International Journal of Environmental Sciences
ISSN: 2229-7359
Vol. 11 No. 4,2025
https://theaspd.com/index.php

Bibliometric and Policy Analysis of Gender Inclusion in Electricity to Attain Sustainable Development Goals in India

Aakash Malik[1], Nakul Sihag[2],Harpreet Kaur[3],Mohit Kumar[4] ,Raashi Gupta[5]
[1,2,3,4]Department of Laws, Panjab University, Chandigarh, India, 160014.
[5]Department of Botany, Panjab University, Chandigarh, India, 160014.

Abstract
Electricity is fundamental to contemporary life and vitally influences the advancement and development of a civilization. The degree to which energy policies in India openly include gender issues remains a significant inquiry. This study aims to analyze the incorporation of gender problems into power regulations. Although several laws recognize the capacity of electricity to empower women, numerous others neglect to address gender-specific requirements and consequences. This oversight may sustain current gender gaps, restricting the comprehensive advantages of electrification. This research seeks to emphasize the significance of a more clear and deliberate approach to gender issues in Indian power planning. It provides suggestions for integrating gender into forthcoming policy frameworks to guarantee that energy availability fosters a more fair and just society. This research also analysis the work done related to the subject from 2005 to 2025.
Keywords: *Gender, Governance, Sustainable Development Goals (SDG) 5 and 7, Energy Policy etc.*

INTRODUCTION

Access to contemporary energy services, especially electricity, is universally acknowledged as crucial for human growth. In addition to its obvious advantages for economic development and enhanced living conditions, access to electricity is widely recognized as an essential means for promoting gender equality and social inclusion. This is particularly relevant in a nation such as India, where women frequently encounter substantial obstacles owing to severe living circumstances and ingrained discriminatory practices. Access to dependable and cost-effective energy may profoundly transform daily life, providing avenues for empowerment and contesting conventional gender norms.A significant corpus of international research offers persuasive evidence about the beneficial effects of electricity availability on individuals' lives, particularly highlighting its influence on women (Joachim 2003; Gurrieri et al. 2013; GSI 2016; Practical Action 2010). Firstly, electricity enhances critical public services. A dependable power supply improves the operation of water systems, healthcare facilities, educational institutions, and access to information and communication technology (ICTs). This has a ripple impact on women's well-being, liberating time formerly devoted to laborious duties such as collecting water or accessing healthcare in remote areas (Small and Yana 2023; IUCN 2017). Secondly, electricity directly enhances women's general well-being by alleviating the burdens of home duties, facilitating income-generating possibilities, and aiding in poverty alleviation (Saurel and Tritah 2023). Research indicates a significant association between access to electricity and enhanced economic prospects for women, facilitating their involvement in home-based enterprises, prolonging working hours, and fostering more participation in the formal sector (Mohun et al., 2016; UNDP/ESMAP 2004) Moreover, access to electricity fosters a more favorable learning environment for youngsters, especially after dusk, thus alleviating the childcare responsibilities of women and enabling them to engage in other pursuits (Uteng 2012). As of 2023, India has achieved considerable progress in enhancing energy availability, with over 99% of homes

linked to the grid (Pib.gov.in). Nonetheless, obstacles remain in guaranteeing a dependable and economical power supply, especially in rural regions (Cook 2011; Sovacool 2012). Although women's empowerment is increasingly acknowledged as a developmental objective, the particular demands and issues of women in the energy industry are sometimes overlooked.

