverty in SC and ST communities requires inclusive policies that address affordability, access, and governance.

Constitutional Framework for Energy and Social Inclusion

India's energy policies prioritise social inclusion by providing equitable access to renewable energy, clean cooking fuel, and electricity for marginalised communities, with a particular emphasis on SC and ST, through the implementation of laws, subsidies, and the development of rural infrastructure. The Indian Constitution establishes a legal framework aimed at ensuring energy access and promoting social inclusion, as described in the Directive Principles of State Policy, Fundamental Rights, and Special Provisions for SC and ST (**Table 1**) (Tripura et al., 2023). Article 21 (Right to Life) has been recognised to encompass access to clean energy and a pollution-free environment (Kumar & Ahirwar, 2022, p. 21). Articles 14 & 15 (Right to Equality) provide a rationale for subsidised energy related programs for SCs/STs by emphasising the prohibition of discrimination (Chauhan, 2022). Article 39(b) requires the equal allocation of resources, ensuring equal access to electricity and clean cooking fuel (Ambrose, 2013). Article 46 illustrates initiatives such as rural electrification

and biogas subsidies aimed at supporting marginalised communities, whereas Article 48A emphasises the importance of clean energy transitions and efforts to reduce pollution (Meena, 2022). Articles 243G & 243W facilitate local governance, allowing Panchayats and Urban Local Bodies to regulate renewable energy initiatives. The Fifth and Sixth Schedules provide tribal councils with the authority to manage energy resources, including hydropower and solar initiatives. Furthermore, the PESA Act (1996) enhances local governance by empowering Gramme Sabhas to manage biogas and solar projects (Sisodia, 2021). The collective nature of these constitutional provisions fosters energy equity and enhances social inclusion.

Table 1: Constitutional provisions supporting energy access and social inclusion in India

Provision	Relevant Article	Implications for Energy & Social Inclusion
Right to Life	Article 21	Interpreted to include access to clean energy and a pollution-free environment.
Right to Equality	Article 14 & 15	Prohibits discrimination, justifying subsidized energy programs for SCs/STs.
Equitable Resource Distribution	Article 39(b)	Ensures fair distribution of electricity and clean cooking fuel.
Welfare of SCs/STs & Weaker Sections	Article 46	Guides policies like rural electrification and biogas subsidies for marginalized groups.
Environmental Protection	Article 48A	Supports clean energy transition and pollution reduction measures.
Local Governance for Energy Decisions	Articles 243G & 243W	Empowers Panchayats & Urban Local Bodies to manage village-level renewable energy projects.
Tribal Area Autonomy	Fifth & Sixth Schedules	Allows tribal councils to govern local energy resources like hydropower & solar projects.
Empowerment of Tribal in Resource Management	PESA Act, 1996	Grants Gram Sabhas the authority to manage local biogas & solar energy projects.

India's energy policies have steadily advanced social inclusion for marginalised communities, especially households belonging to SC/ST groups (**Table 2)**. The Electricity Act (2003) and the Accelerated Rural Electrification Program (2003) established a framework for universal electrification, guaranteeing affordable access to electricity for remote regions (Palit & Bandyopadhyay, 2017). The MGNREGA (2005) and RGGVY (2005) encouraged employment in rural energy initiatives and offered families fall under BPL can receive zero-cost electrical connections (Sirguroh, 2024). The National Biomass Cookstove Initiative (2009) progressed the use of enhanced cookstoves, positively impacting rural women (Palit & Bhattacharyya, 2014). The DDUGJY (2014) and NAFCC (2015) enhanced rural power distribution and facilitated solar energy initiatives in underserved regions (Arunachalam, 2024; Palit & Kumar, 2022). The PMUY (2016) facilitated the providing of no cost LPG connections to households belongs to BPL category, yielding substantial advantages for SC/ST women (Kar, 2019). The *Saubhagya* Scheme, initiated in 2017, aimed to accomplish the goal of electrifying every household (Wasnik, 2023), while the National Bio-Energy Policy, introduced in 2018, promoted the adoption of biogas (Srivastava, 2023). The RDSS (2022) enhanced the consistency of electricity in rural areas (Vardhan et al., 2024), while Ujjwala 2.0 (2022) broadened LPG subsidies, providing additional support to SC/ST women (Singh, 2024). The implementation of these policies significantly improves energy access, health outcomes, and economic prospects for marginalised communities.

