Environmental Science

AIMS Environmental Science, 12(4): 594–614.
DOI: 10.3934/environsci.2025027
Received: 29 September 2024
Revised: 21 April 2025
Accepted: 10 June 2025
Published: 17 June 2025

http://www.aimspress.com/journal/environmental

Mini review

Energy Justice in the 21st century: policy interventions and advocacy for a fair energy transition

Pasquale Marcello Falcone[1,2,*] and Grazia Errichiello[1]

[1] Department of Business and Economics, University of Naples Parthenope, Italy
[2] Sustainability Competence Centre, Széchenyi István University, Győr, Hungary

*** Correspondence:** Email: pasquale.falcone@uniparthenope.it.

Abstract: This article examined the research landscape of energy justice within the social sciences, providing a detailed overview of key developments, trends, and methodologies in this emerging field of study. The study began by identifying the leading journals in the field and mapping co-authorship networks, followed by an analysis of keyword co-occurrences to pinpoint the central themes in the literature. The findings highlight key areas of energy injustice, including accessibility, affordability, and environmental and technological factors. The article further inspected the underlying drivers of these disparities and the actions being taken to address them, emphasizing the critical role of emerging community pressures in shaping policy decisions. Additionally, the study reviewed five case studies that underscore the need for ongoing policy adaptation and illustrate the significant impact of advocacy in the development and implementation of equitable energy policies. The paper concludes by stressing the importance of rethinking current energy policy approaches to create a more inclusive, sustainable, and just energy future.

Keywords: energy justice; sustainable energy policy; advocacy; bibliometric analysis

1. Introduction

Energy plays a crucial role in the functioning of daily life, with its consumption influencing nearly every aspect, from communication and transportation to manufacturing and household activities. This

dependence has developed because of industrialization and technological advancements over the past century, continuing to drive progress today. However, access to energy resources and their benefits is not equally distributed, leading to energy injustices that sustain social, economic, and environmental inequalities despite their fundamental importance [1]. The unequal distribution of energy resources and their effects presents a significant barrier to achieving fair progress and sustainable development [2]. Issues of energy injustice are widely discussed in both the Global South and the Global North. In the former, the focus is primarily on energy insecurity due to lack of availability and energy poverty [3]. In the latter, however, the debate is more centred on limited accessibility to emerging energy technologies and the socio-psychological and justice-related factors that influence flexibility in electric vehicle charging. Disparities among demographic groups are evident, with individuals in more vulnerable socioeconomic conditions facing greater constraints in adapting their charging habits [4]. Moreover, wealthier individuals benefit from easier accessibility to and management of energy flexibility, which is shaped by socio-technical and economic factors [5]. Socio-demographic inequalities are also apparent in the adoption of decentralized household energy management systems, as vulnerable populations tend to show lower flexibility in adjusting their energy consumption [6]. This highlights how the energy transition is not always equitable. Moreover, it is significantly influenced by the interests of multinational corporations and different groups of interest, which exert pressure on regulations to either slow down or accelerate the implementation of green energy policies [7]. In poorer countries, a negative correlation has been observed between lobbying efforts related to fossil fuel production and the expansion of renewable energy sources [8]. While traditional industry lobbies often work to slow down regulations supporting the energy transition, activist movements play a key role in pushing for energy justice. However, their efforts tend to focus on short-term interventions in energy production and consumption rather than addressing the system [9]. To address these challenges, rethinking policy-making approaches is essential. To balance between the interests of different groups that shape energy policies [10], emerges as a key strategy in minimising energy inequalities and promoting a more just and inclusive energy landscape [11].

There is evidence of a bidirectional relationship between energy poverty, income, and ecological footprint [12]. Reducing energy access inequalities fosters economic development but often leads to environmental degradation [13]. In many cases, poorer countries seek a competitive advantage by allowing polluting industries to invest without restrictions on their energy sources [14]. In this context, economic growth and increased energy availability do not always lead to environmentally sustainable outcomes. Instead, they can contribute to environmental harm. The resistance of traditional industries to implement the use of innovations that support clean and equitable energy further obstructs efforts to achieve both sustainability and energy justice. A strong regulatory framework is essential to balance these objectives. However, lobbying activities have been identified as a major barrier to effective climate action. When interest groups fail to advocate for clean energy adoption, ensuring an energy supply that is both fair and sustainable becomes even more challenging [15].

Energy injustices have wide-ranging and complex repercussions [16]. Lack of access to modern energy services might limit prospects for vulnerable people in terms of healthcare, education, and employment [17]. Energy poverty can result from high energy costs, causing people to choose between heating, cooling, or other fundamental needs [18]. Furthermore, communities living close to polluting

facilities may be disproportionately affected by an overreliance on fossil fuels, which could have a negative influence on their health and further reinforce environmental inequities [19].

This paper employs bibliometric analysis to provide a detailed overview of the literature on energy justice, helping readers navigate key academic journals, international collaborations (co-authorship), and keyword co-occurrence in the field. Moreover, the most significant dimensions emerging from the keywords are analyzed, highlighting the importance of balanced and fair decision-making in addressing energy injustices. Through an exploratory approach, the paper discusses key dimensions of energy injustices, examining their causes and effects while exploring the role of interest group pressures in shaping energy policies. Although Ferrall-Wolf et al. [20] conducts a multidisciplinary bibliometric analysis on energy justice, highlighting the issue of energy poverty and the significant but under-recognized role of cooking in energy justice literature, we provide an update and novel contribution by focusing on the economic dimension. Our approach sheds light on the economic implications and the political pressures surrounding the topic.

This research contributes to bridging the gap between theory and practice, offering a valuable knowledge base for developing just and more sustainable energy policies. Advocacy can play a dual role in regulatory change, either accelerating the transition to clean energy and ensuring a just transition by highlighting the needs of local communities. This study examines best practices and case studies at the supranational level to illustrate how policy interventions can mitigate energy injustices and promote fair access to sustainable energy.

The central research question is: Can policy interventions effectively balance competing interests to reduce energy injustices?

The discussion will explore successful initiatives that have influenced policy decisions, demonstrating how targeted regulations can foster inclusivity, drive the transition to clean energy, and generate positive social and environmental outcomes. By analyzing energy justice and the possible source of pressure on policy frameworks, this paper aims to provide a comprehensive perspective on how regulatory mechanisms can be leveraged to address energy injustices effectively.

Section 2 presents the methodology, while Sections 3 and 4 contain the results and discussion. Section 5 focuses on successful case studies related to initiatives aimed at ensuring energy justice. Finally, Section 6 provides the conclusions.