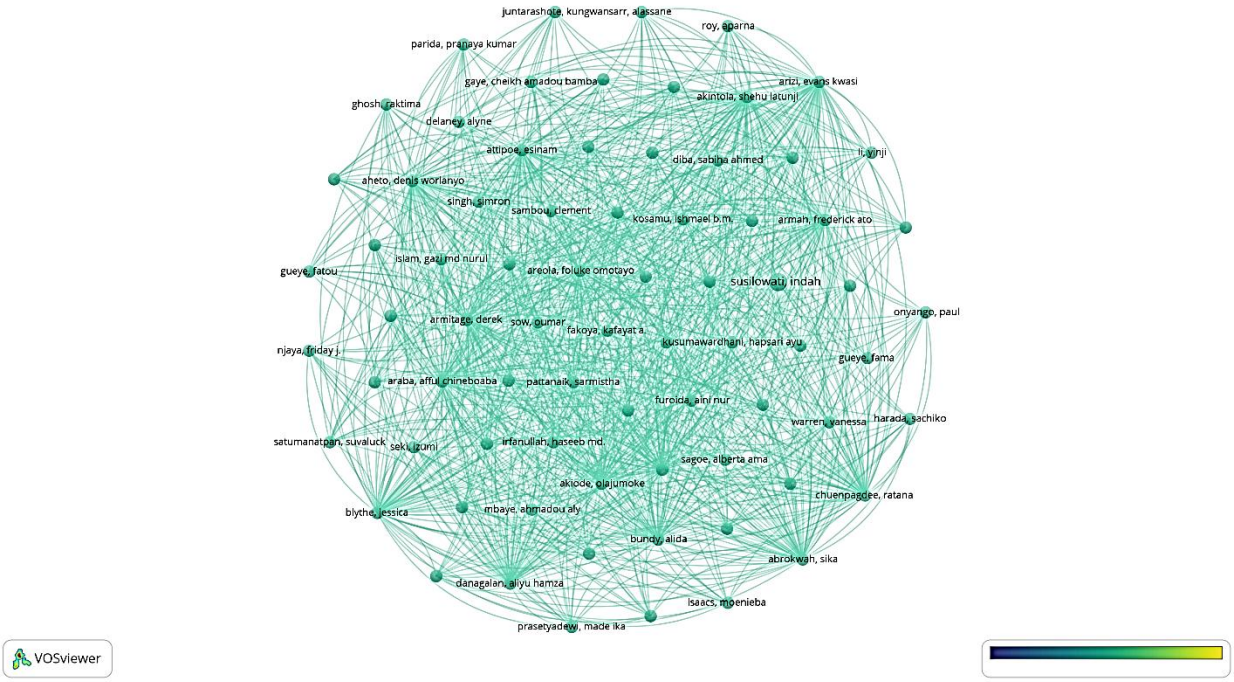


Figure 1: Gender, Energy, Rural Sustainability: Global Bibliometric Analysis via VOSviewer

The lack of dependable power, sometimes referred to as "energy poverty," disproportionately impacts women (Munien and Ahmed 2012). The impact of energy deficit is evident in several forms, reinforcing existing disparities. The dependence on conventional biomass fuels for cooking and illumination subject women and girls to detrimental indoor air pollution, resulting in serious respiratory diseases and other health complications (Sinha and Ray 2015). The labor-intensive and arduous activities of gathering firewood and retrieving water further limit women's access to school, work, and recreation. Insufficient illumination in residences and communities presents safety issues, restricting women's movement and heightening their susceptibility to assault and harassment. The gendered effects of energy poverty highlight the pressing necessity to treat energy access as a critical matter of social justice (Sovacool et al. 2017; ENERGIA,2006).

Notwithstanding the scientific data underscoring the welfare and economic ramifications of electricity, as well as the unequal consequences of energy poverty on women, a substantial gap persists in comprehending how these challenges are converted into policy action. Although politicians increasingly recognize the need of including gender concerns into energy policies, the actual implementation of such integration frequently remains cosmetic (Rai 2013; Allen et al. 2019). Current policies often focus solely on gender-specific welfare programs or include ambiguous mentions of gender equality, neglecting to tackle the fundamental causes of energy-related disparities. This disparity between rhetoric and behavior requires a thorough analysis of the policy environment.The incorporation of gender into energy policy has received increased momentum with the introduction of the UN Sustainable Development Goals (SDGs) (Trends 2017). SDG 7 mandates the provision of "access to affordable, reliable, sustainable, and modern energy for all," expressly encompassing

women and girls. This objective is inherently connected to SDG 5, which aims to attain gender equality and empower all women and girls. Incorporating gender considerations into energy policy is an essential prerequisite for attaining both SDG 7 and SDG 5. Access to energy is not gender-neutral; its effects and advantages are experienced differently by men and women depending to prevailing social and economic frameworks.Prioritizing gender problems in policy discussions is widely seen as essential for tackling wider challenges of social justice and energy ethics (Jenkins et al. 2018). Contemporary researchers have underscored the necessity of incorporating social science viewpoints into energy studies, accentuating the significance of fair allocation of energy resources and advantages (Sovacool et al. 2016). The energy justice framework advocates for the equitable balancing of conflicting objectives in energy policy, ensuring that trade-offs are executed fairly to prevent the reinforcement of existing societal imbalances. Although the framework does not expressly address gender, its fundamental principles of fair results closely align with the necessity to tackle gender inequities in the energy industry.This study aims to bridge the gap by analyzing how prominent emerging nations, particularly India, acknowledge, prioritize, and incorporate gender issues into their national power policy. This study seeks to chronicle particular instances of gendered effects in electricity policies and programs by assessing policy frameworks, programs, and implementation tactics, emphasizing both exemplary practices and noticeable deficiencies.

The Gender Aspects of Electricity Policies

The incorporation of gender issues into energy policy, especially regarding electricity access and services, has progressed over the past few decades, mostly influenced by international frameworks and pledges. The Paris Agreement mandates that countries incorporate gender equality in their climate change mitigation efforts (Carlarne et al. 2019). Nonetheless, converting these international ambitions into tangible national policy and efficient execution is a considerable difficulty. This introduction examines the progression of gender mainstreaming in energy policy, emphasizing the ongoing disparities and the critical necessity for more effective and significant interventions.

Gender and Energy Policies:

Progress and Gaps: The intersection of gender equity and energy policy first gained international traction during landmark events such as the 1995 United Nations Fourth World Conference on Women in Beijing. The resulting *Beijing Platform for Action* explicitly called for incorporating gender perspectives into infrastructure and economic policies, including energy access and conservation (UN Women, 1995; 2014). Subsequent initiatives, such as the 2001 UN Commission on Sustainable Development (CSD-9), reinforced this stance by urging nations to ensure women's equitable access to affordable, sustainable energy technologies (ECOSOC, 2001). More recently, global frameworks like the Sustainable Development Goals (SDGs)—particularly Goal 5 (gender equality) and Goal 7 (clean energy)—and campaigns such as *Sustainable Energy for All (SE4ALL)* have further underscored the urgency of addressing gender disparities in energy systems. For instance, the *Equal by 30* initiative advocates for parity in pay, leadership, and opportunities for women in renewable energy sectors by 2030 (OECD, 2024).Despite these commitments, national energy policies have been slow to integrate gender considerations. A 2017 International Union for Conservation of Nature (IUCN) study revealed that only a third of 192 national energy plans reviewed included explicit references to gender or women's needs (IUCN, 2017). While progress has been uneven, regions like Sub-Saharan Africa show encouraging trends: a 2018 IUCN analysis found that nearly 75% of energy-related documents in the region acknowledged gender to some extent (IUCN, 2018; Chasek, 2018). Similarly, a 2017 UN Women and UNDP-UNEP PEI report noted growing recognition of women's underrepresentation in energy decision-