Table 2: Impact of energy policies on social inclusion in India

Year	Legislation/Policy	Key Provisions	Impact on Social Inclusion	References
2003	Electricity Act	- Mandates universal electrification. - Enables cross-subsidization for affordable electricity.	- Ensures 100% village electrification, benefiting marginalized households.	Palit & Bandyopadhyay, 2017
2003	Accelerated Rural Electrification Program (AREP)	- Strengthens rural electrification through decentralized power supply.	- Expands access to electricity in remote SC/ST areas.	Palit & Bandyopadhyay, 2017
2005	Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY)	- Encourages Below Poverty Line (BPL) households to receive free electricity connections.	- Enhances electricity access in SC/ST-dominated villages.	Sirguroh, 2024
2009	National Biomass Cookstove Initiative (NBCI)	- Promotes improved biomass cookstoves.	- Reduces indoor air pollution, benefiting rural women.	Palit & Bhattacharyya, 2014
2014	Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY)	- Focuses on separating agricultural and non-agricultural electricity supply. - Strengthens rural distribution networks.	- Provides continuous power supply to rural households and farmers.	Palit & Kumar, 2022

2015	National Adaptation Fund for Climate Change (NAFCC)	- Provides funds for climate adaptation projects, including renewable energy.	- Supports solar and decentralized energy access in marginalized regions.	Arunachalam, 2024
2016	Pradhan Mantri Ujjwala Yojana (PMUY)	- Encourages BPL households to receive free LPG connections.	- Benefits SC/ST, rural women, and economically weaker households.	Kar, 2019
2017	Saubhagya Scheme (Pradhan Mantri Sahaj Bijli Har Ghar Yojana)	- Aims for universal electrification of household. - Provides free connections to electricity for every residence without electricity.	- Targets SC/ST, BPL, and remote communities.	Wasnik, 2023
2018	National Policy on Bio-Energy	- Promotes biogas & biomass-based energy. - Offers financial aid for biogas plants.	- Encourages biogas adoption among SC/ST & rural communities.	Srivastava, 2023
2022	Revamped Distribution Sector Scheme (RDSS)	- Improves power distribution in rural and urban regions. - Focuses on smart metering and loss reduction.	- Ensures reliable electricity supply for rural SC/ST and marginalized communities.	Vardhan et al., 2024
2022	Ujjwala 2.0	- Provides refill subsidies and free stoves along with LPG connections.	- Benefits women in rural and SC/ST communities.	Singh, 2024

V. Barriers to Social Inclusion in Energy Access for Marginalised Communities

In India, social inclusion in energy access is still a major problem because of a confluence of institutional, sociocultural, economic, and technical obstacles. These obstacles disproportionately impact women in rural areas and other marginalised groups, especially religious minorities, SC and ST. Designing policies that provide fair access to energy requires an understanding of these challenges.

Socio-Cultural Barriers

Access to energy is frequently influenced by sociocultural disparities. Dominant castes may limit or degrade services for SC populations, who reside in segregated village fringes and experience delays in the supply of LPG and electricity. High infrastructure costs and the absence of land documents required for subsidies prevent ST households from living in remote forests. Religious minorities, such as Muslims and Dalits, who live in slums and rural areas, frequently experience bureaucratic obstacles and disconnections, which are exacerbated by local governance bias.

Economic Barriers

Due to their reliance on daily salaries and unpaid labour, SC and ST households sometimes find it unable to pay for continual energy expenses like electricity costs and LPG refills. Transport and maintenance costs are examples of hidden costs that further discourage the usage of clean energy. Many people who have limited access to banking are not eligible for DBT schemes, and those who lack collateral are unable to obtain renewable energy loans. Programs for renewable energy disproportionately favour wealthier, upper-caste households since SC and ST groups find it difficult to afford the initial and ongoing costs of technologies like biogas systems and solar panels.

Institutional Barriers

Access to LPG connections and subsidies is restricted for SC and ST households because they frequently lack essential documents like *Aadhaar,* ration cards, and ownership documents. Further impeding the benefits of reaching these communities is corruption in local governance. Schemes like Ujjwala Yojana ignore due to ongoing costs, which results in the continued usage of traditional fuels, while policy frameworks like Saubhagya prioritise dense populations, excluding remote tribal communities. Furthermore, SC and ST involvement is limited by upper-caste dominance in village councils and energy cooperatives, which leads to energy decisions that frequently disregard the interests of marginalised people.

Technical Barriers

Due to suppliers giving preference to wealthy locations, SC and ST towns frequently experience inadequate energy infrastructure, including frequent power outages, voltage problems, and postponed repairs. Many ST villages rely on kerosene and biomass because they inability to access to the grid. Moreover, renewable energy initiatives, such as biogas plants and solar microgrids, are usually built in wealthy communities, leaving out underprivileged populations. Additionally, SC and ST populations are unable to obtain employment in the field due to a lack of technical expertise. Although wealthier households are provided with reliable after-sales

services, the majority of households are left with systems that are either broken or inadequately maintained due to the limited post-installation support.

VI. Strategies and Recommendations for Socially Inclusive Energy Policy

It is necessary to frame a comprehensive approach to providing marginalised SC and ST populations with equitable access to energy (Figure 3). Inclusive energy policies that prioritise financial inclusion, policy, community engagement, and technical solutions must tackle historical prejudice, economic disadvantages, and institutional exclusion in order to bridge the energy barriers

Energy planning and decentralized solutions

Caste-sensitive planning and social mapping should be incorporated into energy plans to improve social inclusion by ensuring that SC/ST settlements are covered for LPG distribution and electricity. In SC/ST regions, decentralised renewable energy sources like solar microgrids, biogas, and upgraded cookstoves must to be given priority, with sufficient government backing and technical support for long-term, community-led deployment.