2. Methodology

This study employs bibliometric network analysis using VOSviewer (version 1.6.18) (VOS viewer is a software tool based on social network analysis. It creates maps based on bibliometric network data, making possible the visualization and exploration of keywords through clustering that support the classification of output results.) to provide insights into the literature on energy justice. It emerged as a powerful method for quantitatively examining trends and patterns within academic literature [21]. The software enables the analysis of academic literature using various techniques. In this study, we examined citation sources, co-authorship by country, and keyword co-occurrence to gain insights into the research landscape. Building on the results of the keyword co-occurrence analysis, the study then focuses on various energy injustices related to accessibility, affordability, environmental, and technological factors. They were experienced by diverse societal groups, such as

marginalised communities, low-income households, and regions without fully access to contemporary energy services. To provide a thorough grasp of the varied problems and creative policy responses across different contexts, the paper's geographic coverage includes both developed and developing countries. Practises from different countries are utilised to show the effectiveness of a balanced policymaking in decreasing energy injustices (see section 5). In the first step the documents for the bibliometric analysis were collected Using Scopus on March 20, 2025, the search string yielded 735 results (The bibliographic information was exported using CSV and then uploaded to VOSviewer for analysis.). The research team selected the following string: "TITLE-ABS-KEY (energy AND *justice) AND (LIMIT-TO (SUBJAREA, "ECON") OR LIMIT-TO (SUBJAREA, "BUSI"))". It effectively captures all papers related to energy justice and injustice. The decision to limit the search to the economic domain is motivated by the recognition that energy justice issues are deeply intertwined with economic dynamics, market mechanisms, and policy frameworks. By focusing on the economic aspect, the study aims to provide targeted insights that are particularly relevant for understanding investment decisions, regulatory impacts, and the broader economic implications of energy policies. In the second step by incorporating in the discussion research and literature from various fields, including energy studies, environmental justice, public policy, and the social sciences, this study offers an interdisciplinary perspective. The research involves a detailed exploitation of scientific publications, reports, and case studies from reputable sources to present a thorough study of the role of policymaking in reducing energy injustices and balancing the different interests. Based on the insights provided by the bibliometric analysis, we focused on the literature on energy injustices, cutting-edge policy changes, and their outcomes, an in-depth analysis of academic publications, reports, policy pronouncements, and other relevant materials will be conducted (Results from various search engines, such as Scopus, Google Scholar, ScienceDirect, and Govern Website were considered in this step (see section 4 for references).). This allow to locate important ideas, theoretical frameworks, and political initiatives that are relevant for the analysis. Moreover, considering policy actions initiatives from various countries and regions is crucial to understand the mechanism and the source of pressure behind the success of cutting-edge policy solutions intended to reduce energy disparities.

3. Results of bibliometric analysis

The literature on energy justice has expanded significantly over the years, establishing itself as a key topic in the fields of economics and business. The first document on this subject was published in 1980. However, it was only in the 2000s that the discussion gained prominence, following a steady upward trend that peaked in 2023 with 122 documents indexed in Scopus. Figure 1 shows the trend of the number of documents from 2000 to 2024. Recent studies highlight various dimensions of energy justice, including governance models, policy frameworks, and legal responsibilities. For instance, research on renewable energy transitions in the U.S. emphasizes how cities leverage policymaking autonomy to navigate barriers and implement sustainable energy initiatives. Energy justice principles play a crucial role in promoting both procedural and distributional justice, with local programs emerging as key drivers of equitable energy policies [22]. Earlier discussions in the literature focused

on different aspects of energy justice, such as its application to the fossil fuel industry [23] and the affordability of energy for the most disadvantaged populations [24].

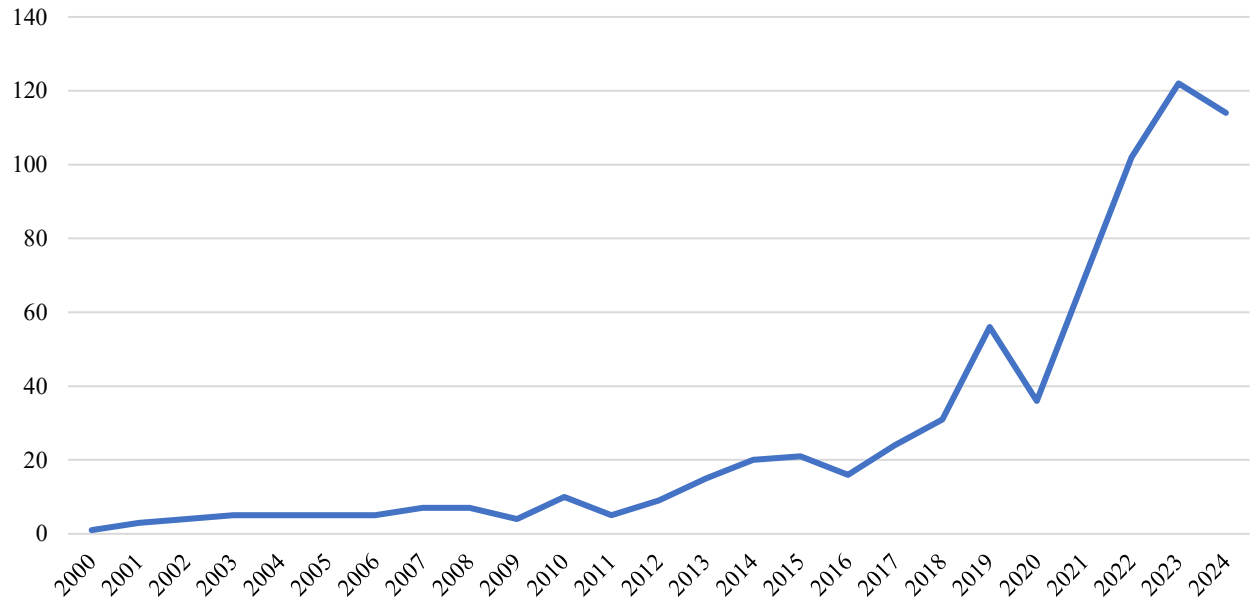

Figure 1. Temporal trend of the number of documents (The year 2025 was included in the analysis; however, the graph was truncated in 2024, the last complete year. A total of 24 documents from 2025 were identified. However, this number is not comparable to previous years since the year has not yet ended.) *Source: own elaboration based on Scopus.*

Table 1 is based on the citation analysis of sources and highlights the journals that have published most papers on the topic (selected threshold 5), along with their citation counts. Ecological Economics and the Journal of Cleaner Production stand out with a high number of citations.

Among the analyzed papers, Aliakbari et al. [25] explores the energy transition and emerging technologies, emphasizing the need for a comprehensive strategy that integrates circular economy principles with a just transition to low-carbon energy. Additionally, Fan et al. [26] demonstrates that energy reforms do not always lead to a reduction in energy injustice. In some cases, such as in China, these reforms may even exacerbate existing inequalities and vulnerability.

Figure 2 presents the co-authorship network with a minimum threshold of five publications, identifying 39 countries. Four clusters were detected, led by the USA, the UK, and Germany, which show the highest number of collaborations and publications.

Table 1: Journal with more documents on energy justice. (Table 1 represent source with minimum number of documents 5, journal without citation or book chapter were not included considered).

Source	Documents	Citations
Journal of cleaner production	36	1017
Ecological economics	24	1185
Futures	15	185
Electricity journal	13	91
Energy economics	12	230
Frontiers in energy research	11	163
Science and engineering ethics	9	154
resources, conservation and recycling	9	127
World development	8	200
Globalizations	8	143
International environmental agreements: politics, law and economics	7	273
Utilities policy	7	53
Resources policy	6	138
Environment, development and sustainability	6	25
International journal of energy economics and policy	5	49
Gaia - ecological perspectives for science and society	5	47
Journal of risk research	5	46
Humanities and social sciences communications	5	33
Journal of the association of environmental and resource economists	5	30

Source: own elaboration using VOSviewer based on Scopus.