making, though such awareness seldom translated into actionable reforms (UN Women & UNDP-UNEP PEI, 2017).Scholarly investigation of gender inclusion within electrical policy, especially in developing areas such as India, is still scarce. The National Electricity Policy (2005) and the National Electricity Plan (2018) include provisions for rural electrification and energy efficiency; nevertheless, they do not have particular gender-oriented objectives and targets (Chicombo 2022). Significant exceptions are gender audits of energy policy and initiatives executed by ENERGIA in many nations. These audits have been significant in revealing the ongoing deficiencies in gender mainstreaming within the energy industry (ENERGIA 2011).Scholars have noted a significant challenge: the absence of systematic gender mainstreaming in energy policy frameworks. Few energy strategies successfully incorporate gender issues. Gender differences are seldom considered a fundamental aspect of national energy policy and program development (Oparaocha and Dutta 2011). This shortcoming is frequently ascribed to the absence of gender-disaggregated data, which is essential for developing evidence-based and gender-responsive policy (Ezirigwe 2024). The emphasis on gender frequently skews towards the cooking energy sector, overlooking other vital domains like as electricity availability and its many effects on women's life. This limited perspective neglects the wider ramifications of electricity availability on women's economic empowerment, education, health, and safety. (Standal 2018; IRADE 2009; Practical Action 2014).Moreover, even when gender factors are incorporated into electrical policy, national execution frequently falls short. This disjunction between policy and practice prompts ethical inquiries on the allocation of advantages and disadvantages of electrification initiatives, especially in relation to their gender-specific effects. Substantial expenditures in electrification initiatives, without sufficient consideration of gender dynamics, may unintentionally intensify existing inequities. The lack of systematic gender integration in energy policy creates a paradox given the stated pledges to gender equality by several national and international initiatives, including the Sustainable Development Goals (SDGs) (Eden and Wagstaff 2020). This disconnection underscores the necessity for a more unified endeavor to convert global pledges into tangible national measures. Incorporating gender into the policy framework is essential for connecting with the rising themes of energy ethics and justice, which highlight participation, representation, and equal sharing of the advantages and limitations of energy transitions (Sovacool et al. 2016).

Methodology

The research involved a thorough desk examination and critical evaluation of national and sub-national electrical policy in India. The evaluated materials encompassed the electrical legislation, policies, plans, and programmes of the individual nations. Only publicly accessible documents in English were evaluated for review. The research evaluated a total of 24 policies, strategies, and programs from India. To evaluate the incorporation of gender in electricity policies, the documents were analyzed based on the following criteria: (a) Provide opportunities to improve women's participation and access to electricity (b) Address the needs of women and girls as end users (c) Ensure women's engagement in supply (d) The degree of women's involvement in policy formulation and implementation The data was collected from Scopus database from 2005-2025 and keywords like "Gender Inclusion" OR "Gender Equality" OR "Women Empowerment" OR "Gender Mainstreaming" OR "Gender Equity" OR "Social Inclusion" OR "Intersectionality" OR "Gender Disparities" OR "Women in Energy Decision-Making" AND "Electricity Governance" OR "Energy Governance" OR "Energy Policy" OR "Rural Electrification" OR "Renewable Energy Policies" OR "Decentralized Energy Systems" OR "Energy Justice" OR "Energy Transition" OR "Energy Poverty" OR "Off-Grid Solutions" AND "India" OR "Indian Energy Policy" OR "South Asia" OR "National Policy for Women" OR "SDG 5" OR "SDG 7" OR "Sustainable Development Goals" AND "Policy Analysis" OR "Policy

Evaluation" OR "Governance Frameworks" OR "Regulatory Frameworks" OR "Stakeholder Engagement" OR "Institutional Barriers" OR "Participatory Governance" AND PUBYEAR > 2004 AND PUBYEAR < 2026. Keywords pertaining to gender (e.g., "gender," "girl," "women," "female," "gender mainstreaming," "engendering," "gender budgeting," "gender equality," "gender inclusion," and familial terms such as "mother," "daughter," "sister," "wife") were examined within these policy documents, utilizing the gender keyword dictionary from IUCN's Global Gender Office, as well as gender mainstreaming documents from ADB, ESMAP, World Bank, and ENERGIA, among others. These terminologies were gender-neutral and implicitly encompassed women, so facilitating the investigation of electricity-related policies and plans for gender implications, even when gender was not explicitly mentioned. The subsequent phase involved analyzing the context of these important terms within the policy texts. Ultimately, one instance was recorded from each nation utilizing secondary literature to demonstrate the effects of gendered policies and regulations, including both commendable approaches and notable deficiencies. The results obtained then were analysed using VOSviewer the visualization maps highlight various trends related to climate change mitigation, where areas related to electricity laws and gender inclusion have received high attention over the past 5 years. Furthermore, research related to policy, energy and in particular renewable energy has also received much attention. Although research on inclusion of women in policies, a gap in the literature can be highlighted regarding research related to specific mitigation technologies.