Financial inclusion and livelihood linkages

Low-interest loans through MFIs and SHGs should help SC/ST households adopt solar, biogas, and clean cookstoves in order to encourage the adoption of clean energy among marginalised groups. Connecting energy access to livelihoods, such as solar irrigation and biogas-powered businesses, can improve economic resilience and lower energy poverty. Strengthening DBT mechanisms, as well as increasing banking access and digital literacy, can ensure equitable subsidy delivery.

Promoting inclusive governance and empowerment

The inclusion of SC/ST representatives in local energy committees is essential for inclusive energy governance, as it promotes equitable decision-making processes. Deprived-led cooperatives can be encouraged to participate in decentralised energy initiatives by offering them training and policy support. Self-help groups must lead targeted awareness campaigns to increase their trust and involvement in renewable energy initiatives.

Enhancing infrastructure and capacity

Infrastructure upgrades for LPG and electricity are essential in disadvantaged regions to close gaps in energy access by ensuring stable supply and servicing. Programs for skill development must provide marginalised youth knowledge about renewable energy, resulting in the creation of local occupations in the cookstoves, biogas, and solar industries. Sustainable maintenance of clean energy systems will be ensured by enhancing last-mile assistance through village service centres and educating women's self-help groups as energy technicians.

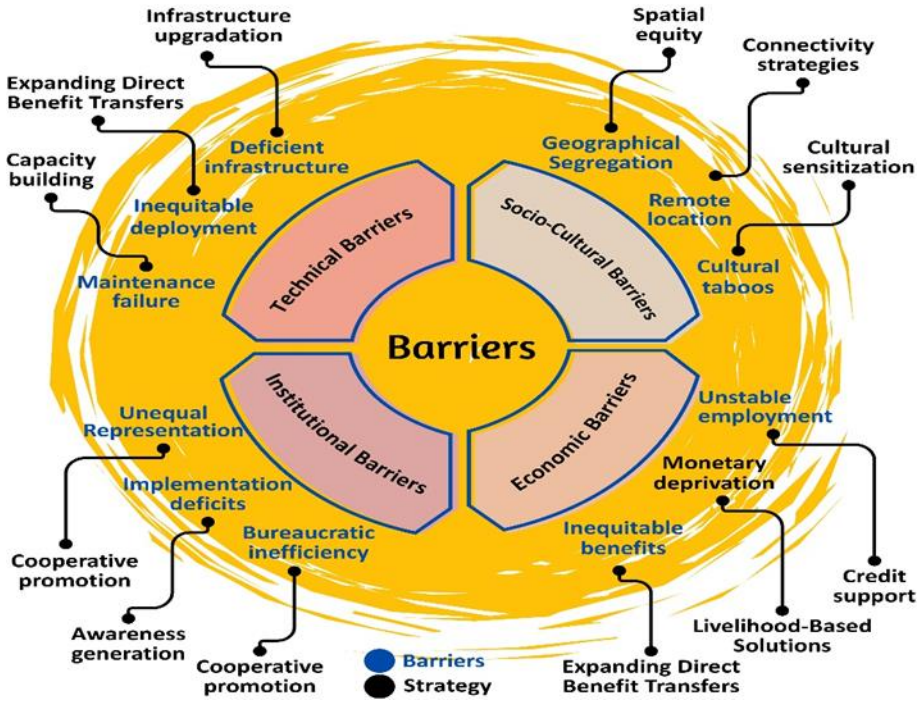

Figure 3: Integrated barrier-strategy framework for enhancing inclusive and sustainable energy access

VII. Conclusion

Social inclusion plays a central part in addressing energy poverty in India, making certain that marginalised communities such as SC, ST, religious minorities, and women are considered in energy transition of the country. The effects of systemic disparities in energy accessibility, cost, and reliability continue to exist despite the advancements made by programs like *Saubhagya* and PMUY, which disproportionately affect underprivileged and marginalised areas. These communities nevertheless have social, economic, and geographic obstacles that obstruct their capability to embrace modern energy solutions. The structural disadvantages these populations experience must be acknowledged, and equity-driven measures must be given priority, in a socially inclusive approach to reducing energy poverty. Existing disparities can be resolved by targeted subsidies, caste- and gender-responsive energy planning, and increased community involvement. Policies must incorporate social justice, participatory governance, and decentralised renewable energy sources to provide equitable and sustainable energy access. In addition to improving their economic prospects and general well-being, ensuring that all social groups have equal access to clean energy would also help achieve the SDG by ensuring an equitable and resilient energy future for India.

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