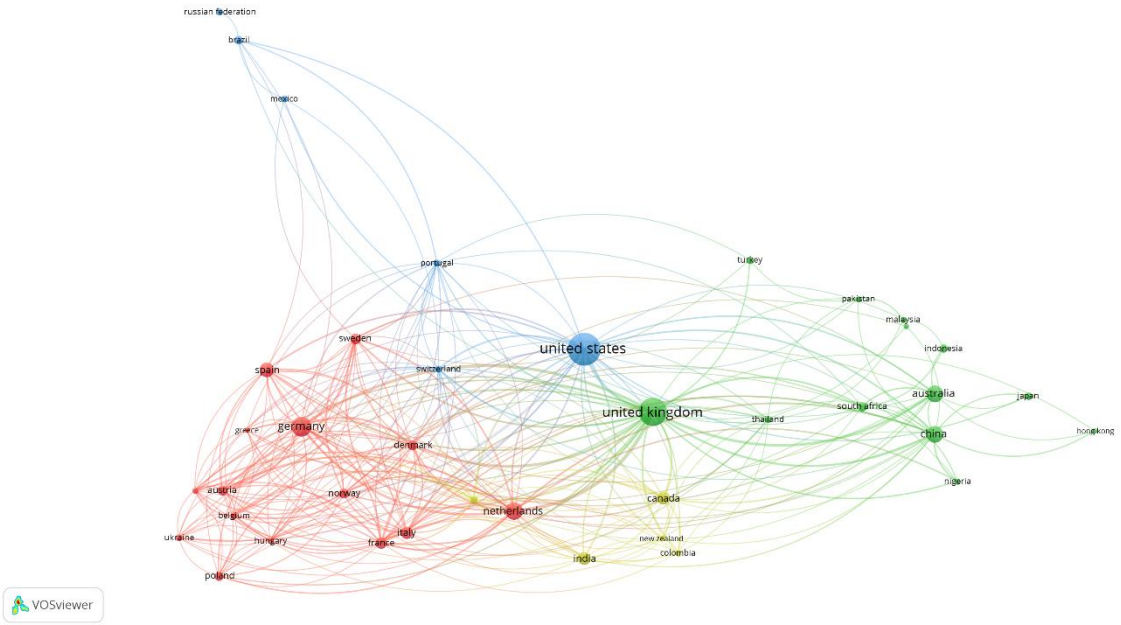

Figure 2. Co-authorship by countries network (*Source: own elaboration using VOSviewer based on Scopus).*

Figures 3 and 4 represent the keyword co-occurrence map. The analysis identifies a total of 3,175 words. A selection of 90 keywords was made by setting a threshold of seven occurrences. The software grouped them into six clusters (see Table 3). Among the most current keywords are circular economy, fossil fuel, alternative energy, and just transition (see Table 4). Among the keywords "energy access", "energy poverty", "environmental justice", "innovation" and "public/energy policy" highlight important themes explored in the literature (see Section 4 for a detailed discussion).

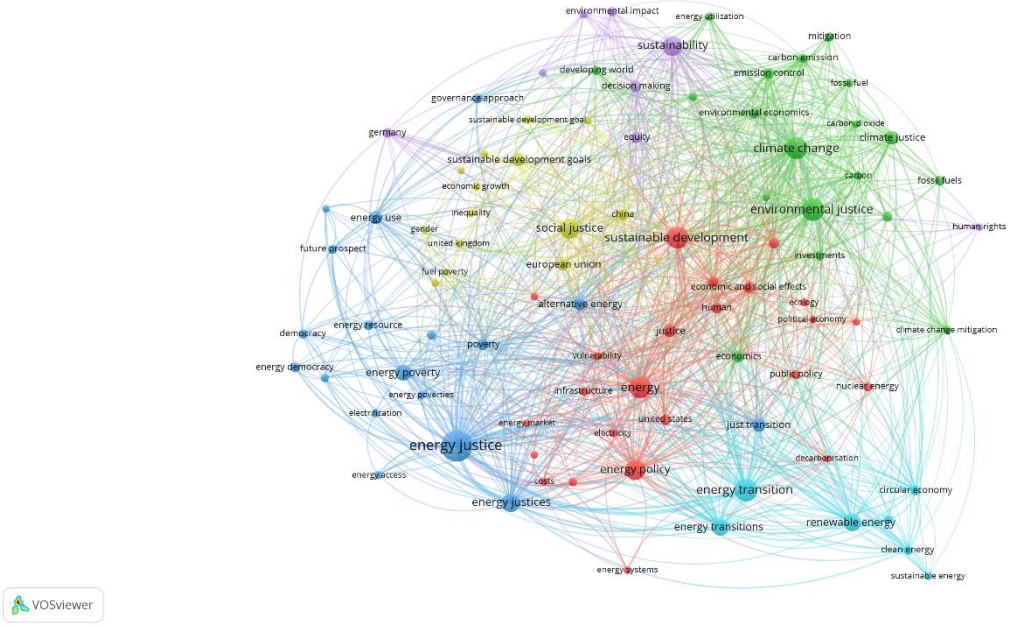

Figure 3. Co-occurrence of keywords map. (*Source: own elaboration using VOSviewer based on Scopus.*)

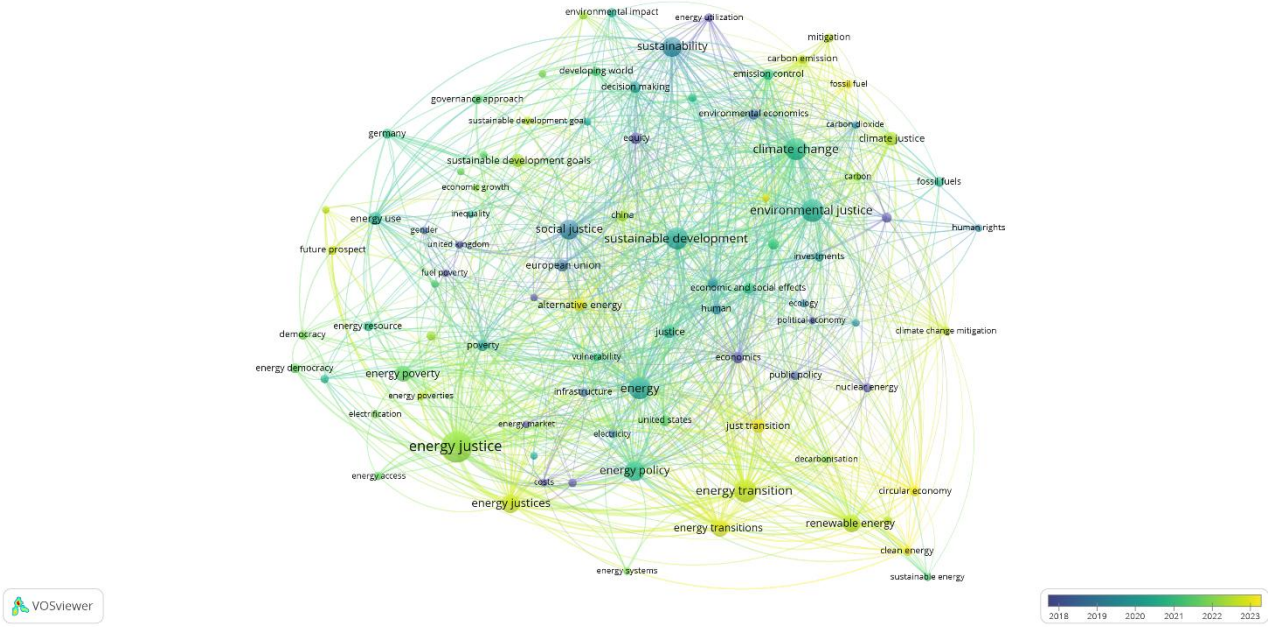

Figure 4. Co-occurrence of keywords map by year. (*Source: own elaboration using VOSviewer based on Scopus.)*

4. Definition and discussion on energy injustices

Due to the unequal distribution of energy resources and the disproportionate negative effects of energy production and consumption on vulnerable populations, energy injustices have become important societal concerns [27]. The idea of energy injustice has drawn a lot of interest from academics, decision-makers, and activists. Numerous research papers, and scholarly articles have examined different aspects of energy injustice throughout the years, giving light on its root origins, effects, and potential policy remedies [28]. Energy injustice arises from a range of challenges, including disparities in access, affordability, and varying environmental and technological conditions, all of which shape the broader landscape of energy equity.