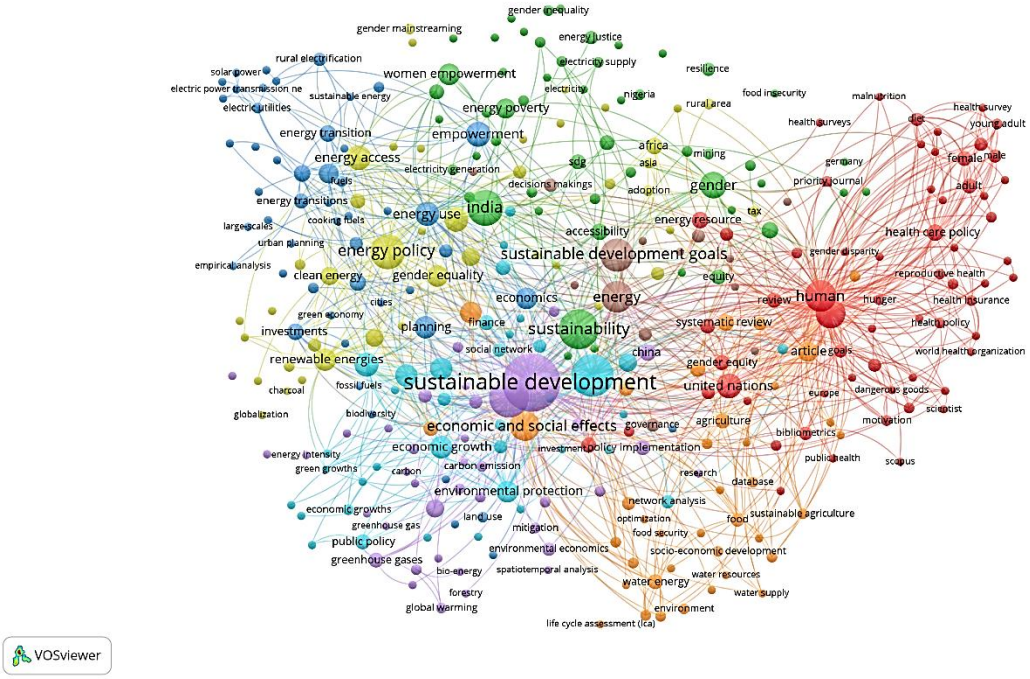


Figure 2. Analysis of studies based on keywords.

RESULTS AND DISCUSSION

Gender Inclusion in India's Electricity Sector Policy

Table 1 delineates the principal characteristics of energy policies in India and highlights the presence of gender-related terminology within them. The initiative for electrification in independent India commenced in the 1950s and has since experienced steady advancement in infrastructure construction and extensive

changes in the electricity industry. The initial electrification initiatives were designed to furnish the populace with essential services and established the groundwork for public infrastructure, which has since been systematically enhanced (powermin.gov.in; iisd.org). Despite the commitment of successive administrations to universal electrification, specific measures were implemented to ensure basic electrical services for the impoverished, marginalized, and disadvantaged populations. Historically, gender considerations have not been prioritized in India's electrical regulations, emerging only relatively lately (see Table 1). Policies mostly employed gender-neutral terminology, such as "consumer" or "customer," to equitably address recipients of all genders. The following section summarizes the few policies analyzed that specifically address women or girls.

Table .1 Key features and gendered terminology of electricity policies in India

Name of the Policy/Plan/Programme	Key Features	Mention of Gender or Related Terminology
National Electricity Policy (2005)	Ensure electricity access to all households at reasonable rates; Achieve minimum energy consumption of 1 kWh per household per day	'Community', 'customers', 'consumers' - (Implies general inclusivity but lacks specific gendered considerations)
Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY) (2005) [Subsumed under DDUGJY]	Mandates free connections for BPL families; Promoted decentralized distributed generation projects where grid extension is not feasible; Central government covered 90% of capital cost and the rest by the states	'Consumers', 'self-help groups', 'franchisee' - (Limited recognition of potential gender roles within community structures)
Rural Electrification Policy (2006)	Provision of quality and reliable electricity supply to all households at reasonable rates	'Women', 'consumers', 'community', 'stakeholders' - (Explicitly mentions women, acknowledging their role in rural electrification)
Integrated Energy Policy (2006)	Reliably meet demand for energy services of all sectors at competitive prices	'Women', 'consumers', 'community', 'disadvantaged' - (Similar to the Rural Electrification Policy, acknowledges women and potentially vulnerable groups)
Remote Village Electrification Programme (2003–2004)	Supports electrification of remote villages using renewable energy sources	No explicit mention, focuses on geographical areas.
Village Energy Security Programme	Supports energy needs of rural communities using locally available biomass	No explicit mention, focuses on community-level energy solutions.
Jawaharlal Nehru National Solar Mission (2010) [Now part of the National Solar Mission]	Achieve grid parity for solar photovoltaic and thermal power by 2022	'Consumers', 'customers' - (General terms, no specific gender focus)
Deen Dayal Upadhyaya Gram Jyoti Yojana (DDUGJY) (2014)	RGGVY subsumed; Strengthening sub-transmission and distribution network; Separation of domestic and agriculture feeders	'Consumers', 'customers' - (General terms, no specific gender focus)
Ujwal Discom Assurance Yojana (UDAY) (2015)	Revamping financial health of ailing discoms; State governments to take over 75% of debt of discoms	None - (Focuses on the financial and operational aspects of the power sector)

24/7 Power for All (2014)	Joint initiative of central government and states/union territories	Not explicitly included; state-specific documents may vary.
Pradhan Mantri Ujjwala Yojana (PMUY) (2016)	Provides LPG connections to BPL households	Women', 'Households' - (Explicitly targets women and aims to improve their well-being)
Prime Minister Sahaj Bijli Har Ghar Yojana (SAUBHAGYA) (2017)	Provide "last mile" connectivity to all unelectrified households; Solar PV systems for remote areas	'Consumers', 'beneficiary', 'stakeholders', 'villagers', 'female-headed households' - (Recognizes the specific needs of female-headed households)
Pradhan Mantri Kisan Urja Suraksha evam Utthaan Mahabhiyan (PM-KUSUM) (2019, Extended till 2026)	Promotes solarization of agricultural pumps, installation of grid-connected solar power plants, and solarization of barren lands	Terms like "farmers," "landowners," and "beneficiaries" are used, which have implicit gendered implications, but no explicit mention of gender.
Production Linked Incentive (PLI) Scheme for High Efficiency Solar PV Modules (Tranche II) (2023)	Incentivizes domestic manufacturing of solar PV modules to reduce import dependence.	Focus on "manufacturers," "companies," and "jobs," with no specific gender focus.
National Bioenergy Programme (2021-26)	Supports the utilization of biomass for energy generation	Rural communities,' 'farmers,' 'entrepreneurs' - (Implicitly includes all genders within these categories)
Amendments to EV Charging Infrastructure Guidelines (2023)	Standardized procedures for EV charging connections, promoting interoperability and transparency in charging fees	"Users," "consumers," "public" - (Gender-neutral language)
Carbon Credit Trading Scheme (2023)	Establishes a platform for trading carbon credits to incentivize emissions reduction.	"Industries" and "entities" - (Focuses on broader economic actors)
Energy Efficiency Financing Platform (EEFP)	Encourages private sector investment in energy efficiency projects.	'Industries,' 'stakeholders,' no gender-specific terms.
Perform, Achieve, and Trade (PAT) Scheme	Targets energy-intensive industries to improve energy efficiency and trade excess savings.	No explicit gender reference, focuses on "industries" and "entities."
National Electric Mobility Mission Plan (NEMMP) (2020)	Promotes electric and hybrid vehicles with incentives for manufacturers and users.	'Consumers,' 'users,' 'public.' - (Gender-neutral language)
Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) India Scheme	Incentives for electric vehicles and charging infrastructure; Reduces dependency on fossil fuels.	'Consumers,' 'public.' - (Gender-neutral language)
Revamped Distribution Sector Scheme (RDSS) (2021)	Reduces losses in power distribution and enhances electricity quality; Aims for prepaid smart metering.	Focus on "consumers," "households," and "beneficiaries." - (Gender-neutral language)

National Hydrogen Energy Mission (2021)	Promotes clean hydrogen production and usage in industries and transport.	No gender-specific language, uses terms like "industries" and "stakeholders."

Table 6.2 Reflection of gender terms in India's electricity policies (2005–2025)

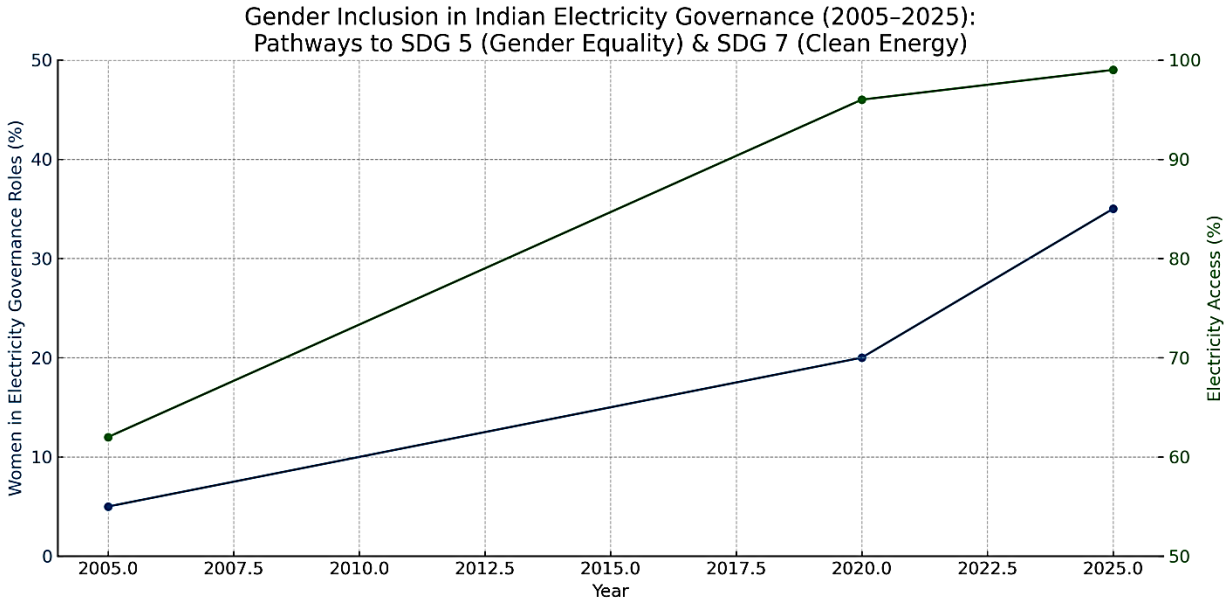
Year	Policy/Program Name	Gender-Related Terms/Provisions	Focus Area	Key Impact on Gender Inclusion
2005	Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY)	Community participation through Self-Help Groups (SHGs), including women's SHGs, to take up project franchises.	Rural Electrification	Empowered women's SHGs by involving them in project franchises, boosting local leadership and economic roles.
2006	Rural Electrification Policy	Acknowledges women bear the burden of energy scarcity; encourages their participation in rural electrification programs.	Rural Electrification Implementation	Recognized women's unique challenges, paving the way for inclusive program execution.
2006	Integrated Energy Policy	Highlights impact of traditional energy sources on women; calls for their participation in energy initiatives.	Policy Design and Franchising	Advocated for women's active involvement, addressing gender-specific drudgery in energy access.
2016	Pradhan Mantri Ujjwala Yojana (PMUY)	Providing LPG connections to women below the poverty line	Clean Cooking Fuel Access	Empowers women by reducing dependence on traditional fuels for cooking.
2017	Saubhagya (Pradhan Mantri Sahaj Bijli Har Ghar Yojana)	Includes female-headed households as eligible beneficiaries for free electricity connections.	Universal Energy Access	Enhanced access to electricity for vulnerable households, particularly benefiting women-led families.
2019	Kusum Scheme (PM-KUSUM)	Renewable energy and solar pumps for farmers	Renewable Energy for Agriculture	Encourages women farmers and women-led groups to participate in renewable energy projects.