Energy access is related distribution of reliable contemporary energy services leads to gaps that impede socioeconomic advancement and maintain social injustices [29]. This is referred to as energy access injustice. Moreover, energy is necessary for economic development and human well-being, millions of people worldwide still lack access to clean cooking facilities and power [30]. In developing nations, rural areas, and marginalised communities, this discrepancy is more pronounced, creating a host of problems that obstruct the achievement of sustainable development objectives [31].

Energy affordability occurs when a sizable segment of the population finds it difficult to pay for necessary energy services, there is an injustice in energy affordability [32]. Energy poverty results from high energy expenditures in relation to income levels. As a result, households must set aside a sizable amount of their income to cover their basic energy needs, leaving little money for other necessities like food, healthcare, and education. Those who are vulnerable, such as low-income families, the elderly, and people on fixed incomes, are especially vulnerable to problems with energy affordability [33].

The unequal distribution of environmental risks and hazards related to the production and use of energy is highlighted by environmental in the energy sector [34]. A greater weight of health problems brought on by air and water pollution falls on vulnerable populations, which are frequently situated close to polluting facilities like coal-fired power stations, refineries, or waste disposal sites [35]. These communities often don't have much political clout and struggle to get the resources they need to participate in politics effectively [36]. Studies have demonstrated that minority and low-income communities frequently face a disproportionate environmental burden, making environmental racism a significant component of injustice [37]. The phrase "sacrifice zones" refers to regions where marginalised groups are disproportionately affected by environmental deterioration and associated health effects [38]. Moreover, unfair access to green and efficient energy technology is referred to as source of injustice [39]. Some communities, especially those in distant or underserved areas, may not have access to contemporary energy options, which limits their ability to make the switch to cleaner options. Inequities in energy availability and affordability are made worse by this disparity. For instance, in developing nations, it may not be possible to extend electricity access to these villages because of infrastructure issues in remote areas of the centralised energy system.

4.1. The socioeconomic and environmental impact of energy injustices

Energy injustices have serious socioeconomic and environmental repercussions for communities and the planet because of differences in access to, price of, and environmental effects of energy. Vulnerable people are impacted by these imbalances, which also impede efforts to achieve sustainable development [40]. This section examines the complex effects of energy inequities on a range of societal and environmental issues.

When focusing on socioeconomic impact of energy injustices poverty and social exclusion, health disparities, gender inequity and economic productivity represent relevant issues.

In communities where there is a lack of access to electricity, poverty and social marginalisation are reinforced [41]. Economic opportunities are restricted and income generating, and economic mobility are hampered by a lack of dependable and contemporary energy services. The potential for human capital development and social advancement is constrained by the lack of power in schools, which has an impact on educational achievements. Furthermore, energy poverty frequently affects marginalised areas the hardest, increasing already-existing social inequities.

Health disparities are influenced by energy-related environmental injustices, particularly in areas where populations are located close to polluting energy sources [42]. In these cases, residents are exposed to toxic fumes and chemicals from fossil fuel-based energy facilities, such as coal-fired power stations and refineries, which causes respiratory ailments and other health issues [43]. The disproportionate impact of energy-related pollution on minority and low-income groups' health is clear evidence of environmental racism [44].

Gender inequality and energy injustice are intertwined, especially in households with low energy consumption [45]. The burden of carrying out energy-related duties, like fuel collection and cooking, frequently falls on women and girls. Gender imbalances are maintained because of the time spent on these duties, which also restricts their ability to pursue education and make money. Women may be empowered, their quality of life can be improved, and gender equality can be furthered by providing solutions for clean cooking and equitable energy access [46].

Economic productivity is hampered by energy poverty, which also restricts entrepreneurship and employment development in energy-poor areas [47]. Without consistent electricity, small businesses and industries struggle to function, which impedes the expansion of the economy. For supporting economic activity, sustaining industry, and promoting the creation of jobs and revenue, access to modern energy services is essential [48].

When considering the environmental impacts of energy injustices, climate change, biodiversity loss, ecosystem degradation, and air and water pollution are noteworthy concerns.

Carbon emissions from energy use considerably contribute to climate change, escalating global warming and its effects. Extreme weather events and climate change are caused by greenhouse gases released during fossil fuel-based energy production. The environmental effects of energy inequalities are exacerbated by the unequal distribution of emissions and consumption patterns [49]. Often the least accountable for carbon emissions, vulnerable people suffer the burden of hazards and vulnerabilities brought on by climate change.

Degradation of ecosystems, biodiversity loss, and habitat destruction are all consequences of the extraction and use of energy resources. Natural ecosystems are harmed and wildlife habitats are

threatened by unsustainable energy practises as mining for fossil fuels or deforestation for bioenergy [50]. The preservation of animals, ecosystem services, and general ecosystem health are all significantly impacted by these environmental effects. Public health and the environment are negatively impacted by the production and consumption of energy, which also leads to contamination of the air and water [51]. The air quality and respiratory health are negatively impacted by the dangerous pollutants that coal-fired power plants and industrial facilities generate, such as sulphur dioxide, nitrogen oxides, and particle matter. Processes used in energy production that require a lot of water can also pollute the water and put a strain on freshwater supplies.

The interlinked nature of disparities that impact marginalised people is highlighted by the interdependence of energy injustices. Access to energy, affordability, and environmental implications interact with other identity-related factors including gender, race, ethnicity, and socioeconomic status to create complicated problems with many different facets. Energy injustices must be addressed with comprehensive, all-encompassing solutions that consider the unique demands and vulnerabilities of various groups. Societies may work towards a more fair and sustainable energy future where no one is left behind by incorporating social and environmental justice concepts into energy legislation.

4.2. Drivers of energy injustices

Energy injustices stem from a complex interplay of factors, including disparities in access, affordability, and environmental impact. These injustices are deeply rooted in socioeconomic, political, institutional, and technological structures, shaping an uneven distribution of energy resources and opportunities. Understanding these underlying causes is essential for designing targeted policies and interventions that promote a more just and sustainable energy system.

Poverty and income inequality are two of the main factors that contribute to energy injustices [52]. Low-income households frequently struggle to get trustworthy and reasonably priced energy providers. Energy-poor people could turn to outdated, inefficient energy sources like kerosene and biomass, which can have negative effects on their health and the environment. Energy poverty is sustained because investments in energy infrastructure and technologies are hampered by a lack of financial resources [53]. Another element causing energy inequalities is a lack of access to credit and money. Individuals and communities might not be able to invest in energy technologies like solar panels or clean cooking options if they lack access to reasonable finance [54]. Lack of credit options may also impede the growth of community-based energy initiatives, underserving areas with a lack of access to electricity. Moreover, progress towards achieving universal access to energy might be hampered by inadequate energy policies and poor governance [55]. Inefficient governance and administrative roadblocks can hinder the involvement of impacted communities in decision-making processes and slow down energy projects. Energy access and affordability may be dramatically impacted by energy subsidies and pricing regimes [56]. Inequalities may be perpetuated by misaligned or poorly targeted subsidies that favour higher-income households over those with limited access to energy. Similar to pricing practises, energy cost burdens might result from policies that do not consider the financial limitations of vulnerable communities. Furthermore, energy injustices are significantly influenced by the accessibility and availability of energy infrastructure [57]. The infrastructure required for energy transmission and distribution may be lacking in remote and underdeveloped

locations, making it difficult and expensive to connect to the centralised grid [58]. Access to and affordability of electricity are hampered by the lack of adequate energy infrastructure and technology in these areas. Indeed, the potential for sustainable energy access in marginalised groups is constrained by the lack of appropriate energy technologies, such as energy-efficient appliances or off-grid renewable energy alternatives. Importantly, some energy production processes, especially those that depend on fossil fuels, can have a negative effect on the environment, including air and water pollution and greenhouse gas emissions [59]. Local communities may be disproportionately affected by these environmental constraints, especially those without access to clean water or medical services, which would perpetuate environmental injustice [60]. These are event more evident for vulnerable communities. Communities that are more vulnerable to extreme weather and the effects of climate change may have more difficulties getting access to energy [61]. Energy infrastructure can be damaged by climatic disasters like hurricanes or droughts, which exacerbates energy poverty in these regions.