Among the 24 Indian policies examined, just 6 used gender-specific terminology and metrics. The Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY), a rural electrification initiative executed from 2005 to 2014, exemplifies the effective integration of gender initiatives through policy implementation. The RGGVY provided women the opportunity to acquire franchises via women's SHGs for metering, billing, connecting procedures, and managing local networks. The Rural Electrification Policy of 2006 is significant as it acknowledged the necessity of women's involvement for the "effective, efficient, and sustainable implementation of rural electrification programs" and mandated women's representation in the District Committees established under section 166(5) of the Electricity Act, 2003. The Integrated Energy Policy of 2006 has explicit gender references and provisions, recognizing the unequal effects and burdens of conventional energy sources on women and girls. The policy design acknowledges "Household Energy

Security" and provides solutions like electricity, clean cooking alternatives, and fuel wood plantings to satisfy energy requirements. Although the strategy includes provisions for women's involvement and participation, it mostly addresses biomass and cooking energy, hence exacerbating gender stereotypes. This policy on electricity references RGGVY and proposes the same recommendations as its predecessor. The recent household electrification initiative—SAUBHAGYA—designates female-headed families as qualifying recipients for complimentary energy connections; nevertheless, there are no additional mentions on the involvement of women in the program. The Kusum Scheme (PM-KUSUM - Pradhan Mantri Kisan Urja Suraksha Evam Utthan Mahabhiyan) advocates for renewable energy and solar pumps for agriculturalists, while also encouraging the involvement of women farmers and women-led agricultural groups in renewable energy initiatives. India has decisively committed to attaining Sustainable Development Goals (SDG) 5 and 7, implementing several significant initiatives over the past two years to promote gender equality and achieve universal energy access, while integrating gender equality and women's empowerment into critical energy policies and actions, necessitating further commitment.

Policy Implementation

When policies promoting gender inclusion are implemented, women may emerge as influential advocates for energy justice by participating in the value chain, a vital avenue for achieving the objectives of Sustainable Development Goals 5 and 7, as well as SE4ALL (Lane et al. 2021). The 2021 National Sample Survey indicates that just 24% of the workforce in the energy industry comprises women, with substantially lesser participation in technical and leadership positions (Shatilova et al. 2021; irena.org). Nonetheless, efforts such as the Ministry of New and Renewable Energy's (MNRE) emphasis on women's self-help organizations in decentralized renewable energy projects illustrate the capacity for transformation.



This diagram shows India's progress in aligning gender inclusion in electricity governance (SDG 5) with expanding energy access (SDG 7) from 2005 to 2025. The blue line shows women's participation in electricity governance roles rising from 5% (2005) to a projected 35% (2025), while the green line reflects electricity access increasing from 62% (2005) to 99% (projected 2025), driven by schemes like *Saubhagya* (2018), which achieved 96% access by 2020 (Ministry of Power, 2018). Early policies like the *National Electricity Policy* (2005)