Energy injustices are influenced by a variety of socioeconomic, political, institutional, technological, and environmental issues. These factors are multidimensional and interdependent. It takes all-encompassing methods, including targeted legislation, inclusive government, and environmentally friendly energy sources, to address these inequities. Societies can create efficient solutions to close the energy gap, advance energy justice, and create a more resilient and equitable energy future for all by understanding the underlying causes of energy inequities.

Table 2. Drivers of energy injustice – evidence from the literature.

Author (year)	Drivers	Actions
Alford-Jones (2022) [55]	Energy policies	Coordination of efforts among local and global organizations to promote energy justice.
Bomberg & McEwen (2012) [61]	Energy policies	Community mobilization through norms and ideal justice.
Falcone & Sica (2023) [54]	Energy access	Strengthening financial mechanisms to support energy access and affordability.
Khan & Majeed (2023) [53]	Energy poverty	Encouraging investment and funding opportunities for sustainable energy initiatives.
Lopolito et al. (2022) [59]	Energy access	Building collaborations based on shared knowledge and institutional linkages.
Patnaik et al. (2020) [60]	Energy access - environmental	Advocacy efforts by stakeholders to influence energy policies and regulations.
Rehman et al. (2012) [56]	Energy access - technology	Promoting diverse energy solutions without bias toward specific technologies.
Stock (2021) [57]	Energy access - environmental	Implementing policies to ensure affordable energy access for the most vulnerable.
Walker & Day (2012) [52]	Energy poverty	Ensuring marginalized communities have a voice in energy policy discussions.
Winkler, et al. (2011) [58]	Energy access	Government actions to expand and improve access to energy services.

Source: Own elaboration.

Table 2 provides a overview, highlighting the key drivers identified through the bibliometric analysis and subsequently discussed. Additionally, the table outlines the proposed actions to address energy injustice, emphasizing the crucial role of policy advocacy in shaping just and equitable energy policies.

4.3. Just policy making

To solve energy disparity and promote a more just and sustainable energy landscape, policy-makers have crucial task. Policymakers may create transformative plans that put a priority on inclusivity, environmental responsibility, and the empowerment of vulnerable populations by embracing forward-thinking approaches and incorporating varied perspectives. This section looks at crucial areas where policy-making may advance energy justice.

To ensure that the perspectives and needs of marginalised populations are heard and considered in energy decision-making processes, inclusive policy-making is essential [62]. Affected communities, civil society organisations, and marginalised groups can be actively involved in the drafting of policies to better fit local conditions and address the problems that vulnerable populations confront. Building trust, ownership, and accountability through inclusive public participation can ultimately result in more successful and sustainable energy efforts [63].

Promoting renewable energy sources and decentralized energy solutions is a cornerstone of policy-making aimed at achieving energy justice. Energy security can be improved, greenhouse gas emissions can be reduced, and underprivileged communities can have more access to clean energy by moving away from fossil fuels and towards renewable technologies like solar, wind, and hydroelectric power. Decentralised energy systems, such mini-grids and off-grid options, give local groups the ability to produce their own energy, boosting energy autonomy and resilience.

Equitable approaches to policy-making can encourages energy efficiency and demand-side management as critical components of the energy transition. Policymakers can cut energy use, energy costs, and energy poverty by rewarding energy-saving behaviours and supporting energy-efficient technologies. Initiatives to improve energy efficiency in buildings, industry, and transportation can have a big impact on environmentally friendly growth and preservation.

A key component of developing creative policies for energy justice is reforming energy subsidies. Reforms to subsidies that are well-targeted and well-designed can reroute financial resources to help the energy-poor, ensuring that subsidies are given to those who need them the most. The gradual elimination of fossil fuel subsidies can both free up financial resources and promote the use of greener, more sustainable energy sources. Reinvesting subsidy savings in social safety nets and renewable energy initiatives will help advance energy justice and reduce poverty. To change patterns of energy consumption and promote a culture of sustainable energy practises, energy education and awareness campaigns are crucial. Policymakers may support energy literacy by funding educational initiatives that inform communities about energy-saving techniques, the advantages of renewable energy, and the significance of energy justice. Individuals can be empowered to make thoughtful decisions and promote just energy policies by being more aware of the social, economic, and environmental effects of their energy choices.

The role of inclusive policy-making in addressing energy injustices cannot be overstated. Policymakers can pave the way for a more just, sustainable, and equitable energy future by embracing inclusivity and public participation, encouraging renewable energy and decentralisation, encouraging energy efficiency and demand-side management, reforming energy subsidies, and spending money on energy education and awareness. Societies may cooperate to close the energy gap, strengthen marginalised communities, and create a robust and inclusive energy landscape for future generations through inclusive, sustainable and forward-thinking policies.

5. Policy initiatives and best practices

This section includes five study case that show how policymaking can advance energy justice in a profound way. These case studies illustrate effective projects from throughout the globe where decision-makers have adopted progressive tactics to solve energy disparities, advance sustainable energy practises, and strengthen marginalised communities. By examining these examples, we gain valuable insights into the diverse approaches used to achieve energy justice and the potential for inclusive and equitable energy transitions.

Sustainable development must include energy justice, which includes fair and equal access to affordable and clean energy. However, to achieve energy justice, more is needed than simply increasing the energy supply; instead, a thorough and inclusive strategy that considers the unique requirements and circumstances of vulnerable groups is required. The policy initiatives discussed here demonstrate how creative policies can strengthen local economies, lessen energy insecurity, and promote a fair and sustainable energy future for all.

We examine the importance of targeted subsidies, community-based energy solutions, the adoption of renewable energy, social safety nets, and inclusive public participation in advancing energy justice through these real-world instances. Each case shows the distinctive difficulties and opportunities that various regions face, as well as the political initiatives that have successfully reduced energy inequities.

The Energiewende in Germany

The major Energiewende plan in Germany, which translates to "energy transition," aims to overhaul the nation's energy system and phase out nuclear power with its target of reaching at least a level of 80% electricity generation by renewable energies by 2050 [64]. The policy emphasises decentralising energy production, advancing renewable energy sources, and enhancing energy efficiency [65]. Germany has been a global pioneer in the use of renewable energy implementing balanced regulations, financial incentives, and public involvement [66]. The success of Energiewende is attributed to its inclusive strategy, which involves communities and citizens in decision-making and builds public support for the energy transition [67]. This case study highlights how, in Germany, involving citizens in addressing the challenges of transitioning to renewable energy has proven to be an effective strategy. Furthermore, it reinforces the discussion in the introductory section (see Section 1), specifically that energy injustice in more developed countries primarily pertains to access to green energy.

The UJALA Scheme in India

Energy justice efforts include the Unnat Jyoti by Affordable LEDs for All (UJALA) programme in India. The programme, which was introduced in 2015, intends to encourage energy efficiency and lower consumer energy prices, especially in rural areas [68]. Energy-efficient LED lights are made available to low-income households through this programme at discounted prices [69]. UJALA has significantly cut energy consumption, decreased greenhouse gas emissions, and improved access to electricity for millions of homes, supporting India's commitment to energy justice and sustainable development [70]. This case study demonstrates how, in India, energy affordability is a key issue that the government can address by taking into account the needs of the most vulnerable populations.

Community Solar Programs in the United States

In the United States, community solar programmes increase access to solar energy for homes and businesses who cannot put solar panels on their properties, providing a promising example of energy justice [71]. Through these programmes, local residents can contribute to or subscribe to solar projects that are located off-site, enjoying the cost savings and advantages of clean energy production. Community solar programmes enhance energy justice and sustainability by embracing cutting-edge finance mechanisms and encouraging community involvement, making it possible for a wider cross-section of society to take part in the transition to clean energy [72]. Once again, it is highlighted that in developed countries, energy justice is closely linked to the accessibility of renewable energy sources.

The Bolsa Familia Programme in Brazil

Although not solely an energy project, Brazil's Bolsa Famlia programme significantly affects energy justice by offering conditional cash transfers to low-income families [73]. The programme attempts to reduce poverty and expand access to necessities like food and energy [74]. Families may better afford their essential energy needs thanks to these financial transfers, improving access to energy and lowering energy poverty. Bolsa Familia shows how social safety nets can work in tandem with initiatives for energy justice to guarantee that people in vulnerable situations have access to dependable and reasonably priced energy services [75]. The proposed case confirms that in Brazil, energy affordability is a key issue for the poorest populations and policy initiatives can make the difference.

Noor Ouarzazate Solar Complex in Morocco

The Noor Ouarzazate Solar Complex in Morocco is one of the first large-scale solar energy adoption projects in the Middle East and North Africa [76]. Numerous concentrated solar power plants make up the complex, which supplies sustainable energy to more than one million people. Morocco has lessened its reliance on fossil fuels, enhanced energy security, and increased electricity access for rural areas by utilising the region's enormous solar resources [77]. Community acceptance is almost universal, particularly because solar power is perceived to be environmentally friendly [78]. The Noor Ouarzazate Solar Complex serves as an example of how cutting-edge renewable energy projects may support sustainable development and energy justice. This evidence shows that also in less developed countries, supporting initiatives that promote energy transition can be really useful to enhances energy accessibility. Table 3 contains the five-policy examined and the vector used to address injustice.

Table 3. study case examined

Policy	Country	Vector
The Energiewende	Germany	Renewable energy
The UJALA Scheme	India	High-efficiency LED light bulbs
Community Solar Programs	United States	Solar energy
The Bolsa Familia Programme	Brazil	Financial support
Noor Ouarzazate Solar Complex	Morocco	solar energy

Source: Own elaboration

6. Conclusion and recommendations

This study emphasizes the importance of energy justice in shaping a sustainable and equitable energy future. As global challenges such as climate change, energy poverty, and socioeconomic inequalities persist, inclusive policy-making has become a vital tool for addressing the energy divide while promoting social and environmental well-being. The findings underscore that achieving energy justice involves more than just ensuring access to modern energy services for marginalized groups—it also requires making energy affordable, reducing environmental harm, and empowering communities to actively participate in energy decision-making. To achieve these goals, policymakers must prioritize equity and inclusivity in the energy sector, engaging marginalized communities, civil society, and vulnerable populations to ensure that their needs are met. By fostering inclusive participation, energy policies can better address the specific challenges faced by different communities, resulting in more equitable and sustainable solutions.

Decentralized renewable energy systems offer a pathway to reduce reliance on fossil fuels, lower greenhouse gas emissions, and improve energy access in underserved areas. Additionally, promoting energy efficiency, reforming energy subsidies, and implementing demand-side management measures can help mitigate energy poverty and reduce environmental impacts. However, addressing energy justice also requires the widespread adoption of education and awareness initiatives that inform consumers about the social, economic, and environmental implications of their energy choices. The case studies of Germany, India, the United States, Brazil, and Morocco highlight the transformative impact of inclusive policy approaches and demonstrate the potential for positive change when policies embrace innovation, equity, and stakeholder collaboration.

To ensure long-term progress, several recommendations are proposed. Policymakers should prioritize equity by engaging with marginalized communities and civil society organizations, ensuring their perspectives are incorporated into energy policies. International cooperation is crucial to share knowledge and resources, accelerate the transition to universal energy access, and foster technological innovation. Local community empowerment is essential for ensuring the successful implementation and sustainability of energy projects, and robust data collection and analysis are necessary to track progress and identify areas for intervention. Additionally, promoting technological advancements, such as decentralized renewable energy systems and energy storage solutions, will be key in addressing energy injustices. Policymakers should also remain flexible, adapting policies to the evolving landscape of energy transitions, technological advances, and climate challenges.

Despite these insights, the study has several limitations. The bibliometric analysis was based solely on Scopus data, which may exclude relevant literature not indexed in this database. Furthermore, the case studies discussed were selected based on their relevance to the topic, which could introduce biases in the interpretation of energy justice initiatives globally. Given the rapidly evolving nature of the energy justice field, continuous research is required to keep pace with new developments and address emerging challenges. Future research could focus on conducting cost-benefit analyses of energy justice policies, exploring the long-term impacts of these initiatives, and investigating how emerging technologies, such as blockchain or AI, might further reduce energy injustices. Additionally, future studies could examine the scalability of successful energy justice models to ensure that effective policies can be implemented in diverse global contexts.

Use of AI tools declaration

The authors declare they have not used Artificial Intelligence (AI) tools in the creation of this article.

Conflict of interest

All authors declare no conflicts of interest in this paper.

Acknowledgments

This research received funding from the European Union – NextGenerationEU MUR (PRIN 22) - Project Number 2022RCXRB2.

References

1. McCauley D, Heffron R (2018) Just transition: Integrating climate, energy and environmental justice. *Energy Policy* 119: 1–7. https://doi.org/10.1016/j.enpol.2018.04.014.
2. Casati P, Moner-Girona M, Khaleel S I, et al. (2023) Clean energy access as an enabler for social development: A multidimensional analysis for Sub-Saharan Africa. *Energy for Sustainable Development* 72: 114–126. https://doi.org/10.1016/j.esd.2022.12.003.
3. Chan C, Delina L L (2023) Energy poverty and beyond: The state, contexts, and trajectories of energy poverty studies in Asia. *Energy Res Soc Sci* 102: 103168. https://doi.org/10.1016/j.erss.2023.103168.
4. Chen W A, Chen C F, Tomasik S, et al. (2024) Flexibility justice: Exploring the relationship between electrical vehicle charging behaviors, demand flexibility and psychological factors. *Energy Res Soc Sci* 118: 103753. https://doi.org/10.1016/j.erss.2024.103753.
5. Powells G, Fell M J (2019) Flexibility capital and flexibility justice in smart energy systems. *Energy Res Soc Sci* 54: 56–59. https://doi.org/10.1016/j.erss.2019.03.015.
6. Chen W A, Chen C, Tomasik S (2024) Investigating intentions and barriers in adopting decentralized home energy management systems: A justice dimension of demand flexibility. *Energy Build* 318: 114458. https://doi.org/10.1016/j.enbuild.2024.114458.