prioritized infrastructure but lacked gender focus, whereas post-2016 initiatives, such as the *Ujjwala Scheme* (improving women's energy access) (PMUY, 2016) and the 2020 mandate for 33% female representation in regulatory bodies (Ministry of Power, 2020), strengthened inclusion. Despite progress, gaps persist: pre-2015 programs like *Deendayal Upadhyaya Gram Jyoti Yojana* (2014) improved access but excluded gender audits (NITI Aayog, 2015). Post-2020 projections highlight synergies, such as women-led renewable cooperatives (2023 pilots), aiming to achieve SDG 5 and 7 by 2025 (IEA, 2023; SDG India Index, 2023). The upward trend post-2016 suggests that gender-inclusive governance correlates with sustainable energy outcomes, though historical gender-blind policies delayed equity gains.This research framework sought examples from the study nations that exemplify successful transitions of law or policy into reality, as well as instances of missed chances in delivering the intended advantages to women (Christopherson et al. 2022). The state energy distribution corporations in Maharashtra, Odisha, and West Bengal, India, included women in the last stage of power distribution as part of their strategy. The policy provided opportunities for women to acquire franchises via women's self-help groups for metering, billing, and managing local networks. In Odisha, these franchises allegedly led to substantial enhancements in lowered distribution losses, diminished aggregate technical and commercial losses, elevated billing percentages, expanded customer coverage, and enhanced total yearly collections (Government of Odisha 2012; Shatilova et al. 2021). Additional compelling anecdotal data indicates the beneficial effects of such policy measures on gender outcomes. The Maharashtra State Electricity Distribution Company Ltd. (Mahavitaran) appoints women line staff, referred to as Mahila Vidyut Sahayak (Women Electricity Support Staff), in accordance with a policy that allocates 30% of electricity line staff positions for women, as part of Mahavitaran's initiative for women's empowerment (mahadiscom.co.in). The energy business has employed women as line personnel to engage directly with electricity poles, transformers, live wires, and other field equipment utilized in a power supply network (Dholakia 2019). The policies recognize the necessity of improving women's involvement in decision-making and their access to energy services and technology. In India, several regulations recognize the necessity of including women through affirmative measures. Nonetheless, none of the programs have openly recognized or tackled the gender-disparate access to and control over resources and benefits derived from electricity-related development initiatives. These policies have failed to establish the connection between access to energy and empowerment, so neglecting the potential to systematically and thoroughly incorporate gender into policymaking. The policies, as before, persist in prioritizing (1) the expansion and provision of power to people without access, (2) the affordability of electrical services for the most impoverished sectors, and (3) the enhancement of service availability and dependability (Michael et al. 2020). Although national electricity plans may appear gender neutral and align with constitutional mandates, they frequently overlook women's expertise in energy management and the advantages of including both genders in the supply chain. They also neglect the intrinsic disparity in baselines between women and men. Consequently, the policies predominantly remain gender-neutral and persist in the assumption that benefits would disseminate fairly to both women and men (Choudhuri and Desai 2020; Zhang et al. 2022). Although the necessity of generating gender-disaggregated data for policymakers has been long advocated, national statistics persist in utilizing households as the unit of analysis, obscuring the distinct impacts of electricity access on different gender groups. This may also be attributed to the better social cohesion of households in South Asian nations, with government subsidies allocated correspondingly (Winther et al. 2020). Recently, several sister policies have begun to prioritize women more significantly. The Prime Minister Housing Programme in India offers subsidies for constructing residences, exclusively in the names of women, together with provisions for

electricity and additional advantages. Despite a more pronounced gender association in cooking and household lighting—partly due to the historical discourse on gender and energy—most electrification projects, particularly grid initiatives, are executed without a clear focus on gender issues, including benefit distribution or enhanced opportunities for women's participation in supply chains. As of 2024, women constitute only 11% of India's renewable energy workforce, significantly below the global average of 32%. However, increasing women's participation to 30% could generate up to 3.2 million additional jobs by 2025 (clasp.ngo). As of March 2022, a total of 2.86 crore households, including tribal households, had been electrified since the launch of Saubhagya (pib.gov.in).The obstacles of implementing gender-sensitive strategies in electrification may be associated with their hierarchical design methodology. Our desk study indicates a deficiency in documentation about the advantages of including gender factors into electrification strategies. The dedication of India's national governments to attaining Sustainable Development objectives, especially objectives 5 and 7, should ideally demonstrate the progressive traits of gender-sensitive policy and its procedures to realize the overarching objective of a gender-equitable energy policy.

Bibliometric Analysis: Total 165 documents were analyzed in which 115Articles, 16 Book Chapters, 13 Review, 13 Conference Papers, 2 Note, 2 Book, 1 Retracted, 1 Editorial, 1 Data paper, 1 Conference Review were obtained which discussed on gender inclusion in electricity policies to promote gender equality.