7. Errichiello G, Falcone P M, Popoyan L (2025) Navigating climate policy: The influence of lobbying trends and narratives in Europe. *Environ Sci Policy* 163: 103974. https://doi.org/10.1016/j.envsci.2024.103974
8. Ankrah I, Appiah-Kubi M, Antwi E O, et al. (2025) A spotlight on fossil fuel lobby and energy transition possibilities in emerging oil-producing economies. *Heliyon* 11: e41287. https://doi.org/10.1016/j.heliyon.2024.e41287.
9. Fuller S, McCauley D (2016) Framing energy justice: perspectives from activism and advocacy. *Energy Res Soc Sci* 11: 1–8. https://doi.org/10.1016/j.erss.2015.08.004.
10. Stokes L C (2020) Short circuiting policy: Interest groups and the battle over clean energy and climate policy in the American States. Oxford University Press. 2020. https://doi.org/10.1093/oso/9780190074258.001.0001
11. Castrejon-Campos O, Aye L, Hui F K P (2020) Making policy mixes more robust: An integrative and interdisciplinary approach for clean energy transitions. *Energy Res Soc Sci* 64: 101425. https://doi.org/10.1016/j.erss.2020.101425.
12. Yasmeen R, Tao R, Shah W U H (2023) Economic growth and environmental technology simultaneously important for reducing energy poverty and ecological footprint in E7 economies: do political institutions play a role? *Environmental Science and Pollution Research* 30: 65102–65118, Apr. 2023, 10.1007/s11356-023-26923-4.
13. Raghutla C, Chittedi K R (2022) Energy poverty and economic development: evidence from BRICS economies. *Environmental Science and Pollution Research* 29: 9707–9721, 2022. https://doi.org/10.1007/s11356-021-16174-6
14. Khan A, Chenggang Y, Hussain J, et al. (2021) Impact of technological innovation, financial development and foreign direct investment on renewable energy, non-renewable energy and the environment in belt & Road Initiative countries. *Renew Energy* 171: 479–491. https://doi.org/10.1016/j.renene.2021.02.075
15. Botrel C A, Rekker S, Wade B, et al. (2024) Understanding the lobbying actions taken by the Australian renewable energy industry. *J Clean Prod* 434: 139674. https://doi.org/10.1016/j.jclepro.2023.139674
16. Debnath R, Simoes G M F, Bardhan R, et al. (2020) Energy justice in slum rehabilitation housing: an empirical exploration of built environment effects on socio-cultural energy demand. *Sustainability* 12:3027. https://doi.org/10.3390/su12073027
17. Ramirez J, Böhm S (2021) Transactional colonialism in wind energy investments: Energy injustices against vulnerable people in the Isthmus of Tehuantepec. *Energy Res Soc Sci* 78: 102135. https://doi.org/10.1016/j.erss.2021.102135
18. Soriano-Hernández P, Mejía-Montero A, van der Horst D (2022) Characterisation of energy poverty in Mexico using energy justice and econophysics. *Energy for Sustainable Development* 71: 200–211. https://doi.org/10.1016/j.esd.2022.09.005.
19. Healy N, Stephens J C, Malin S A (2019) Embodied energy injustices: Unveiling and politicizing the transboundary harms of fossil fuel extractivism and fossil fuel supply chains. *Energy Res Soc Sci* 48: 219–234. https://doi.org/10.1016/j.erss.2018.09.016

20. Ferrall-Wolf I, Gill-Wiehl A, Kammen D M (2023) A bibliometric review of energy justice literature. *Frontiers in Sustainable Energy Policy* 2: 1175736. https://doi.org/10.3389/fsuep.2023.1175736
21. Buonocore E, Picone F, Russo G F, et al. (2018) The scientific research on natural capital: a bibliometric network analysis. *Journal of Environmental Accounting and Management* 6: 381–391. https://doi.org/10.5890/JEAM.2018.12.010
22. Jangjoo S, Tang T (2025) Renewable energy transitions from the ground up: Building a framework for local action despite limited state support. *Cities* 158. https://doi.org/10.1016/j.cities.2025.105737
23. Mose T M, Hazrati M (2019) Is energy justice in the fossil fuel industry a paradox? in The Palgrave Handbook of Managing Fossil Fuels and Energy Transitions, 2019: 529–549. https://doi.org/10.1007/978-3-030-28076-5_19
24. Heindl P, Schüßler R, Löschel A (2014) The German energy transition from the perspective of social justice. *Wirtschaftsdienst* 94: 508–514. https://doi.org/10.1007/s10273-014-1705-7
25. Aliakbari R, SafdariPour A, Kowsari E, et al. (2025) Energy justice within low-carbon circular economy; geostatistical analysis; policymaking; and economical nexuses. *J Clean Prod* 495. https://doi.org/10.1016/j.jclepro.2025.144940
26. Fan S, Zha S, Zhao C, et al. (2022) Using energy vulnerability to measure distributive injustice in rural heating energy reform: A case study of natural gas replacing bulk coal for heating in Gaocheng District, Hebei Province, China. *Ecological Economics* 197. https://doi.org/10.1016/j.ecolecon.2022.107456
27. Hartwig M, Emori S, Asayama S (2023) Normalized injustices in the national energy discourse: A critical analysis of the energy policy framework in Japan through the three tenets of energy justice. *Energy Policy* 174: 113431. https://doi.org/10.1016/j.enpol.2023.113431.
28. Lacey-Barnacle M, Robison R, Foulds C (2020) Energy justice in the developing world: a review of theoretical frameworks, key research themes and policy implications. *Energy for Sustainable Development* 55: 122–138. https://doi.org/10.1016/j.esd.2020.01.010
29. Tarekegne B (2020) Just electrification: Imagining the justice dimensions of energy access and addressing energy poverty. *Energy Res Soc Sci* 70: 101639. https://doi.org/10.1016/j.erss.2020.101639
30. H. Ritchie and M. Roser, 'Access to energy. Springer, 2019.
31. Bhattacharyya S C (2012) Energy access programmes and sustainable development: A critical review and analysis. *Energy for Sustainable Development* 16: 260–271. https://doi.org/10.1016/j.esd.2012.05.002.
32. Dubois U, Meier H (206) Energy affordability and energy inequality in Europe: Implications for policymaking. *Energy Res Soc Sci* 18: 21–35. https://doi.org/10.1016/j.erss.2016.04.015
33. Bouzarovski S, Simcock N (2017) Spatializing energy justice. *Energy Policy* 107: 640–648. https://doi.org/10.1016/j.enpol.2017.03.064.
34. Marks D, Zhang J (2019) Circuits of power: Environmental injustice from Bangkok's shopping malls to Laos' hydropower dams. *Asia Pac Viewp* 60: 296–309. https://doi.org/10.1111/apv.12242

35. Falcone P M, D'Alisa G, Germani A R, et al. (2020) When all seemed lost. A social network analysis of the waste-related environmental movement in Campania, Italy. *Polit Geogr* 77. https://doi.org/10.1016/j.polgeo.2019.102114
36. D'Alisa G, Germani A R, Morone P (2017) Political ecology of health in the Land of Fires: A hotspot of environmental crimes in the south of Italy. *J Polit Ecol* 24. https://doi.org/10.2458/v24i1.20782
37. Wright W J (2021) As above, so below: Anti-Black violence as environmental racism. *Antipode* 53: 791–809. https://doi.org/10.1111/anti.12425
38. Bullard R D (2021) Sacrifice zones: the front lines of toxic chemical exposure in the United States. 2011, National Institute of Environmental Health Sciences.
39. Sovacool B K, Martiskainen M, Hook A, et al. (2019) Decarbonization and its discontents: a critical energy justice perspective on four low-carbon transitions. *Clim Change* 155: 581–619. https://doi.org/10.1007/s10584-019-02521-7
40. Niaz M U (2022) Socio-Economic development and sustainable development goals: a roadmap from vulnerability to sustainability through financial inclusion. *Economic research-Ekonomska istraživanja* 35: 3243–3275. https://doi.org/10.1080/1331677X.2021.1989319
41. Buzar S (2016) Energy poverty in Eastern Europe: hidden geographies of deprivation. Routledge, 2016. https://doi.org/10.4324/9781315256504
42. Bartiaux F, Schmidt L, Horta A, et al. (2016) Social diffusion of energy-related practices and representations: Patterns and policies in Portugal and Belgium. *Energy Policy* 88: 413–421. https://doi.org/10.1016/j.enpol.2015.10.046.
43. Smith K R, Frumkin H, Balakrishnan K, et al. (2013) Energy and human health. *Annu Rev Public Health* 34: 159–188. https://doi.org/10.1146/annurev-publhealth-031912-114404
44. Bullard R (2019) Addressing environmental racism. *J Int Aff* 73: 237–242.
45. Feenstra M, Özerol G (2021) Energy justice as a search light for gender-energy nexus: Towards a conceptual framework. *Renewable and Sustainable Energy Reviews* 138: 110668. ttps://doi.org/10.1016/j.rser.2020.110668
46. Sunikka-Blank M (2020) Why are women always cold? Gendered realities of energy injustice. in *Inequality and Energy* 2020: 173–188. https://doi.org/10.1016/B978-0-12-817674-0.00008-4
47. Garba I, Bellingham R (2021) Energy poverty: Estimating the impact of solid cooking fuels on GDP per capita in developing countries-Case of sub-Saharan Africa. *Energy* 221: 119770. https://doi.org/10.1016/j.energy.2021.119770
48. Falcone P M, Tutore I (2025) Mapping the Nexus: A Bibliometric Analysis and Social Network Analysis of Transformative Innovation Policies and Sustainable Development Goals. *Bus Strategy Environ* 34: 2423–2435. https://doi.org/10.1002/bse.4104.
49. Dou Y, Zhao J, Dong X, et al. (2021) Quantifying the impacts of energy inequality on carbon emissions in China: A household-level analysis. *Energy Econ* 102: 105502. https://doi.org/10.1016/j.eneco.2021.105502.
50. Giganti P, Barra C, Falcone P M (2025) Unveiling the nexus of institutional quality and renewable energy utilizing a Topic Modelling approach. *Renewable and Sustainable Energy Reviews* 214: 115516. https://doi.org/10.1016/j.rser.2025.115516.

51. Henry M S (2019) Extractive fictions and postextraction futurisms: Energy and environmental injustice in Appalachia. *Environ Humanit* 11: 402–426. https://doi.org/10.1215/22011919-7754534
52. Walker G, Day R (2012) Fuel poverty as injustice: Integrating distribution, recognition and procedure in the struggle for affordable warmth. *Energy Policy* 49: 69–75. https://doi.org/10.1016/j.enpol.2012.01.044.
53. Khan M, Majeed M T (2023) Financial sector development and energy poverty: empirical evidence from developing countries. *Environmental Science and Pollution Research* 30: 46107–46119. https://doi.org/10.1007/s11356-023-25585-6
54. Falcone, Pasquale Marcello (2023) Sustainable Finance and the Global Health Crisis. *Taylor & Francis* https://doi.org/10.4324/9781003284703
55. Alford-Jones K (2022) How injustice can lead to energy policy failure: A case study from Guatemala. *Energy Policy* 164: 112849. https://doi.org/10.1016/j.enpol.2022.112849.
56. Rehman I H, Kar A, Banerjee M, et al. (2012) Understanding the political economy and key drivers of energy access in addressing national energy access priorities and policies. *Energy Policy* 47: 27–37, 2012. https://doi.org/10.1016/j.enpol.2012.03.043
57. Stock R (2021) *Illuminant intersections: Injustice and inequality* through electricity and water infrastructures at the Gujarat Solar Park in India. *Energy Res Soc Sci* 82: 102309. https://doi.org/10.1016/j.erss.2021.102309
58. Winkler H, Simões A F, La Rovere E L, et al. (2011) Access and affordability of electricity in developing countries. *World Dev* 39: 1037–1050. https://doi.org/10.1016/j.worlddev.2010.02.021
59. Lopolito A, Falcone P M, Sica E (2022) The role of proximity in sustainability transitions: A technological niche evolution analysis. *Res Policy* 51: 104464. https://doi.org/10.1016/j.respol.2021.104464
60. Patnaik A, Son J, Feng A, et al. Racial Disparities and Climate Change—PSCI. Princeton University: Princeton, NJ, USA, 2020.
61. Bomberg E, McEwen N (2012) Mobilizing community energy. *Energy Policy* 51: 435–444. https://doi.org/10.1016/j.enpol.2012.08.045
62. Gupte M (2010) Accommodating marginalized groups in the planning process. National, regional and global institutions, infrastructures and governance 1, 2010.
63. MacArthur J L (2016) Challenging public engagement: participation, deliberation and power in renewable energy policy. *J Environ Stud Sci* 6: 631–640. https://doi.org/10.1007/s13412-015-0328-7
64. Energiewende A , 'insights on Germany's Energiewende. Berlin Germany: Agora Energiewende O. 2, p. 13, 12AD.
65. Beveridge R, Kern K (2013) 'The Energiewende in Germany: background, developments and future challenges. *Renewable Energy L. & Pol'y Rev*. 4: 3.
66. Rogge K S, Johnstone P (2017) Exploring the role of phase-out policies for low-carbon energy transitions: The case of the German Energiewende. *Energy Res Soc Sci* 33: 128–137. https://doi.org/10.1016/j.erss.2017.10.004.

67. Schweizer P J, Renn O, Köck W, et al. (2016) Public participation for infrastructure planning in the context of the German "Energiewende". *Util Policy* 43: 206–209. https://doi.org/10.1016/j.jup.2014.07.005.
68. India Government - Ministry of Power, 'Governmentof India's UJALA & Street Lighting National Programme Complete Five Successful years of Illuminating India. 2020.
69. Mir D A, Doll C N H, Lindner R, et al. (2020) Explaining the diffusion of energy-efficient lighting in India: A technology innovation systems approach. *Energies (Basel)* 13: 5821. https://doi.org/10.3390/en13215821
70. Fowlie M, Meeks R (2021) The economics of energy efficiency in developing countries. *Rev Environ Econ Policy* 15: 238–260. https://doi.org/10.1086/715606
71. Weber L (2023) Community Solar. National Renewable Energy Lab.(NREL), Golden, CO (United States), 2023.
72. Gai D H B, Shittu E, Attanasio D, et al. (2021) Examining community solar programs to understand accessibility and investment: Evidence from the U.S. (2021) *Energy Policy* 159: 112600. https://doi.org/10.1016/j.enpol.2021.112600.
73. Saad-Filho A (2015) Social policy for neoliberalism: the Bolsa Família programme in Brazil. *Dev Change* 46: 1227–1252. https://doi.org/10.1111/dech.12199
74. Martins A P B, Monteiro C A (2016) Impact of the Bolsa Família program on food availability of low-income Brazilian families: a quasi experimental study. *BMC Public Health* 16: 1–11. https://doi.org/10.1186/s12889-016-3486-y
75. Sacchet T, Mariano S, Carloto CM (2020) Women, Gender and Conditional Cash Transfers: Interdisciplinary Perspectives from Studies of Bolsa Família. *Routledge*, 2020. https://doi.org/10.4324/9780429286131
76. Neslen A (2016) Morocco to switch on first phase of world's largest solar plant. The Guardian 4, 2016.
77. Terrapon-Pfaff J, Fink T, Viebahn P, et al. (2019) Social impacts of large-scale solar thermal power plants: Assessment results for the NOORO I power plant in Morocco. *Renewable and Sustainable Energy Reviews* 113: 109259. https://doi.org/10.1016/j.rser.2019.109259
78. Hanger S, Komendantova N, Schinke B, et al. (2016) Community acceptance of large-scale solar energy installations in developing countries: Evidence from Morocco. *Energy Res Soc Sci* 14: 80–89. https://doi.org/10.1016/j.erss.2016.01.010.

AIMS Press