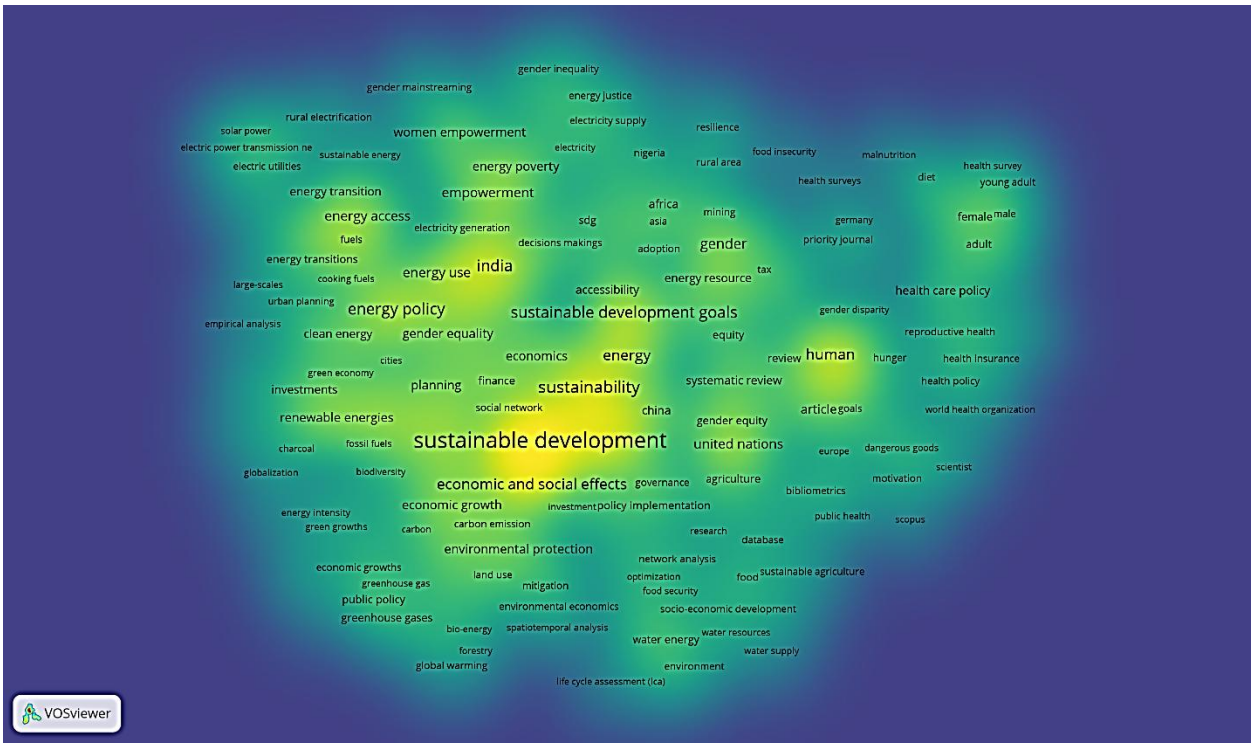


Figure 3: Analysis of data and related papers.

Suggestions

Based on our research and analysis, we propose five policy recommendations for developing gender-inclusive electricity policies and programs:

Policy Recommendations for Gender-Inclusive Electricity Frameworks

Embed Gender Perspectives in Energy Planning: Many national energy strategies neglect gender considerations. Governments must prioritize integrating gender-responsive approaches into energy policies, investments, and implementation processes. Aligning energy-sector initiatives with evidence-based, gender-

aware strategies will strengthen accountability toward Sustainable Development Goals (SDGs) and Sustainable Energy for All (SE4ALL) targets while addressing women's needs.

Develop Metrics for Gender-Responsive Energy Access: Establish a standardized index to measure women's empowerment in energy access, inspired by methodologies like the Women's Empowerment in Agriculture Index (WEAI). Such a tool would evaluate disparities in decision-making authority, resource control, and household empowerment between genders, enabling targeted interventions (IFPRI 2012).

Design Gender-Tailored Subsidy Programs: Energy regulations should incorporate subsidies and financing mechanisms specifically targeting women's access to electricity for essential services (e.g., healthcare, education) and income-generating activities. This will reduce disparities in productive energy use and enhance economic opportunities.

Promote Gender Equity in Energy Sector Employment: Address systemic underrepresentation of women in technical and leadership roles by adopting gender-balanced recruitment and capacity-building policies. Evidence suggests prioritizing on-the-job training over rigid pre-qualification requirements can reduce barriers to entry (Winther 2008; Ulsrud et al. 2015). Such measures will improve women's participation across policy, technical, and managerial domains.

Strengthen Cross-Sectoral Policy Integration: Ensure electricity initiatives align with broader gender equality goals and complementary sectors like agriculture and rural development. Current programs often fail to address structural inequalities, such as women's limited participation in energy supply chains or access to ancillary resources. Coordinated policies can amplify electrification's potential to mitigate gender disparities. Therefore, a holistic approach of linking energy frameworks with gender equality objectives and cross-sectoral policies is critical to dismantle systemic biases. This alignment will clarify how electrification can advance equitable outcomes while addressing root causes of inequality.

CONCLUSION

Recognizing the gender dimensions within the electricity governance framework is essential to ensuring equitable and sustainable energy access. A gender-inclusive approach can amplify the social, economic, and environmental benefits of energy policies while addressing longstanding disparities. To promote gender equity in electricity governance, it is crucial to conduct a comprehensive gender assessment before formulating or amending energy policies. This evaluation should explore the distinct needs and priorities of women and men, focusing on energy access, usage patterns, and policy impacts. Such insights can inform targeted interventions that address structural inequalities and enhance energy accessibility for marginalized groups. The formulation of a Gender Action Plan is a logical next step. This plan should outline actionable strategies to reduce gender disparities, incorporating measurable objectives, targets, and indicators to track progress. A well-implemented plan can serve as a roadmap for integrating gender considerations across the energy sector. It is equally important that promotion of women's participation in the energy industry. Policies should be designed to enhance women's representation in decision-making roles, technical fields, and entrepreneurial ventures. Initiatives such as capacity-building programs, affirmative action measures, and improved access to financial resources can empower women to become active contributors and leaders in the energy transition. Moreover, it is imperative to address the gendered impacts of energy poverty. Women often bear the brunt of health risks and time poverty associated with traditional cooking methods and limited access to clean energy. Policies should prioritize clean cooking solutions and expand access to modern energy services, thereby alleviating these burdens and improving the overall quality of life for women and their families. By

integrating these measures, India's electricity governance can evolve into a more inclusive framework that aligns with the dual objectives of gender equality and sustainable energy access. Such efforts will not only accelerate the attainment of SDGs 5 and 7 but also contribute to the broader vision of inclusive and sustainable development. The next phase of policy and program implementation must embrace this transformative approach, ensuring that no one is left behind in the energy transition.

CONFLICT OF INTEREST:

The authors declare no conflict of interest. This research received no specific grant from funding agencies in the public, commercial, or not-for-profit sectors. All data sources and methodologies are transparently documented to ensure reproducibility.

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